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FROM NPOESS TO JPSS: AN UPDATE ON THE NATION'S RESTRUCTURED POLAR WEATHER SATELLITE PROGRAM

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

AND

SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

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CONTENTS

September 23, 2011

	Page
Witness List	2
Hearing Charter	3

Opening Statements

Statement by Representative Paul C. Broun, Chairman, Subcommittee on Investigations and Oversight, Committee on Science, Space, and Technology, U.S. House of Representatives	18
Written Statement	19
Statement by Representative Andy Harris, Chairman, Subcommittee on Energy and Environment, Committee on Science, Space, and Technology, U.S. House of Representatives	22
Written Statement	23
Statement by Representative Brad Miller, Ranking Minority Member, Subcommittee on Energy and Environment, Committee on Science, Space, and Technology, U.S. House of Representatives	20
Written Statement	21

Witnesses:

The Honorable Kathryn Sullivan, Ph.D., Assistant Secretary of Commerce for Environmental Observation and Prediction and Deputy Administrator, National Oceanic and Atmospheric Administration	
Oral Statement	25
Written Statement	27
Mr. Christopher Scolese, Associate Administrator, National Aeronautics and Space Administration	
Oral Statement	43
Written Statement	44
Mr. David A. Powner, Director, Information Technology Management Issues, Government Accountability Office	
Oral Statement	46
Written Statement	48

Appendix I: Answers to Post-Hearing Questions

The Honorable Kathryn Sullivan, Ph.D., Assistant Secretary of Commerce for Environmental Observation and Prediction and Deputy Administrator, National Oceanic and Atmospheric Administration	76
Mr. Christopher Scolese, Associate Administrator, National Aeronautics and Space Administration	107
Mr. David A. Powner, Director, Information Technology Management Issues, Government Accountability Office	111

Appendix II: Additional Material for the Record

Submitted Report for the Record, "NASA's Management of the NPOESS Preparatory Project"	113

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

FRIDAY, SEPTEMBER 23, 2011

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT, AND
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittees met, pursuant to call, at 10:05 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Paul Broun [Chairman of the Subcommittee on Investigations and Oversight] presiding.

Ralph Hall, Texas
Chairman

Eddie Bernice Johnson, Texas
Ranking Member

U.S. House of Representatives
Committee on Science, Space, and Technology
Suite 2321 Rayburn House Office Building
Washington, DC 20515-6301
(202) 225-6371

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

Friday, September 23, 2011
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

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

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).

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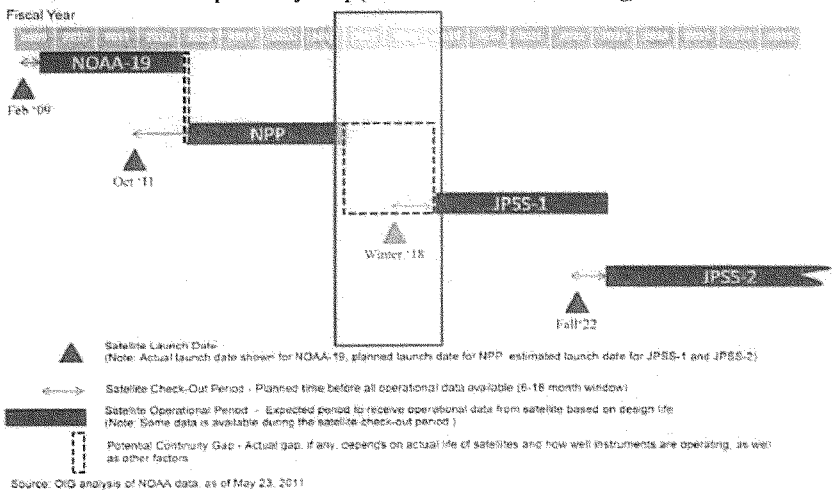
[10] House Report 112-169
[11] Senate Report 112-78
[12] "NASA's Management of the NPOESS Preparatory Project," Office of the Inspector General, National Aeronautics and Space Administration, June 2, 2011.
[13] NOAA-19 is the last satellite in the POES series.

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

[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.

Chairman BROUN. The Subcommittee on Investigations and Oversight and the Subcommittee on Energy and Environment will come to order.

Good morning, everyone. Welcome to today's hearing entitled "From NPOESS to JPSS: An Update on the Nation's Restructured Polar Weather Satellite Program." In front of you are packets containing the written testimony, biographies and truth in testimony disclosures for today's witness panel.

Before we get started, since this is a joint hearing involving two subcommittees, I want to explain how we will operate procedurally so all Members understand how the question and answer period will be handled. As always, we will alternate between the majority and the minority Members and allow all Members an opportunity for questioning before recognizing a Member for a second round of questions, if we have time. We will recognize those Members of either Committee present at the gavel in order of seniority on the Full Committee and those coming in after the gavel will be recognized in the order of their arrival, and I recognize myself for myself for five minutes for an opening statement.

The National Polar-orbiting Operational Environmental Satellite System, NPOESS, program was originally envisioned to reduce duplication and save $1.3 billion. Initial estimates for that program came in at $6.5 billion for six satellites, operating in three orbits, carrying 13 instruments, with the first satellite launched around 2010. The costs of the new Joint Polar Satellite System, or JPSS, are now more than double the costs of the original program, but that doesn't fully reflect the dire straits the program is truly in. With JPSS, NOAA is only planning to operate three satellites in one orbit, one of which is technically a NASA research satellite. If you were to add the costs of the Department of Defense and European portions of the system, which were originally parts of NPOESS, the costs would be much higher, roughly $17 billion when you add the Defense Weather Satellite System and well over $20 billion when you add the cost of what the Europeans spent on MetOp. Aside from cost, the schedules have been delayed, and gaps in data coverage are looming.

To date, the Federal Government has spent over $6 billion on the NPOESS and JPSS programs, and the only thing we have to show for it is a modified research satellite that hopefully will launch next month. In the past, the program was troubled by interagency bickering, overly optimistic cost estimates, lax oversight and technical complexity. More recently, the uncertain fiscal environment has also challenged the program.

NOAA's testimony states the projected gap in services is due to "the lack of adequate, timely and stable appropriated funds." In my mind, if the program had actually delivered on its cost, schedule and performance, we would not be in this position right now. Unfortunately, we are in this position, and there is certainly enough blame to go around. Multiple Administrations and Congresses controlled by both Republicans and Democrats, numerous contractors, and multiple agencies all have had a hand in this program. The new problems faced by this program are the result of a perfect storm of factors: a drastic reorganization, a scheduled ramp-up in development costs and flat funding from Continuing Resolutions.

This Committee has been consistent in both its support, and its oversight of NPOESS and JPSS. This is evidenced by the Committee's Views and Estimates that call for full funding of JPSS, and the fact that this is the Committee's eighth hearing on the topic.

At a hearing on NPOESS two years ago, I asked the questions "how did we get here?" and "where do we go from here?" At last year's hearing, I asked "where are we going?" Unfortunately, I still don't have an answer to that question.

Nearly two years after the President reorganized the program, we still do not have a baseline. As GAO will state in their testimony, "It is still not clear what the programs will deliver, when, and at what cost." This is despite the fact that the NASA Authorization Act of 2005 and the Consolidated Appropriations Act of 2008 requires both NASA and NOAA to provide program baselines. NOAA contends that they cannot develop a credible baseline for costs and capabilities without a stable and predictable budget horizon. On the other hand, 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.

I look forward to working with the Administration as we move forward. As I have said at previous hearings, every American is impacted by this program whether they know it or not. It is our responsibility to ensure that the farmers, the fisherman, the hunters, the war fighters and everyday commuters continue to receive weather and climate information. But we must not forget to be good stewards of taxpayers' money as well.

[The prepared statement of Mr. Broun follows:]

PREPARED STATEMENT OF CHAIRMAN PAUL BROUN

The National Polar-orbiting Environmental Satellite System (NPOESS) program was originally envisioned to reduce duplication and save $1.3 billion dollars. Initial estimates for that program came in at $6.5 billion for six satellites, operating in three orbits, carrying 13 instruments, with the first satellite launched around 2010. The costs of the new Joint Polar-orbiting Satellite System (JPSS) are now more than double the costs of the original program, but that doesn't fully reflect the dire straits the program is truly in. With JPSS, NOAA is only planning to operate three satellites in one orbit (one of which is technically a research satellite). If you were to add the costs of the Department of Defense (DOD) and European portions of the system, which were originally parts of NPOESS, the costs would be much higher—roughly $17 billion when you add the Defense Weather Satellite System (DWSS), and well over $20 billion when you add the cost of what the Europeans spent on MetOp. Aside from cost, the schedules have been delayed, and gaps in data coverage are looming.

To date, the federal government has spent over $6 billion on the NPOESS and JPSS programs, and the only thing we have to show for it is a modified research satellite that hopefully will launch next month. In the past, the program was troubled by inter-agency bickering, overly optimistic cost estimates, lax oversight, and technical complexity. More recently, the uncertain fiscal environment has also challenged the program.

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I look forward to working with the Administration as we move forward. As I've said at previous hearings, every American is impacted by this program whether they know it or not. It is our responsibility to ensure that the farmers, fisherman, war-fighters, and everyday commuters continue to receive weather and climate information. But we must not forget to be good stewards of taxpayers' money as well.

Chairman BROUN. Now the Chair recognizes Mr. Miller for an opening statement. Mr. Miller, you are recognized for five minutes.

Mr. MILLER. Thank you, Dr. Broun. Good morning. I want to thank the two Chairs of the Subcommittees for calling this hearing. This certainly continues to be a subject that needs our time and attention, and I know that Ms. Edwards may be late but she would join with me in congratulating NOAA and NASA on the good work they have done in the last year trying to get this project back on track. It is undoubtedly true, as Chairman Broun has said, that this remains a snake-bit project but it appears that because of your efforts, it is being bitten by fewer and less-venomous snakes, and sometimes you just have to celebrate small victories. This is a project that needs to succeed. We need the data that these satellites will promise.

The Science Committee has devoted years of oversight to the satellite program. When I was Chairman of the Investigations and Oversight Subcommittee, I led much of the work on that with bipartisan support from Dr. Broun and from Mr. Sensenbrenner. The relentless pressure from this Committee and from GAO helped create the environment in which the program could be restructured and which we recognized the changes had to happen, and NOAA and NASA were put in charge of their own fates.

Once in charge of their own fates, however, our friends on the Appropriations Committee did drop the ball by failing to fund this program fully. Decisions have consequences, and that one shortsighted choice means that there will be gaps in weather and climate forecasting data. I hope we can build consensus support for this program, for a reform program, so that we never again have to ask that NOAA and NASA push back delivery of the first JPSS satellite.

This Committee's first hearing on this subject was in 2003, my first year in Congress. It does feel like some things never change here. At that time, the launch date for the first NPOESS satellite was projected to be 2009, and here we are in 2011, as Chairman Broun has already said, and now the first JPSS satellite, the renamed satellite, is not scheduled to launch until 2017. We are eight years beyond our first hearing but remain six years away from the launch of the first next-generation power satellite. This pattern of

delay must change, and the decisions made by NOAA and NASA during the last year suggest that they do understand the importance of changing that. NOAA and NASA had made some smart choices as far, as we can tell, and they have put us on a path that will prevent a data gap in the next few months. However, the appropriations shortfall has ensured that a gap will happen, now projected for 2016 until 2017. That gap will mean that we will see a decline in the accuracy of forecasts beyond the two to four day window that our satellites and weather sensors support. We must do any and everything we can to ensure that American taxpayers, American travelers, American business sectors that are so dependent upon weather forecasts do get the short- and long-term forecasts that are critical to saving lives and protecting property and planning business activities around.

This year alone, the country has witnessed in every region and on every coastline some of the most extreme record-breaking weather events. The more warning we have, the better decisions public officials can make about public safety and the better choices our businesses can make. The idea of not fully funding the satellite program is unacceptable. It is remarkably shortsighted. The delays, lack of baseline, and cost overruns we will hear about today are important; but the most important fact is that the budget shortfall delivered in the fiscal year 2011 budget is going to produce a weather data gap and any future shortfalls will create an even greater gap. In failing to support the program, we are putting our lives, our property, and critical infrastructure in danger, and without accurate and timely information, we would no longer see accurate, advanced warnings of extreme events. This will make it extremely difficult to conduct safe and strategic evacuations of American people from coastal areas and elsewhere.

I hope we will spend our time today trying to deal with the needs of this program as it is, agreeing where we need to go and determining to make sure that we all work together to get there. This program in my first term was a program that was snake-bit and a Republican President but there was never any suggestion that this was a partisan failure and it is not a partisan failure now. It is something we should all be trying to make work because too much of America depends upon this data.

Finally, I want to encourage NOAA and NASA to take every step they can responsibly, that they can responsibly take, to narrow the projected gap in data that we anticipate after March of 2016. If you need help in getting what you need, please tell us, please ask us to help.

I now yield back to the Chairman my negative 26 seconds.

[The prepared statement of Mr. Miller follows:]

PREPARED STATEMENT OF RANKING MEMBER BRAD MILLER

Good morning. I want to thank both Chairs for calling this hearing today. This is certainly a subject worthy of our time. I also want to join my colleague, Ms. Edwards, in congratulating NOAA and NASA on the good work they have done throughout this past year getting this project back on track.

The Science Committee has devoted years of oversight to this satellite program. During my tenure as Chairman of the Investigations and Oversight Subcommittee, I led much of the work on this—with bipartisan support from my Ranking Members, both Mr. Sensenbrenner and Mr. Broun. The relentless pressure from this Committee and from GAO helped create the environment in which the program could

be restructured and NOAA and NASA put in charge of their own fates. Once in charge of their own fates however, our friends on Appropriations dropped the ball by failing to fully fund this program.

Decisions have consequences, and that one short-sighted choice means that there will be gaps in weather and climate furcating data. I hope we can build consensus support for this program so that we never again have to ask the NOAA and NASA to push back delivery of the first JPSS satellite.

The Committee's first hearing on this subject was in 2003, my first year in Congress. At that time, the launch date for the first NPOESS satellite was projected to be 2009. Here we are in 2011 and now the first JPSS satellite is not slated to launch until 2017. We are eight years beyond our first hearing but remain six years away from the launch of the first next generation polar satellite. This pattern of delay is must change, and the decisions made by NOAA and NASA during the last year suggest that they understand this.

They have made smart choices, as far as we can tell, and they have us on a path that will prevent a data gap in the next few months.

However, the appropriations shortfall has ensured that a gap will occur—now projected for 2016 and into 2017. That gap will mean that we will see a decline in the accuracy of forecasts beyond the two to four day window that our other satellites and weather sensors support.

We must do any and everything we can to ensure that American taxpayers, American travelers, and American business sectors are supplied the short—and long—term weather forecasts that are critical to saving lives and protecting property. This year alone, this country has witnessed in every region and on every coastline some of the most extreme, record-breaking weather events. The more warning we have the better decisions public officials can make about public safety and the better choices our businesses can make.

The idea of not fully funding this satellite program is totally unacceptable. The delays, lack of a baseline, and cost overruns we will hear about today are important; but the most important fact is that the budget shortfall delivered up in FY2011 is going to produce a weather data gap and any future shortfalls will create an even greater gap.

In failing to support this program, we are putting our lives, property, and critical infrastructure in danger. Without accurate and timely information, we would no longer see accurate advance warnings of extreme events. This will make it extremely difficult to conduct safe and strategic evacuations of American people. I hope we will spend our time today dealing with the needs of this program as it is, agreeing where we need to go, and determining to make sure we all work together to get there.

Finally, I want to encourage NOAA and NASA to take every step they can responsibly take to narrow the projected gap in data that we anticipate after March of 2016. If you need help in getting what you need, please ask us for that assistance.

Yield back.

Chairman BROUN. Well, thank you, Mr. Miller. You know I have never kept a tight time clock on you.

I now recognize the Chairman of the Subcommittee on Energy and Environment, Dr. Harris, for his opening statement. Dr. Harris, you are recognized for five minutes.

Mr. HARRIS. Thank you very much, Mr. Chairman. I will be brief.

Good morning. I want to thank our witnesses for being here today to testify on the Joint Polar Satellite System. I do appreciate you taking time from what have to be busy schedules to appear with us this morning.

You know, the most critical issue facing our Nation today is out-of-control spending by the Federal Government. Knowing that we cannot spend more than we have should seem like pretty simple math, but it has taken dire economic conditions for some folks to wake up and take notice. In these times, it is even more important than ever that the money we do spend is spent wisely and efficiently.

You know, the JPSS program does appear to be the poster child of a runaway government program that has overpromised, is over

budget, and honestly has underperformed. While the White House's decision to split apart the defense and civilian satellite programs last year may have been the correct one, the lack of understanding about the complexity of that transition and insufficient planning appears to have contributed to even further delays and what is turning into even a more costly program.

Now, there is no doubt that weather satellites play a vital role in keeping the country informed and safe. However, given the number of problems this program has experienced, the time has come to talk about what is the best way for NOAA to obtain the necessary data to make these forecasts. And by best way, I do mean the most efficient and cost-effective way. As Chairman of the Energy and Environment Subcommittee, I want to understand what policies got us in this mess to begin with and how do we avoid the same problems in the future because as the Ranking Member said, this is a project that does need to succeed.

The Executive Order to combine the defense and civilian satellite programs was issued in 1994 but the first satellite, a research-turned-operational satellite, is set to launch just this year. It has taken these government agencies 17 years to go from the initial order to the actual launching of a satellite. Given this record, it appears that NOAA actually needs to start thinking now what it will do to obtain the necessary data when the JPSS satellites are no longer functional 17 years from now, assuming they last that long.

Honestly, we no longer have the luxury to blindly appropriate funding for any program in the government, no matter how essential. Careful planning, realistic expectations, and innovative, outside-the-box type of thinking will be required in order to ensure weather forecasting capabilities in the future.

Thank you again for your time, and I yield back the balance of my time.

[The prepared statement of Mr. Harris follows:]

PREPARED STATEMENT OF CHAIRMAN ANDY HARRIS, SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

Good morning. I want to thank our witnesses for being here today to testify on the Joint Polar Satellite System, or JPSS. I appreciate you taking time from your busy schedules to appear before us this morning.

The most critical issue facing our nation today is out-of-control spending by the Federal government. Knowing that we cannot spend more than we have should seem like pretty simple math, but it has taken dire economic conditions for some folks to wake up and notice. In these times, it is even more important that the money we do spend is spent wisely and efficiently.

The JPSS program is the ultimate example of a runaway government program that has over promised, is over budget, and has underperformed. While the White House's decision to split apart the defense and civilian satellite programs in February 2010 may have been the correct one, the lack of understanding about the complexity of transition and insufficient planning have contributed to even further delays and a more costly program.

There is no doubt that weather satellites play a vital role in keeping the country informed and safe. Severe weather jeopardizes human health, costs billions of dollars every year, and has a significant impact on our economic vitality. The ability to do timely and accurate weather forecasting is not at question here, and should not be compromised. However, given the number of problems this program has experienced, the time has come to talk about what is the best way for NOAA to obtain the necessary data to do these forecasts. And by best way, I mean the most efficient and cost effective way.

I am pleased we are having this hearing today, and I commend the Chairman of the Investigations and Oversight Subcommittee on his continued work ensuring that

Federal science and technology programs are appropriate, cost-effective, and are managed properly. As Chairman of the Energy and Environment Subcommittee, I want to understand what policies got us in this mess to begin with, and how do we avoid the same problems in the future. The JPSS program will only give us two satellites for a cost of more than double its initial estimates. However, without a baseline for this program, it is impossible to say what the ultimate costs will be.

The witnesses from this Administration will likely blame "budget uncertainty" from this Congress for the planning failures of JPSS, but providing a basic and reasonable baseline for a project is something that every business in the country has to do.

The Executive Order to combine the defense and civilian satellite programs was issued in 1994. The first satellite—a research turned operational satellite—is set to launch later this year. It has taken these government agencies seventeen years to go from the initial order to the launching of a satellite. Given this record, NOAA needs to start thinking now what it will do to obtain the necessary data when the JPSS satellites are no longer functional seventeen years from now—assuming they last that long.

We no longer have the luxury to continuously appropriate funding for programs like this. Careful planning, realistic expectations, and outside-the-box type of thinking will be required in order to ensure continued and advancing weather forecasting capabilities in the future.

Thank you again for your time.

Chairman BROUN. Thank you, Dr. Harris.

If there are any Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this point I would like to introduce our witness panel. Our first witness is the Hon. Kathryn Sullivan, Dr. Kathryn Sullivan, Assistant Secretary of Commerce for Environmental Observation and Prediction, and Deputy Administrator at the National Oceanic and Atmospheric Administration. Our second witness is Mr. Christopher Scolese, Associate Administrator for the National Aeronautics and Space Administration, and our third and final witness is Mr. David Powner, Director of Information Technology Management Issues at the Government Accountability Office.

As our witnesses should know, spoken testimony is limited to five minutes each after which the Members of the Committee will each have five minutes, or we may shorten that due to time and votes that are predicted to occur somewhere around 11:00.

It is the practice of the Subcommittee on Investigations and Oversight to receive testimony under oath. Do any of you have objections to taking an oath? No? Let the record reflect that all witnesses are willing to take an oath by their heads being shook from side to side in the traditional method of saying no. You may also be represented by counsel. Do any of you have counsel here today? They all shake their heads side to side again. So let the record reflect that none of the witnesses have counsel.

If all of you would please now stand and raise your right hand? Do you solemnly swear or affirm to tell the truth, the whole truth, so help you God? Be seated, please. Let the record reflect that all the witnesses participating have taken the oath.

I now recognize our first witness, Dr. Sullivan. You may proceed. And as I said, we have got votes that are projected between 11:00 and maybe a little after, so if you all could hold to your five minute times or maybe even if you could shorten it up, please. Dr. Sullivan.

TESTIMONY OF HON. KATHRYN SULLIVAN, PH.D., ASSISTANT SECRETARY OF COMMERCE FOR ENVIRONMENTAL OBSERVATION AND PREDICTION, AND DEPUTY ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. SULLIVAN. Thank you, Mr. Chairman. I appreciate the opportunity to appear before you here today and discuss the status of the Joint Polar Satellite System.

As was noted from the panel, the year 2011 has established itself in the record books as an historic year for weather-related disasters. Truly, every state and territory has experienced some kind of severe weather event that has cost lives and exacted a high economic toll. As Deputy Administrator and frankly as an ordinary citizen, I am very proud of the unfailing dedication of NOAA's employees and contractors who provided the forecasts, watches and warnings that allowed people in these areas to take timely, life-saving actions and enabled rapid response and recovery.

Members of this Committee, as your remarks make clear, know all too well how critical the polar operational weather satellites are to our forecasting enterprise. Over 90 percent of the data that goes into numerical weather models comes from satellites and by far the largest proportion of that comes from the instruments aboard our polar orbiters. We would indeed lose the forecast reliability upon which preparedness response and the protection of life and property rest if we lost this unique source of critical environmental intelligence.

I would like to take just a few moments to highlight some of the key developments that we have achieved during the past year. This week, NOAA completed the Level 1 Requirements Document for the JPSS program with formally validated and prioritized requirements and thus defines the scope and focus of the program. In order to collect and analyze these requirements, individuals from NOAA, NASA and the Defense Department were designated by their respective organizations to represent and communicate the needs of their users. With the recent transition of the Advanced Technology Microwave Sounder instrument through a NASA JPSS contract, NOAA and NASA have now completed the transition of all of the capabilities and assets that were designated for the JPSS program from the NPOESS program. This is a major accomplishment for both agencies, the Defense Department and our contractor companies. With this complete, NOAA and NASA have now returned to the weather satellite management and oversight structure that has served the Nation so well for many decades. Under this construct, NOAA retains the overall responsibility for the JPSS program while NASA serves as our acquisition agent.

In addition, we are finalizing the management control plan that lays out in detail how the two agencies will work together to deliver JPSS. This document is currently being circulated for final review at both of our agencies and we expect to have it signed in the very near future.

We all know that nothing gets done without talented staff, and the challenging meaningful work are what attract the best and brightest. NOAA and NASA management remain on constant alert to ensure that we have the right mix of skills and top-notch talent

working on this program in both the contractor and civil service ranks. We have been aided in this important task in fact by the NPP program. Put bluntly, NPP is not only bridging our data streams between our current polar orbiters and JPSS but frankly has served as a bridge for our workforce. I believe that this has helped us avert talent losses that we might otherwise have suffered due to budget uncertainties.

Looking ahead, full funding at the President's fiscal year 2012 budget request level would permit us to ramp up the workforce to levels needed to meet the current launch readiness date. This would be an increase of over 500 high-quality STEM jobs. Fiscal year 2011 budget uncertainties prevented us from taking these actions during that year.

I am also pleased to report that Harry CiKanek started on September 12th as the Director of the Joint Polar Satellite System Office.

In addition to those milestones, we have stood up the JPSS program office, fully staffed it with a competent and experienced NOAA/NASA team that leverages the expertise that had been acquired in the former NPOESS Integrated Program Office. We selected a spacecraft bus contractor. We have accelerated the fielding and testing of the ground system in preparation for the NPP launch so that we can use that data operationally, and we have completed all of the testing and preparation activities to support an on-time launch on October 25th. I believe these milestones constitute a firm foundation for JPSS future program success.

I would be remiss if I did not address the funding picture. The fiscal year 2011 Continuing Resolution levels fell well short of the amounts requested in the President's budget, and even after reprogramming, the JPSS program was unable to move forward at the rate needed to assure continuity of data. As noted from the Chair, we now face a near-certain gap of data in the 2016 time frame.

In conclusion, I would like to reflect on why we are here today. Very soon after coming aboard this past May, I visited Joplin, Missouri. My trip came just days after a major tornado ripped through the town, cutting a swath more than 6 miles long and up to a mile wild. The utter devastation was mind boggling and heart wrenching. I was standing the Red Cross emergency shelter filled with hundreds of now-homeless people when a woman came out of her way towards me, took my hand in both of hers and looked up at me with tear-filled eyes. She had spotted the NOAA logo on my polo shirt and wanted to thank me for the warnings our National Weather Service teams had provided. These had saved her life, quite literally, and also given her time to gather a dozen of her neighbors under a sheltering staircase as the building came down around them. She knew all too clearly how much worse things might have been without NOAA's forecast and warning services.

NOAA appreciates the Committee's continued interest in the success of the agency satellite programs. They are very complicated and difficult systems to build and field. We believe we are now on the right track, and though funding uncertainties continue to be a serious challenge, we remain hopeful that the fiscal year 2012 ap-

propriations process will put the program on sound footing for mission success, and I will be happy to answer any of your questions.

[The prepared statement of Dr. Sullivan follows:]

PREPARED STATEMENT OF HON. KATHRYN SULLIVAN, PH.D., ASSISTANT SECRETARY OF COMMERCE FOR ENVIRONMENTAL OBSERVATION AND PREDICTION AND DEPUTY ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Good morning Chairman Broun and Chairman Harris, Ranking Member Edwards and Ranking Member Miller, and Members of the Subcommittees. My name is Dr. Kathryn D. Sullivan. I am the Assistant Secretary for Environmental Observation and Prediction for the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Thank you for the opportunity to join David Powner from the Government Accountability Office (GAO), and Chris Scolese from the National Aeronautics and Space Administration (NASA) at today's hearing.

Satellites and NOAA's Mission

NOAA's ability to succeed in its mission to provide science, service, and stewardship to the Nation is fundamentally dependent upon information derived from NOAA's fleet of operational satellites. NOAA maintains two types of environmental satellites, polar-orbiting and geostationary satellites. These are part of NOAA's integrated observing system, which includes satellites, radars, surface automated weather stations, weather balloons, sounders, buoys, instrumented aircraft, and other sensors, along with the data management infrastructure needed to maintain this system. This integrated system is the foundation upon which NOAA works towards achieving our four main goals – a weather-ready Nation, climate adaptation and mitigation, healthy oceans, and resilient coastal communities and ecosystems.

Overview of NOAA's Satellite Mandate

The Nation relies on NOAA's satellites and information as a key part of the global observing network. NOAA satellites and information services are a critical component of the observing, modeling, and computing resources needed to produce weather forecasts, watches, and warnings. NOAA satellites and the observations they gather are key national infrastructure that help protect lives and property and add immense value to the national economy. Uninterrupted flow of data from NOAA satellites is required to support two Department of Commerce Primary Mission

Essential Functions,[1] which have been approved by the National Continuity Coordinator, thus making NOAA satellites not just NOAA priorities but also national priorities. NOAA is investing now to ensure that the Nation can continue to rely on these critical observations in the future. These observations and the derived products and services allow the Nation to prepare effectively for and deal with severe weather and other environmental phenomena. NOAA has been successfully developing, acquiring and managing its satellites and their operations for over 50 years. We have adapted to meet new challenges and have learned from past setbacks. We are poised to successfully meet our mission because we have an excellent team in place with strengths in program management and the development and implementation of successful end-to-end systems and a strong partnership with NASA. NASA is a world leader in satellite development and acquisition.

NOAA's two major satellite programs each play critical roles in providing environmental information to the Nation. The two systems provide complementary observational data required to support the Nation's forecasting and environmental monitoring capabilities.

NOAA's Geostationary Operational Environmental Satellite's (GOES) are used for short-term weather forecasting and severe storm tracking. These are the satellites that continuously watch over the Western Hemisphere providing images of severe weather events such as Hurricane Irene and Tropical Storm Lee that are seen by millions of Americans everyday in their local or national media outlets. GOES-P (now called GOES-15), the last of the current GOES series, was launched in early 2010. NOAA is currently acquiring its next generation geostationary satellites, the GOES-R series. GOES-R is currently scheduled for launch in 2015 to provide uninterrupted geostationary satellite coverage over the Western Hemisphere before the end of GOES-15's projected life.

NOAA's Polar-orbiting Operational Environmental Satellite (POES) series provides surface and atmospheric information over the entire Earth. Placed in the afternoon orbit, POES are crucial for NOAA's long-term weather predictions and climate monitoring and modeling. The last NOAA POES was launched in early 2009. NOAA is developing its next generation polar-orbiting satellites - the Joint Polar Satellite System (JPSS) - to provide continuity of polar-orbiting observations, as well as planned improvements over the 1980's POES technology.

The decision to pursue the instrument improvements for JPSS was based on demonstrated benefits to NOAA's weather forecasting mission from operational use of data from NASA's research and development Earth Observing System (EOS) satellites Aqua, Terra, and Aura and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Metop series of satellites. Following the launch of NASA's Aqua and Terra satellites, NOAA worked to successfully incorporate their data into its numerical weather prediction models and

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[1] **PMEF DOC-2:** Collect and provide the Nation with critical intelligence data, imagery, and other essential information for predictive environmental and atmospheric modeling systems and space-based distress alert systems by operating NOAA-controlled satellites, communications equipment, and associated systems.

PMEF DOC-3: Provide the Nation with environmental forecasts, warnings, data, and expertise critical to public safety, disaster preparedness, all-hazards response and recovery, the national transportation system, safe navigation, and the protection of the Nation's critical infrastructure and natural resources.

will continue to do so until their end-of-lives. The improvements to model output and forecast skill were so impactful that NOAA made the decision to develop its next generation polar-orbiting satellites to transition these improvements onto NOAA's operational platform. The first of these instruments will be flown on NASA's National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) mission, which will continue critical EOS global change measurements and reduce risk on JPSS.

JPSS and the DoD counterpart – the Defense Weather Satellite System (DWSS) are the successor programs to the former NPOESS Program. The NPOESS Program was dissolved in early 2010 because it had an ineffective program management structure and it experienced developmental challenges resulting in delays in acquisition schedules and cost overruns, which resulted in significant slips in the launch date of the NPP satellite as well as the first NPOESS satellite. In February 2010, the Administration announced its decision to restructure the NPOESS program into the separate defense and civil polar-orbiting satellite programs, DWSS and JPSS, respectively. The announcement also reflected the decision to use NPP data in NOAA's operational weather models. NPP is expected to provide a bridge from NOAA POES to JPSS. NPP is currently scheduled for launch next month, October 2011.

Importance of Polar-orbiting Satellites to the Nation

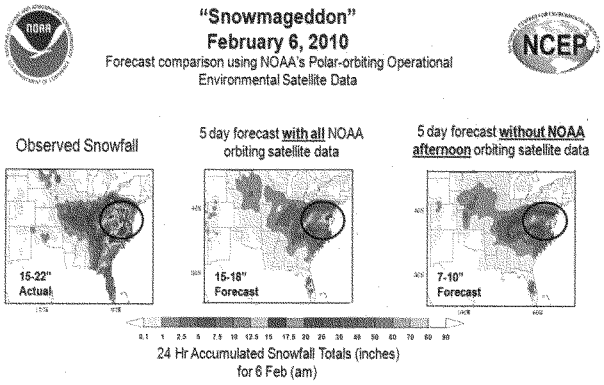
The year 2011 has already established itself in the record books as a historic year for weather-related disasters.

- The states in the southern United States, from Arizona through Florida, are currently experiencing record-breaking drought and are facing tremendous vulnerability to wildland fires.
- The states along the East Coast, from North Carolina to Vermont, are recovering from the effects of Hurricane/Tropical Storm Irene and Tropical Storm Lee.
- Communities in Missouri (Joplin) and Alabama (Tuscaloosa) are still coping with the aftermath of the spring tornados.
- States along the Mississippi basin, from Illinois to Louisiana, experienced record breaking floods in March and April, from a combination of heavy precipitation and the melting of a higher-than-normal snowpack.
- At the same time, Minnesota experienced significant flooding along the Red River.

In all of these instances, NOAA provided accurate forecasts and warnings to emergency managers and affected populations that these extreme weather events would occur, and that they should make preparations to minimize the impact of these pending events on lives and property. NOAA's environmental predictive capabilities, which support accurate forecasts and warnings, are underpinned by four foundational pillars – observations, computer models, research, and our people. Polar-orbiting satellites, including NOAA polar-orbiting satellites, NASA Earth Observing System, and NOAA instruments that fly on European weather satellites, provide over 80 percent of the observational data for the numerical weather prediction models. The output from these models supports the 3- to 7-day weather forecasts on which Americans, businesses, and industry have come to rely.

Retrospective analyses of what the weather forecast would have been for the February 6, 2010

"Snowmageddon" storms without the NOAA polar-orbiting satellite data in the afternoon orbit has crystallized for us just how important these data are to protecting lives, property, and critical infrastructure from these severe weather events. NOAA's forecast skill is the combined result of advances in computing capability, improved modeling and data assimilation methods, and full and timely access to data from the observing system.



At 5 days before the event, NOAA issued a forecast to the public, state, and local governments that a major snow storm would occur with predictions of snowfall between 15-18 inches. While the actual snowfall was 15-22 inches, if NOAA had not had access to polar-orbiting satellite data in the afternoon orbit, the forecast would have been for 7-10 inches of snow, an *under-forecast of the snowfall by at least 10 inches*. The impact would have been much more severe and widespread: many more aircraft and airline passengers would have been stranded; an increased amount of ground commerce would have been halted with no mitigation plans; populations, municipalities, and state governments would have been unprepared for the paralyzing snow-depth.

In addition to providing the foundational data needed to support accurate weather forecasting in the near-term, data and information from JPSS are important for predictions from 2 weeks to about 3 years. Weather forecasts and longer-term predictions are critical for smart and efficient planning in many sectors of the economy. In fact, a recent study concluded that the aggregate dollar amount of variation in U.S. economic activity associated with weather variability could be 3.4%, or $485 billion per year of the 2008 gross domestic product.[2] Some of these sectors include:

Aviation: Polar-orbiting satellites' value to commercial and general aviation comes from providing atmospheric profiles of temperature, moisture, and pressure to forecast models, in the use of satellite images in data-sparse areas, through volcanic ash advisories, and by the relay of distress signals from emergency beacons.

Emergency preparedness: Advance warning of extreme events in the critical planning period 3 days and beyond would be significantly diminished without polar-orbiting satellite data in the

[2] Lazo, J.K., Lawson, M., Larsen, P.H., and Waldman, D.M., U.S. Economic Sensitivity to Weather Variability. *Bulletin of the American Meteorological Society*, June 2011, pp. 709-720

afternoon orbit. Sounding data in forecast models provide products for severe weather, drought, and flood forecasting. High-resolution imagery can detect fires or other hazards when polar-orbiting satellites provide images of opportunity in data-sparse areas. Polar-orbiting satellite data are also important for longer term predictions for example with the climate outlook that alerted the upper Missouri River and central Mississippi River basins in January that the spring flood potential was very high, allowing decision-makers to begin flood preparations and recovery effort planning.

Agriculture: JPSS will provide continuity of critical data for monitoring vegetation conditions in drought and flood areas. JPSS vegetative products will be a great improvement over current capabilities. This will allow the U.S. Department of Agriculture (USDA), NWS, and global agricultural communities to better assess and predict changes in crop yields. This in turn will have a considerable economic and humanitarian impact through improved food security, reduction of agricultural market volatility, and more effective hunger relief efforts.

Energy: Reliable and accurate predictions from shorter to longer time horizons, which rely on polar-orbiting satellite data are useful to urban planners working energy efficiency plans including solar and renewable, and to the entire energy industry.

Marine Operations (shipping, fishing, and recreational boating): Polar-orbiting satellites are valuable in providing atmospheric profiles of temperature, moisture, and pressure to the forecast models in order to identify areas of warm sea surface temperature. These areas are key indicators of regions of possible tropical cyclone development. Polar-orbiting satellite images of opportunity are valuable in support of commercial shipping and recreational boating that occurs in open ocean areas and northern ports, where geostationary imagery may not be available. Polar-orbiting satellite data are also important for short-term and longer-term global forecasts and predictions that affect marine operations and activities. An example of this short-term climate outlook is the 18- to 24-month look at the phases of El Niño (or La Niña) and how it will affect precipitation and temperature patterns over the United States for upcoming seasons, or how they will likely affect the various fisheries.

National Security and Defense: Military users rely on data from both the DoD's and NOAA's operational polar-orbiting weather satellites to provide decision dominance for 24/7 operations. Timely high resolution satellite imagery over foreign data sparse areas assists in "go/no-go" decisions for helicopter, drone, and other counter-terrorist operations. Military weather models derived from polar orbiting satellite data also guide deliberate planning for army and naval maneuver, flight routing and attack profiles, humanitarian operations and troop deployments.

The Nation is at risk of having degraded weather forecasts and other important services because of a projected gap in access to critical NOAA polar-orbiting data. This projected gap is due to the lack of adequate, timely, and stable appropriated funds to develop and launch the JPSS satellite by mid-2016, before NPP has reached the end of its projected life.

NOAA and NASA have concluded that the lack of adequate funds is the major challenge to achieving JPSS mission success as envisioned by the Administration's February 2010 decision. The FY 2011 Yearlong Continuing Resolution (P.L. 112-10) did not provide the JPSS Program with the $1.060 billion requested in the FY 2011 President's Budget. This has resulted in a

much greater risk of experiencing a data gap when the NPP satellite reaches the end of its projected life in mid-2016. Currently, the launch date of JPSS-1 is the first quarter of FY 2017 provided we receive full funding of the President's FY 2012 Budget Request. Appendix A provides a comparison of the launch schedules based on the Administration's February 2010 decision and the launch schedule as a result of the FY 2011 enacted amounts.

Accomplishments since the inception of the JPSS Program

Since the Administration's announcement of JPSS in February 2010, NOAA, in collaboration with NASA, has made considerable progress transitioning to the JPSS program. It has established the necessary workforce and organizational structure, and instituted proper program management to achieve the civil mission success requirements that had eluded the previous NPOESS program.

Following the decision to restructure the NPOESS program, NOAA continues to work towards implementing a successful program leveraging the efforts completed during the NPOESS era. To achieve this, NOAA has focused on the following three areas.

Transition of JPSS Elements

- NOAA and NASA have strategically maximized FY2011 resources towards the launch of the NPP mission scheduled for the end of October. NPP is expected to be the bridge between NASA's current EOS satellites and NOAA's current aging polar-orbiting satellites and NOAA's future polar-orbiting satellite system, JPSS, and will serve as a test for the application of the products and services from the technologically advanced instruments.
- NOAA and NASA have successfully transitioned all JPSS-relevant contracts for instrument development from the NPOESS contract to NASA management, which allows for proper Government oversight of the work to ensure it meets NOAA and NASA standards.
- NOAA and NASA successfully transitioned the full NPOESS ground system contract while making significant progress to meet the milestones required in preparation for the launch of NPP. The final phase of ground system testing was completed in August 2011, and NPP arrived safely in California only a few weeks ago where it is scheduled for launch in October. The ground system supports operations, data processing, and data distribution for both JPSS and DWSS, as well as other satellites.

Workforce and Organizational Structure

- NOAA and NASA have fully staffed the JPSS Program Office with competent and experienced staff, leveraging the expertise contained in the former NPOESS Integrated Program Office to implement a smooth transition.

Program Management

- Alignment with a proven development and acquisition center: NOAA has aligned the JPSS program with NASA, a proven developer of spaceflight systems. Time and again, this partnership has proven to be successful at acquiring and operating environmental satellites. The JPSS program has already benefited tremendously from this partnership with the ability to reach into technical and management expertise at NASA Headquarters Joint Agency Satellite Division (JASD) and the NASA Goddard Space Flight Center (GSFC). The roles,

responsibilities, and authorities of the JPSS Program are being documented in a Management Control Plan, which adopts proven NASA program and project management processes and procedures.

- Operational processes: The JPSS Program has also strengthened its connection with the NOAA offices that will provide the long-term operational support of the JPSS satellites, data processing and distribution, and long-term data archive. For example, NOAA Office of Satellite and Product Operations (OSPO) will command and control NPP and JPSS satellites and will develop operational products for distribution to users. The NOAA Center for Satellite Applications and Research (STAR) will provide long term monitoring of product quality and control, and NOAA's National Data Centers will provide for long-term archiving and access to users
- Budget Baseline: NOAA is completing the JPSS program baseline. The Program estimate, which was used as the basis for the FY2011 and FY2012 budget requests, is being reconciled with an Independent Cost Estimate, which is underway now. Once completed, NOAA will have a program baseline with the level of cost confidence recommended by the NPOESS Independent Review Team and as outlined in the Administration's February 2010 restructure of the NPOESS program.
- User requirements: NOAA has formally established requirements for the JPSS Program. These requirements map to the requirements that were established for the afternoon orbit of the NPOESS system. NOAA has drafted the terms of reference for a Users Working Group which will provide a formal mechanism for the user community to engage with the JPSS program on a regular basis to ensure their requirements are being addressed. In addition, NOAA is working to establish a Proving Ground effort that will test and implement data and products from the new instruments so that maximum utility can be gained from the JPSS system beginning on Day 1.

Status of the JPSS Program

The FY 2011 Yearlong Continuing Resolution Appropriations Act did not provide the necessary increases over the FY 2010 enacted levels to support planned JPSS development. In response, the Department worked with NOAA and our Appropriations Committees to reallocate additional resources from within the Department to JPSS in FY 2011, however, the total funding available remains far less than required. This has significantly slowed progress of developing JPSS-1 and this funding situation leaves the JPSS Program vulnerable to cost, technical, and schedule challenges. Despite the lack of sufficient FY 2011 funding, NOAA and NASA professionals have made progress in JPSS program development.

Status of the Space Segment – JPSS-1 Spacecraft

In June 2010, NOAA directed NASA to contract with the developer of the NPP spacecraft bus to develop a near-duplicate of the NPP spacecraft bus as the JPSS-1 spacecraft bus. This decision was made to meet the planned 2014 launch of the JPSS-1 satellite, and minimize the chances of a gap in observations.

However, due to lack of sufficient FY 2011 appropriated funds coupled with allocation of funds late in the fiscal year, the launch of JPSS-1 is now estimated to occur in the first quarter of FY 2017, resulting in near-certainty of a gap in observations after the end-of-life of NPP.

To operate with the available FY 2011 funding, NASA has had to slow work on the development of the JPSS-1 spacecraft bus to the minimum required to maintain contract viability. If the FY 2012 appropriations are not at the level of the President's Budget and not appropriated by the end of the first quarter of FY 2012, additional launch delays in spacecraft bus development, and subsequently the JPSS-1 launch, will likely occur.

Status of the Space Segment - Instruments

The following instruments have been built, tested, and integrated onto the NASA NPP satellite for launch in October 2011:

- Visible/Infrared Imager/Radiometer Suite (VIIRS)
- Cross-track Infrared Sounder (CrIS)
- Advanced Technology Microwave Sounder (ATMS)
- Cloud and Earth Radiant Energy System (CERES)
- Ozone Mapping and Profiler Suite (OMPS) Nadir, and OMPS-Limb

These NPP instruments will provide more advanced data and capabilities than are currently available on the NOAA POES satellites. In some instances, NPP will provide new capabilities not currently available from NOAA POES. NOAA will continue to use the environmental data from NASA's research and development Earth Observing System (EOS) Aqua and Terra satellites in its operational weather forecasting capabilities as long as these systems remain viable.

The JPSS Program of Record as announced and budgeted for in the February 2010 decision will carry the instruments to meet the requirements as envisioned for the afternoon orbit of the NPOESS system including: VIIRS, CrIS, ATMS, OMPS-Nadir on JPSS-1, OMPS-Nadir and Limb on JPSS-2, TSIS, CERES, Advanced Data Collection System (A-DCS), Satellite-assisted Search and Rescue (SARSAT).[3]

Appendix B provides a summary of the measurements and applications from these instruments, and Appendix C provides the status of instrument development.

Other data being leveraged include:

- Microwave imaging data from the Japan Aerospace Exploration Agency (JAXA) Advanced Microwave Scanning Radiometer (AMSR) instrument, which will fly on the JAXA Global Change Observation Mission (GCOM) missions.

  NOAA has completed negotiations with JAXA to acquire data from the first GCOM satellite (GCOM-W1) which is scheduled for launch in 2012. These measurements will partially fulfill requirements that would have been provided by the technically-challenging Microwave Imager Sounder previously planned for the NPOESS program.

[3] For the JPSS-1 satellite, NOAA is exploring an alternate platform to carry the A-DCS, SARSAT, and TSIS instruments which will not fit on the JPSS-1 spacecraft bus. Currently, NOAA and NASA plan to conduct a full and open competition for the JPSS-2 spacecraft bus.

- NOAA will use data from DoD DWSS sensors as available. The Space Environment Monitor, expected to fly on the DoD DWSS satellite, is critical to meet the operational needs of the NOAA Space Weather Prediction Center.

Status of the Ground Segment

The JPSS ground system consists of the antennas and support infrastructure that will:
- communicate with NPP, and future polar orbiting satellites, JPSS and DWSS,
- retrieve data from the satellites,
- provide for the command and control center,
- process data for use by the NWS and other operational users, and
- support product quality assurance and long term data archive.

Due to the need to support NPP operations once it launches, NOAA applied a significant portion of its FY 2011 funds towards developing and fielding the ground system network in support of the October 2011 NPP launch. This will facilitate NOAA's operational use of the NPP data for weather forecasting.

The ground system built in preparation for NPP also serves as the precursor system for JPSS. When JPSS-1 launches in FY 2017, the time between gathering data on the satellite and delivering it to the National Weather Service will improve from approximately 120 minutes to 80 minutes. When JPSS-2 launches, our current plan is to reduce the latency further to approximately 30 minutes.

NOAA and NASA have just successfully completed an end-to-end test of the ground system in advance of the NPP launch. The ground system currently deployed for NPP serves as the basis for the JPSS ground system. A series of improvements and updates are planned that will allow the ground system to support legacy satellites as well as JPSS, Defense Meteorological Satellite Program (DoD DMSP), Metop (EUMETSAT) and GCOM (JAXA) satellites. All of which will provide data to the Nation's numerical weather models through the ground system.

There may be a period of time when NOAA and DoD will operate legacy satellites that are ending their useful life, while at the same time operating the JPSS satellites. NOAA's data processing systems will support ingest and data processing from these legacy systems (i.e., POES, DoD Defense Meteorological Satellite Program), and future systems – NPP and JPSS satellites. By having access to data from legacy and JPSS systems at the same time, NOAA will be able to support calibration and validation of the new NPP/JPSS data in a measured and deliberate manner. The period of overlap will allow NOAA to work with its users to allow for a smooth transition from the legacy to the future systems without affecting operational weather forecasting activities.

Challenges: NOAA-identified Risks to JPSS Program Success

Before I close, I would like to discuss some of the risks to JPSS program success that the NOAA-NASA technical and executive team has identified.

1. Lack of adequate, stable, and timely funding for the JPSS Program

As discussed above, the lack of adequate, stable, and timely funding is a major impediment to JPSS program success. Despite the FY2011 situation, NOAA has worked to preserve the instrument suite in the February 2010 program of record and maintain the diverse set of observations and services at the expense of launch date delays. However, if the FY 2012 appropriations fall short of the President's budget request, NOAA will need to reevaluate its core requirements and weigh those against any additional launch delays. These discussions and decisions will need to take into account the impacts of the diverse users of NOAA's satellite data.

Prior to the February 2010 restructuring of the NPOESS program, an independent review team concluded that the NPOESS program was inadequately funded and did not have the reserves necessary to address development challenges as they arose. The Administration presented budget requests in FY 2011 and FY 2012 that provided the funding required for a successful JPSS program, a program of known complexity. With the lack of appropriated funds, the JPSS program is rapidly reverting to the management posture of the NPOESS program in which programmatic decisions are based on available funds instead of meeting user requirements and achieving the scope and goals of the program.

With current FY 2011 funding, NOAA is facing a near 100 percent chance of a data gap in the U.S. civilian polar orbit, on which both civilian and military users rely. This data gap would likely begin when the NPP satellite has reached the end of its projected life.

2. Risk of a gap in critical observations and impacts to users

As the Nation's polar-orbiting satellites near their end-of-life, NOAA is working with users to understand how to incorporate the next-generation observations and develop mitigation plans should a gap in observations become realized due to a failed NPP launch, early on-orbit failure of NPP, or continued delays to JPSS-1 and beyond.

The risk of a gap is not only a concern, but also jeopardizes the very principle of NOAA as an operational agency. Because budget constraints resulted in a near-term focus of resources on NPP and JPSS-1, NOAA has been unable to define JPSS-2 and any subsequent satellites. Without satellites ready on the ground, ready for launch in the event of a launch or on-orbit failure, NOAA would no longer be able to consider this system operational in that the program would continually carry the significant risk of a gap in observations. NOAA is working with partner agencies, domestic and international, to determine what, if any, mitigation options are possible. These options include the potential use of data from foreign weather satellites; however, the potential use of data from foreign satellites would not mitigate the impacts of any loss in coverage of NOAA's polar-orbiting satellites in the afternoon orbit.

3. Reduced credibility of the U.S. as a leader in world-wide meteorological satellite data and services

Many domestic and international organizations and agencies have come to rely on the U.S. to provide continuous coverage in the afternoon polar orbit. Emergency manager organizations in

the U.S. have the ability and infrastructure to receive timely, accurate weather forecasts and warnings to influence their decision-making. International weather agencies such as EUMETSAT have official agreements with NOAA to provide open access to each respective agency's data. Should the U.S. suffer a gap in civil operational polar-orbiting satellite observations, there will be a ripple effect to multiple agencies and entities that depend on uninterrupted data from NOAA. This could have negative consequences in the long-term for the U.S. as we work toward the implementation of a global environmental observational network that leverages assets around the world and provides for increased cost efficiencies in space-based observations.

Conclusion

Providing operational earth and solar observations are imperative to helping protect life and property. NOAA is poised to continue and accelerate the activities in order to meet this mission and provide critically important observations, including through its core satellite programs and partnering with domestic and international entities.

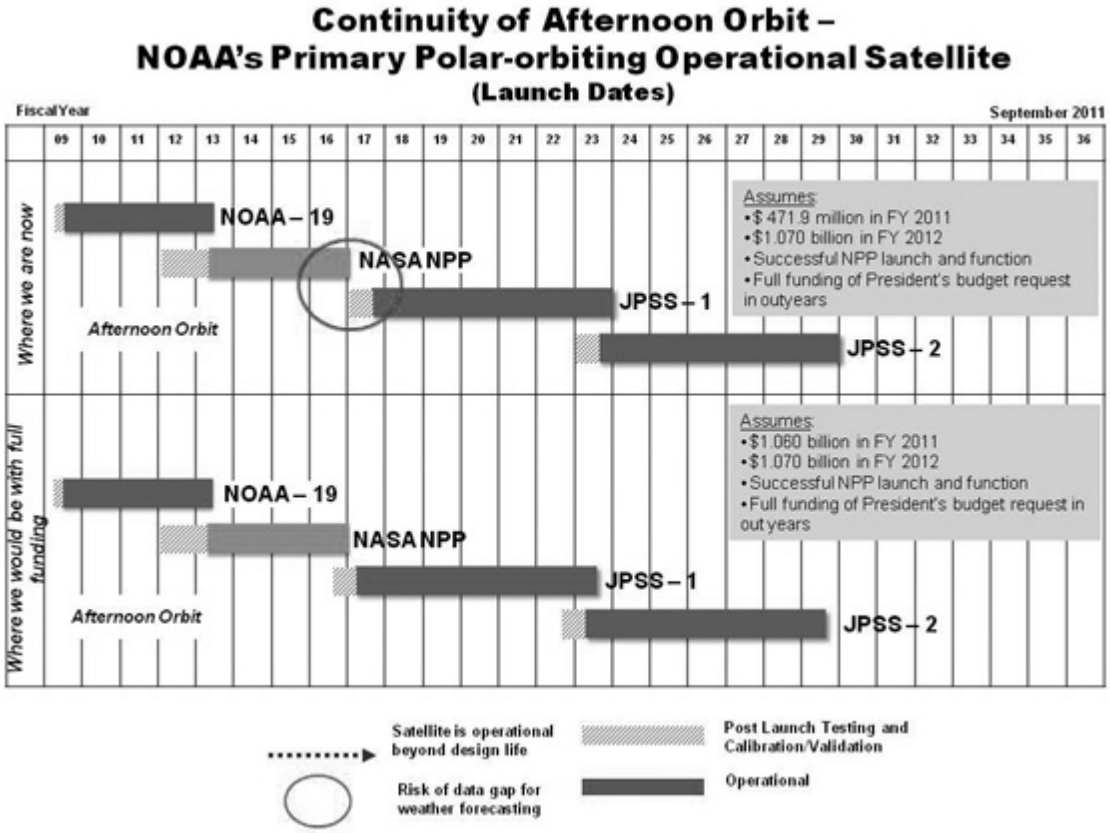
NOAA can achieve improvements in its forecast mission by strengthening four foundational pillars - improved satellite and in-situ observations; computing capacity; coupled atmosphere, ocean, land models, research and science advancements; and our people. NOAA believes that we can revolutionize the forecast process across the entire spectrum from relatively small-scale, short range applications to long-range weather and climate predictions. Although nothing can eliminate the physical threat that severe weather and natural hazards pose, NOAA has demonstrated success in better predicting these severe weather events, reducing their impact, and helping vulnerable communities become more resilient to their devastating effects – and will work to continuously improve its natural hazards products and services to the Nation. The foundation of these improvements is uninterrupted, continuous and sustained polar-orbiting satellite data that NPP and JPSS will provide.

The advanced observational capabilities that the NPP satellite will demonstrate, and that are planned for the JPSS satellites, will provide significantly improved data that will benefit all users. This NPP and JPSS data will be vital inputs to forecast models, which provide the accurate forecast products critical to emergency managers' preparations for severe weather events. We will also continue to evaluate polar-orbiting imagery wherever possible to support missions in data sparse areas. NPP will also continue critical global change measurements, which NASA initiated with its EOS, and further our understanding of climate and global change to enable informed decisions to mitigate and adapt to regional environmental changes.

The largest risk to achieving success of the JPSS program of record remains the lack of adequate, stable, and timely funding.

In conclusion, NOAA thanks the Committee for its continued interest and involvement in the success of NOAA's satellite programs.

I would be happy to answer any questions you may have.


Continuity of Afternoon Orbit –
NOAA's Primary Polar-orbiting Operational Satellite
(Launch Dates)
Fiscal Year
September 2011
09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Where we are now
NOAA – 19
NASA NPP
JPSS – 1
JPSS – 2
Afternoon Orbit
Assumes:
•$ 471.9 million in FY 2011
•$1.070 billion in FY 2012
•Successful NPP launch and function
•Full funding of President's budget request in outyears
Where we would be with full funding
NOAA – 19
NASA NPP
JPSS – 1
JPSS – 2
Afternoon Orbit
Assumes:
•$1.060 billion in FY 2011
•$1.070 billion in FY 2012
•Successful NPP launch and function
•Full funding of President's budget request in out years
Satellite is operational beyond design life
Risk of data gap for weather forecasting
Post Launch Testing and Calibration/Validation
Operational

Appendix B
List of JPSS Instruments in the February 1, 2010 Program of Record

Instrument	Function	Contractor	Source of Funding
Visible/Infrared Imager/Radiometer Suite (VIIRS)	Collects visible and infrared data to monitor atmospheric and surface environmental phenomena such as clouds, sea surface temperature, snow and ice	Raytheon El Segundo, CA	JPSS Program funds instrument development, integration onto spacecraft bus, and launch
Cross Track Infrared Sounder (CrIS)	Teams with ATMS to provide characterization of the Earth's atmosphere (temperature, moisture, and pressure)	ITT Corporation (ITT) Fort Wayne, IN	JPSS Program funds instrument development, integration onto spacecraft bus, and launch
Advanced Technology Microwave Sounder (ATMS)	Teams with CrIS to provide characterization of the Earth's atmosphere (temperature, moisture, and pressure)	Northrop Grumman Electronic Systems (NGES) Baltimore, MD	JPSS Program funds instrument development, integration onto spacecraft bus, and launch
Clouds and the Earth's Radiation Energy System (CERES)	Provides data on incoming and outgoing radiant energy	Northrop Grumman Aerospace Systems (NGAS) El Segundo, CA	NOAA Climate Sensor Program funds instrument development. JPSS program funds integration onto spacecraft bus, and launch
Ozone Mapping and Profiler Suite (OMPS) Nadir and Limb	Provides data on amount of Ozone in the atmosphere, compliance with Montreal Accords	Ball Aerospace Boulder, CO	OMPS-Nadir instrument development, integration, and launch funded by JPSS Program OMPS-Limb instrument development funded by NOAA Climate Sensor Program. JPSS program funds integration onto spacecraft bus, and launch
Total and Solar Spectral Irradiance Sensor (TSIS)	Provides data on the amount of energy emitted by the Sun	Laboratory for Atmospheric and Space Physics (LASP) Boulder, CO	TSIS instrument development funded by NOAA Climate Sensor Program. JPSS program funds integration onto spacecraft bus, and launch
Advanced Data Collection System (ADCS)	Monitors data from unmanned sites (buoys, etc.)	French Space Agency (CNES) France	CNES funds instrument development and provides it to NOAA. JPSS Program funds integration onto spacecraft bus, and launch
Search and Rescue Satellite-Aided Tracking (SARSAT)	Relays distress signals from mariners, aviators, and persons in distress	Canadian Department of Defence (DND) Canada	CNES and DND funds instrument development and provides it to NOAA. JPSS Program funds integration onto spacecraft bus, and launch

		French Space Agency (CNES) France	
Microwave imaging and sounding	Passive-microwave radiometer which measures precipitation rate, cloud water, water vapor, sea surface winds, sea surface temperature, ice, snow, and soil moisture.	To be procured by Japan Aerospace Exploration Agency (JAXA) Japan	JAXA funds instrument development, integration and launch. NOAA leverages data from JPSS program ground system.

Appendix C
Status of JPSS Instruments (as of September 21, 2011)

Instrument	Status	NPP	JPSS-1	JPSS-2
Visible/Infrared Imager/Radiometer Suite (VIIRS)	Contract transferred from NGAS to NASA management control in September 2010	Instrument integrated on NPP. Launch scheduled for October 2011	Work slowed due to lack of sufficient FY 2011 funding	Work halted due to lack of sufficient FY 2011 funding
Cross-track Infrared Sounder (CrIS)	Contract transferred from NGAS to NASA management control in November 2010	Instrument integrated on NPP. Launch scheduled for October 2011	Work slowed due to lack of sufficient FY 2011 funding	Work halted due to lack of sufficient FY 2011 funding
Advanced Technology Microwave Sounder (ATMS)	Letter contract with NGES	Instrument integrated on NPP. Launch scheduled for October 2011	Work slowed due to lack of sufficient FY 2011 funding. IP issues remain unresolved.	Work halted due to lack of sufficient FY 2011 funding
Cloud and Earth Radiant Energy System (CERES)	No change to contract. Already under NASA management control	Instrument integrated on NPP. Launch scheduled for October 2011	Government furnished equipment (GFE). Will be integrated on JPSS-1 spacecraft	Under Review
Ozone Mapping and Profiler Suite (OMPS) Nadir	Contract transferred from NGAS to NASA management control in November 2010	Instrument integrated on NPP. Launch scheduled for October 2011	Work slowed due to lack of sufficient FY 201 funding	Work halted due to lack of sufficient FY 2011 funding
Ozone Mapping and Profiler Suite (OMPS) Limb	No change to contract. Already under NASA management control		Not on JPSS-1 manifest	Planned manifest on JPSS-2 spacecraft
Total Solar and Spectral Irradiance Sensor (TSIS)	No change to contract. Already under NASA management control	Not on NPP manifest	GFE. Studies for flight on a dedicated platform on-going	Under Review
Advanced Data Collection System (A-DCS)	Discussions on-going with French Space Agency	Not on NPP manifest	GFE. Studies for flight on a dedicated platform on-going	Under Review
Satellite-assisted Search and Rescue (SARSAT)	Discussions on-going with French Space Agency and Canadian Defence	Not on NPP manifest	GFE. Studies for flight on a dedicated platform on-going	Under Review
Microwave imaging	JAXA GCOM scheduled for launch in 2012	Not on NPP manifest	Not on JPSS-1 manifest	Not on JPSS-2 manifest
Space Environment Monitor (SEM)	DWSS manifest	Not on NPP manifest	Not on JPSS-1 manifest	Not on JPSS-2 manifest

Chairman BROUN. Thank you, Dr. Sullivan.

I now recognize our second witness, Mr. Christopher Scolese. Sir, you may proceed. You are recognized for five minutes.

TESTIMONY OF MR. CHRISTOPHER SCOLESE, ASSOCIATE ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. SCOLESE. Thank you, Mr. Chairman and Members of the Subcommittee for the opportunity to appear today to share information regarding NASA's role in and commitment to NOAA's Joint Polar Satellite System program, JPSS.

As has been stated, JPSS is essential to the Nation's weather forecasting system and is critical to the Nation's research activities in earth science. As the Nation's civil space agency, NASA is fully supporting JPSS on a reimbursable basis for NOAA.

NOAA and NASA share a 40-year partnership developing the Nation's polar and geosynchronous weather satellites. That partnership continues as NOAA and NASA implement the restructuring of the NPOESS program. The 2010 restructuring of NPOESS resulted in the establishment of JPSS, as has been noted.

In April 2010, NASA established the Joint Agency Satellite Division within our science mission directorate to assure that NASA effectively supported NOAA's requirements for JPSS. We refer to this office as JASD. This office is responsible for the cross-agency collaboration between NOAA and NASA and assures that senior NASA management up through the Administrator is aware of the progress and issues on this critical national program so they can be resolved quickly. The combined NOAA and NASA team is responsible for the formulation and implementation of all JPSS missions and their associated elements including the spacecraft, instruments, launch services, ground segments and post-launch support. Over the past year, NASA has worked closely with NOAA to put in place a high-caliber team of experienced personnel from both agencies to implement JPSS, and that team is working well.

The initial focus of the JPSS team has been to complete activities required to support the upcoming launch of the NPOESS Preparatory Project satellite, NPP, as has been mentioned earlier. Originally, this was designed as a technology demonstration for NPOESS and to provide data continuity between key elements of NASA's earth-observing satellites and NPOESS, which was to replace those. NPP will now also serve as an operational bridge mission for the current polar weather satellites until the launch of the first JPSS mission.

In addition to supporting the NPP mission, the JPSS team has focused the last 12 months on completing the transition of the program and contract elements from the former NPOESS program to the new JPSS program. As has been mentioned, the JPSS program is now of control of and managing all the instruments and ground system contracts. In September 2010, the JPSS program awarded a fixed-price contract for the JPSS–1 spacecraft, a bus that is similar to the NPP spacecraft bus. That was done in order to reduce risk and uncertainty in both cost, schedule and technical.

NASA shares NOAA's commitment to the success of the JPSS, as evidenced by the caliber of personnel assigned to the program and the continued support from NASA senior management. The re-

quirements are defined, the program is in place, and with the requested funding we are confident that we can implement the JPSS program as planned. NOAA and NASA are striving to ensure that the Nation's weather and environmental requirements are met on the most efficient and predictable schedule without reducing system capabilities or further increasing risk. With the delivery of the NPP satellite to Vandenberg Air Force base on August 30th, the first fruits of the NOAA/NASA partnership for JPSS are undergoing final preparations for launch this October 25th. With your continued support, we expect this partnership to successfully develop and deliver the JPSS–1 mission for launch in fiscal year 2017.

Once again, thank you for the opportunity to testify today. I appreciate the support of this Committee and the Congress for NASA's programs and for JPSS and look forward to answering any of the questions you may have.

[The prepared statement of Mr. Scolese follows:]

PREPARED STATEMENT OF MR. CHRISTOPHER J. SCOLESE, ASSOCIATE ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear today to share information regarding the NASA role in, and commitment, to the National Oceanic and Atmospheric Administration (NOAA) Joint Polar Satellite System (JPSS) Program. JPSS is critical to the Nation's weather forecasting system, climate monitoring and research activities. As the Nation's civil space agency, NASA is fully supporting JPSS on a reimbursable basis for NOAA.

Background

In February 2010, in conjunction with the FY 2011 Budget Request, the Administration directed a major restructuring of the National Polar-orbiting Operational Environmental Satellite System (NPOESS). That decision was reaffirmed by the June 2012 National Space Policy. In April 2010, NASA established the Joint Agency Satellite Division (JASD) within its Science Mission Directorate to manage the NASA role as NOAA's acquisition agent for JPSS systems. Specifically, JASD was charged with managing the transition of NPOESS to the new JPSS, as well as for formulation and implementation of all JPSS missions and their associated elements, including instruments, spacecraft, launch services, the ground segment, and post-launch support. Since that time, NASA has worked with NOAA to put in place a high-caliber team of experienced personnel from both agencies to implement JPSS, and this team is working well.

JPSS Organization

NASA and NOAA have been partners for over 40 years in developing the Nation's polar and geosynchronous weather satellites. With the President's direction last year, NASA and NOAA have returned to this successful partnership where NASA serves as the acquisition agent. The establishment of dedicated teams at both NASA Headquarters and the NASA Goddard Space Flight Center in Greenbelt, Maryland, has enabled a smooth transition to the new JPSS program.

NASA and NOAA have established joint program management boards to direct JPSS, and have integrated their decision-making processes to efficiently and effectively manage this cooperative activity. The NASA and NOAA teams have demonstrated a strong working relationship over the last 18 months.

NPP

The initial focus of the JPSS team has been to complete the activities required to support the launch of the NASA NPOESS Preparatory Project (NPP) satellite. NPP was originally designed as a technology demonstration for NPOESS and to provide data continuity between key elements of the NASA Earth Observing System (EOS) satellites and the first NPOESS satellite. NPP will fly the first copies of a new generation of Earth observing instruments, and we will spend the first 18 months comparing their performance with legacy sensors flying on NASA and NOAA satellites currently in orbit. The NPP mission is intended to characterize performance of these new sensors, providing feedback to improve the development of the operational sensors that will fly on JPSS. As these sensors are characterized

and calibrated against the legacy sensors, data products from these sensors will be made available to the research and operational weather communities. While NPP was not intended to be used as an operational asset, our plan is to make data available to the NOAA operational weather community as soon as is practical, to serve as a bridge from the current polar weather satellites to the first JPSS mission in FY 2017.

In support of the NPP mission, JPSS is providing engineering support for three critical instruments provided by the NPOESS program and is continuing the development of the ground system that will operate NPP (as well as subsequent JPSS and the Defense Weather Satellite System (DWSS) spacecraft) and process the instrument data products. Last year, one of our major concerns with the transition from NPOESS to JPSS was the readiness of the JPSS ground system to support the NPP mission schedule. Upon the launch of NPP, the ground system will be responsible for command, control, communications, and data processing. I am pleased to report that the NASA-NOAA team has made significant progress over the past 12 months to ensure the JPSS ground system will enable NPP to launch next month as planned.

Since the ground system contracts were transferred last year from the Department of Defense (DOD) to NASA, the JPSS program has certified close to 1,500 products ready for launch, completed twenty software releases, completed numerous operational exercises totaling almost 400 hours of spacecraft interface time and has closed more than 4,000 work requests.

While the ground system was being readied for the launch of NPP, the JPSS program has fulfilled commitments previously made to both the DoD and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), including refurbishment of the MG1 antenna in McMurdo Station in Antarctica, to allow it to receive X-band data for EUMETSAT's Meteorological Operational satellite programme (MetOp), cutting the data latency in half for the mid-morning orbit. The program also installed the first of the JPSS receptor sites in McMurdo, modified using DoD funds, allowing the Defense Meteorological Satellite Program (DMSP) to receive their mission data at McMurdo as well. These capabilities will also be used by the JPSS–1 mission when it launches in FY 2017.

JPSS Transition Status

In addition to supporting the NPP mission, the JPSS team has focused for the last 12 months on completing the transition from the NPOESS program and contracts to the new JPSS program and contracts. The transition to JPSS is now complete and NASA, as NOAA's acquisition agent, is in control of, and managing, all of the JPSS instrument and ground system contracts, including a new NASA contract to produce the Advanced Technology Microwave Sounder (ATMS) signed last week. The change to NASA-held and managed contracts has been beneficial for a number of reasons, including, NASA's expertise as an experienced space acquisition organization and government management of separate contracts for each major element (spacecraft, instruments and ground segments). Through the transition, the instrument vendors continued to make progress in the development of the flight units for JPSS–1, and a spacecraft contract was awarded to Ball Aerospace for JPSS–1. Assuming full funding of the President's FY 2012 budget request for NOAA, it is anticipated that JPSS–1 will be ready to launch in the first quarter of FY 2017, five years after the planned October launch of NPP.

Conclusion

NASA and NOAA are committed to the JPSS program, and ensuring the success of this program is essential to both agencies and the Nation. The requirements are defined, the program is in place, and with the requested funding NASA and NOAA are confident that the agencies can implement the JPSS program as planned. NOAA and NASA are striving to ensure that weather and environmental requirements are met on the most efficient and predictable schedule without reducing system capabilities or further increasing risk.

With the delivery of the NPP satellite to Vandenberg Air Force Base in Lompoc, California, on August 30, 2011, the first fruits of the NASA-NOAA partnership for JPSS are undergoing final preparations for a planned launch on October 25, 2011. With your continued support, NASA expects this partnership to successfully develop and deliver the JPSS-1 mission for launch in FY 2017, thus ensuring continued support of NOAA's weather and environmental monitoring program.

Mr. Chairman, thank you for the opportunity to testify today. I appreciate the continued support of this Subcommittee and the Congress, and I would be pleased to respond to any questions you or the other Members of the Subcommittee may have.

Chairman BROUN. Thank you, Mr. Scolese.

I now recognize our final witness, Mr. David Powner. Sir, you may proceed. You are recognized for five minutes.

TESTIMONY OF MR. DAVID POWNER, DIRECTOR, INFORMATION TECHNOLOGY MANAGEMENT ISSUES, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. POWNER. Chairman Broun, Chairman Harris, Ranking Member Miller and Members of the Subcommittees, we appreciate the opportunity to testify this morning on the JPSS program.

Last summer when I testified before this Subcommittee, we stressed the importance of addressing key transition risks associated with the disbanding of NPOESS and establishing a new program. We also emphasized the importance of expediting decisions on the cost, launch schedules and the functionality to be delivered with this new satellite acquisition. NOAA and NASA have made solid progress transferring contracts and establishing an experienced program management team. To date, the contracts for the spacecraft and the five JPSS sensors have been transferred from NPOESS that was previously managed by DOD to NASA.

Additionally, just last week, a new JPSS Director started bringing solid aerospace engineering and almost three decades of experience to the program. Although this progress is commendable, I would like to stress that transitioning program management to NASA alone does not guarantee success. In fact, we have listed NASA's acquisition management as high risk since 1990, given its inconsistent performance in delivering large-scale projects. Given that, it is imperative that NOAA performs rigorous executive-level oversight of JPSS. The program management plan that Dr. Sullivan mentioned should lay out the details of the program's needed governance structure.

Although there is good news in the transferring of contracts and establishing an experienced management team, the JPSS program still needs to make firm decisions on the program's cost, launch dates and the functionality to be delivered. Eighteen months have passed since the disbanding decision and there is still no baseline and NOAA does not plan to establish this baseline until later this year. Clearly, budget uncertainties have contributed to this. I would like to highlight why this baseline is so important.

First, from a cost perspective, it is important that NOAA bases its cost estimate on realistic budget scenarios. The program has an internal cost estimate but is unwilling to disclose this until an independent cost estimate is completed. NOAA told us this estimate should be around $12 billion. If estimates come in higher than this $12 billion market, it appears NOAA is willing to reduce functionality to keep overall costs within this ballpark.

Another reason the baseline is critical is to know exactly when the JPSS sensors will be launched so that potential gaps in satellite coverage can be managed. My written statement lays out these potential gaps. The bottom line is this: we are banking on NPP, the demonstration satellite now used for operations, to provide coverage from roughly 2012 to 2017. Due to a necessary on-orbit checkout period, the anticipated gap in coverage between NPP and the first JPSS satellite is expected to be around 6 to 12

months. This gap will increase if NPP doesn't last the full five years, and opinions on this vary. For example, some NASA engineers are concerned that selected NPP sensors will only last three years. This gap will also increase if the first JPSS launch is delayed beyond late 2016. These gaps are critical, Mr. Chairman. NOAA reports that data gaps could place lives, property and critical infrastructure in danger.

My two key takeaways this morning are, one, baseline the program as soon as possible, and two, have contingency plans in place to manage the potential gaps in coverage. Regarding the gap, first and foremost is NPP performance and is ability to last roughly five years. We will get our first indication of this soon after next month's launch. Also launching the first JPSS bird in late 2016 at a minimum is key. NOAA has been proactively managing this situation and is looking at options to remove functionality so that the first JPSS satellite is launched possibly sooner. Expediting these decisions and contingencies are critical to ensuring the continuity of weather and climate data.

Mr. Chairman, this concludes my statement. Thank you for your leadership and oversight of this acquisition.

[The prepared statement of Mr. Powner follows:]

PREPARED STATEMENT OF MR. DAVID A. POWNER, DIRECTOR, INFORMATION TECHNOLOGY MANAGEMENT ISSUES, GOVERNMENT ACCOUNTABILITY OFFICE

United States Government Accountability Office

GAO

Testimony

Before the Subcommittees on Investigations and Oversight and Energy and Environment, Committee on Science, Space, and Technology, House of Representatives

For Release on Delivery
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POLAR SATELLITES

Agencies Need to Address Potential Gaps in Weather and Climate Data Coverage

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

U.S. Government Accountability Office
GAO 90 YEARS 1921-2011
ACCOUNTABILITY * INTEGRITY * RELIABILITY

GAO-11-954T

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Highlights

Highlights of GAO-11-954T, a testimony before the Subcommittees on Oversight and Investigations and Energy and Environment, Committee on Science, Space, and Technology, House of Representatives

September 23, 2011

POLAR SATELLITES

Agencies Need to Address Potential Gaps in Weather and Climate Data Coverage

Why GAO Did This Study

Environmental satellites provide critical data used in weather forecasting and measuring variations in climate over time. In February 2010, the White House's Office of Science and Technology Policy disbanded the National Polar-orbiting Operational Environmental Satellite System (NPOESS)—a tri-agency satellite acquisition that had encountered continuing cost, schedule, and management problems—and instructed the National Oceanic and Atmospheric Administration (NOAA) and the Department of Defense (DOD) to undertake separate acquisitions. Both agencies have begun planning their respective programs—the Joint Polar Satellite System (JPSS) and the Defense Weather Satellite System (DWSS)—including creating program offices and transitioning contracts.

GAO was asked to summarize the status of ongoing work assessing (1) NOAA's and DOD's plans for their separate acquisitions and (2) the key risks in transitioning from NPOESS to these new programs. In preparing this statement, GAO relied on the work supporting previous reports, attended monthly program management meetings, reviewed documentation on both programs, and interviewed agency officials.

What GAO Recommends

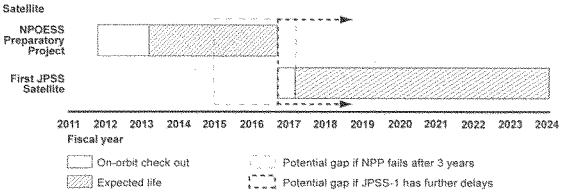
GAO is not making new recommendations in this statement.

View GAO-11-954T or key components. For more information, contact David A. Powner at (202) 512-9286 or pownerd@gao.gov.

What GAO Found

In May 2010, GAO reported on the transition from NPOESS to two separate programs, and recommended that both NOAA and DOD expedite decisions on the cost, schedule, and capabilities of their respective programs. Since that time, both agencies have made progress on their programs, but neither has finalized its plans or fully implemented the recommendations. NOAA is currently focusing on the October 2011 launch of the NPOESS Preparatory Project satellite—a demonstration satellite that the agency now plans to use operationally in order to minimize potential gaps in coverage. In addition, NOAA has transferred contracts for satellite sensors from the NPOESS program to the JPSS program. However, NOAA officials stated that the agency slowed down the development of the first JPSS satellite due to budget constraints, causing a delay in the launch date. As a result, NOAA is facing a potential gap in satellite data continuity. Such a delay could significantly impact the nation's ability to obtain advanced warning of extreme weather events such as hurricanes.

Potential Gaps in Satellite Coverage



Source: GAO analysis of NOAA data.

Meanwhile, DOD began planning for its satellite program. Department officials reported that DWSS is to consist of two satellites with three sensors: an imager, microwave imager/sounder, and a space environment sensor. The first satellite is to be launched in 2018. The department has not, however, finalized the cost, schedule, and functionality of the program. It expects to do so in early 2012. Until both NOAA and DOD develop and finalize credible plans for their respective programs, it will not be clear what the programs will deliver, when, and at what cost.

In its prior report, GAO also recommended that NOAA and DOD establish plans to mitigate key risks in transitioning from NPOESS to the successor programs, including ensuring effective oversight of JPSS program management, and addressing cost and schedule implications from contract and program changes. Both agencies have taken steps to mitigate these risks, but more remains to be done. For example, NOAA could not provide firm time frames for completing its management control plan or addressing residual contracting issues. Moving forward, it will be important for the agencies to continue efforts to mitigate these risks in order to ensure the success of their respective programs.

Chairman Broun, Chairman Harris, Ranking Member Miller, Ranking Member Edwards, and Members of the Subcommittees:

Thank you for the opportunity to participate in today's hearing on efforts to disband and replace the National Polar-orbiting Operational Environmental Satellite System (NPOESS). NPOESS was planned to be a state-of-the-art, environment-monitoring satellite system that would replace two existing polar-orbiting environmental satellite systems. Managed jointly by the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), the Department of Defense (DOD)/U.S. Air Force, and the National Aeronautics and Space Administration (NASA), the program was considered critical to the nation's weather forecasting and climate monitoring needs through the year 2026. However, to address continuing cost, schedule, management, and technical challenges, the White House's Office of Science and Technology Policy decided in February 2010 to disband the NPOESS acquisition and, instead, to have NOAA and DOD undertake separate acquisitions. As requested, this statement summarizes ongoing work we are doing for your full committee to assess the status of NOAA's and DOD's plans for separate acquisitions and key risks in transitioning from NPOESS to these new programs.

In preparing this testimony, we relied on the work supporting our previous reports[1] and on observations from our ongoing work. To obtain updated information, we attended NOAA's monthly program management council meetings, reviewed briefings for both programs, and interviewed officials from NOAA, NASA, and DOD. All of our work for the prior reports and this testimony was performed in accordance with generally accepted government auditing standards. Those standards require that we plan and

[1]GAO, *Polar-orbiting Environmental Satellites: Agencies Must Act Quickly to Address Risks That Jeopardize the Continuity of Weather and Climate Data*, GAO-10-558 (Washington, D.C.: May 27, 2010); *Polar-orbiting Environmental Satellites: With Costs Increasing and Data Continuity at Risk, Improvements Needed in Tri-agency Decision Making*, GAO-09-564 (Washington, D.C.: June 17, 2009); *Environmental Satellites: Polar-orbiting Satellite Acquisition Faces Delays; Decisions Needed on Whether and How to Ensure Climate Data Continuity*, GAO-08-518 (Washington, D.C.: May 16, 2008); and *Polar-orbiting Operational Environmental Satellites: Restructuring Is Under Way, but Technical Challenges and Risks Remain*, GAO-07-498 (Washington, D.C.: Apr. 27, 2007).

perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Since the 1960s, the United States has used satellites to observe the earth and its land, oceans, atmosphere, and space environments. Satellites provide a global perspective of the environment and allow observations in areas that may be otherwise unreachable or unsuitable for measurements. Used in combination with ground, sea, and airborne observing systems, satellites have become an indispensable part of measuring and forecasting weather and climate. For example, satellites provide the graphical images used to identify current weather patterns, as well as the data that go into numerical weather prediction models. These models are used to forecast weather 1 to 2 weeks in advance and to issue warnings about severe weather, including the path and intensity of hurricanes. Satellite data are also used to warn infrastructure owners when increased solar activity is expected to affect key assets, including communication satellites or the electric power grid. When collected over time, satellite data can also be used to observe climate change—the trends and changes in the earth's climate. These data are used to monitor and project seasonal, annual, and decadal changes in the earth's temperature, vegetation coverage, and ozone coverage.

The NPOESS Program: Inception, Challenges, and Divergence

Since the 1960s, the United States has operated two separate operational polar-orbiting meteorological satellite systems: the Polar-orbiting Operational Environmental Satellite (POES) series, which is managed by NOAA, and the Defense Meteorological Satellite Program (DMSP), which is managed by the Air Force.[2] Two

[2]NOAA provides command and control for both the POES and DMSP satellites after they are in orbit.

operational DMSP satellites and one operational POES satellite are currently in orbit and are positioned so that they cross the equator in the early morning, midmorning, and early afternoon. In addition, the government relies on a European satellite, called the Meteorological Operational satellite, for data in the midmorning orbit.[3] Together, they ensure that, for any region of the earth, the data provided to users are generally no more than 6 hours old.

With the expectation that combining the POES and DMSP programs would reduce duplication and result in sizable cost savings, a May 1994 Presidential Decision Directive required NOAA and DOD to converge the two satellite programs into a single satellite program—NPOESS—capable of satisfying both civilian and military requirements.[4] To manage this program, DOD, NOAA, and NASA formed a tri-agency Integrated Program Office, with NOAA responsible for overall program management for the converged system and for satellite operations; the Air Force responsible for acquisition; and NASA responsible for facilitating the development and incorporation of new technologies into the converged system.

When its primary contract was awarded in August 2002, NPOESS was estimated to cost about $7 billion through 2026 and was considered critical to the United States' ability to maintain the continuity of data required for weather forecasting and global climate monitoring. To reduce the risk involved in developing new technologies and to maintain climate data continuity, the program planned to launch a demonstration satellite, called the NPOESS Preparatory Project (NPP) in May 2006. NPP was to demonstrate selected instruments that would later be included on the NPOESS satellites. The first NPOESS satellite was to be available for launch in March 2008.

[3]The European Organisation for the Exploitation of Meteorological Satellites' MetOp program is a series of three polar-orbiting satellites dedicated to operational meteorology. MetOp satellites are planned to be launched sequentially over 14 years. The first of these satellites was launched in 2006 and is currently operational. The next two are expected to launch in 2012 and 2017, respectively.

[4]Presidential Decision Directive NSTC-2, May 5, 1994.

However, in the years after the program was initiated, NPOESS encountered significant technical challenges in sensor development, program cost growth, and schedule delays. By November 2005, we estimated that the program's cost had grown to $10 billion and the schedule for the first launch was delayed by almost 2 years. These issues led to a 2006 restructuring of the program, which reduced the program's functionality by decreasing the number of planned satellites, orbits, and instruments. The restructuring also led agency executives to decide to mitigate potential data gaps by using NPP as an operational satellite.[5] Even after the restructuring, however, the program continued to encounter technical issues in developing two sensors, significant tri-agency management challenges, schedule delays, and further cost increases. To help address these issues, in recent years we have made a series of recommendations to, among other things, improve executive-level oversight and develop realistic time frames for revising cost and schedule baselines.[6]

Faced with costs that were expected to exceed $14 billion and launch schedules that were delayed by over 5 years, in August 2009, the Executive Office of the President formed a task force, led by the Office of Science and Technology Policy, to investigate the management and acquisition options that would improve the NPOESS program. As a result of this review, the Director of the Office of Science and Technology Policy announced in February 2010 that NOAA and DOD would no longer jointly procure the NPOESS satellite system; instead, each agency would plan and acquire its own satellite system.[7] Specifically, NOAA is responsible for the afternoon orbit and the observations planned for the first and third NPOESS satellites. DOD is responsible for the early-morning orbit and the observations planned for the second and fourth NPOESS satellites. The partnership with the European satellite agencies for the midmorning orbit is to continue as planned.

[5] Using NPP as an operational satellite means that its data will be used to provide climate and weather products.

[6] GAO-09-564, GAO-08-518, and GAO-07-498.

[7] The announcement accompanied the release of the President's fiscal year 2011 budget request.

Prior GAO Work Evaluated Preliminary Plans for Separate NOAA and DOD Satellite Programs and Recommended Actions to Solidify Plans and Address Risks

In May 2010, we reported on NOAA's and DOD's preliminary plans for initiating new environmental satellite programs and highlighted key transition risks facing the agencies.[8] At that time, NOAA had developed preliminary plans for its new satellite acquisition program—called the Joint Polar Satellite System (JPSS). Specifically, NOAA planned to acquire two satellites (called JPSS-1 and JPSS-2) for launch in 2015 and 2018.[9] NOAA also planned technical changes to the satellites, including using a smaller spacecraft than the one planned for NPOESS and removing sensors that were planned for the NPOESS satellites in the afternoon orbit.[10]

In addition, NOAA planned to transfer the management of the satellite acquisition from the NPOESS program office to NASA's Goddard Space Flight Center, so that it could be co-located at a space system acquisition center as advocated by an independent review team. NOAA developed a team to lead the transition from NPOESS to JPSS, and planned to begin transitioning in July 2010 and complete a transition plan—including cost and schedule estimates—by the end of September 2010. NOAA estimated that the JPSS program would cost approximately $11.9 billion to complete through 2024.[11] It also anticipated funding of about $1 billion in fiscal year 2011 to set up the new program office and handle the costs

[8]GAO-10-558.

[9]NOAA officials noted that these dates could change as transition plans were further developed.

[10]NOAA officials planned to exclude (1) the Space Environment Monitor (which collects data to predict the effects of space weather on technological systems), and instead, to obtain this information from DOD's DWSS satellites, and (2) the Microwave Imager/Sounder (which collects microwave images and data needed for measurements such as rain rate and soil moisture), and instead, to obtain this data through an agreement with the Japan Aerospace Exploration Agency. Although they plan to launch the Total and Spectral Solar Irradiance Suite, NOAA officials had not made a decision on which satellite will host the sensor.

[11]This estimate includes approximately $2.9 billion in NOAA funds spent on NPOESS through fiscal year 2010, but does not include approximately $2.9 billion that DOD has spent through fiscal year 2010 on NPOESS. NOAA officials also reported that the JPSS cost estimate is at a higher confidence level than the previous NPOESS life-cycle cost estimates.

associated with transitioning contracts from the Air Force to NASA while continuing to develop NPP and the first JPSS satellite.

DOD was at an earlier stage in its planning process at the time of our June 2010 testimony, in part because it had more time before the first satellite in the morning orbit was needed. DOD officials were developing plans—including costs, schedules, and functionality—for their new program, called the Defense Weather Satellite System (DWSS). At that time, DOD expected to make final decisions on the spacecraft, sensors, procurement strategy, and staffing in August 2010, and to begin the program immediately.

In our report, we noted that both agencies faced key risks in transitioning from NPOESS to their separate programs. These risks included the loss of key staff and capabilities, delays in negotiating contract changes and establishing new program offices, the loss of support for the other agency's requirements, and insufficient oversight of new program management. We reported that until these risks were effectively mitigated, it was likely that the satellite programs' costs would continue to grow and launch dates would continue to be delayed. We also noted that further delays could lead to gaps in the continuity of critical satellite data.

We made recommendations to ensure that the transition from NPOESS to its successor programs was efficiently and effectively managed. Among other things, we recommended that the Secretaries of Defense and Commerce direct their respective NPOESS follow-on programs to expedite decisions on the expected cost, schedule, and capabilities of their planned programs; and to direct their respective follow-on programs to develop plans to address the key transition risks we identified. As discussed below, the agencies have not yet fully implemented these recommendations.

NOAA and DOD Have Made Progress, but Decisions are Needed to Address Potential Gaps in Weather and Climate Data

Over the last year, NOAA and NASA have worked to establish the JPSS program, to keep the NPP satellite's development on track, and to begin developing plans for the JPSS satellite. However, of the funding made available to NOAA in its fiscal year 2011 appropriations, JPSS was allocated $471.9 million–far less than the $1 billion identified in the President's budget to establish a program and stay on track with satellite deliverables. As a result, the JPSS program office decided to focus on developing NPP and the satellite's ground system so that it could remain on track for an October 2011 launch. The program slowed development efforts on the first JPSS satellite and halted work on the second JPSS satellite. Table 1 shows the status of key components of NPP and JPSS-1.

Table 1: Status of NPP and JPSS-1 as of August 2011

Satellite	Status
NPP	• All of the sensors have been integrated onto the NPP spacecraft. • Environmental testing and ground compatibility testing have been completed. • NASA plans to complete the final operational and mission readiness reviews in early September. • The launch date is currently planned for October 25, 2011.
JPSS-1	• Contracts for all sensors have been transferred to NASA. • Work on most sensors, including the Clouds' and the Earth's Radiant Energy System, the Visible/Infrared Imager/Radiometer Suite, Total Solar Irradiance Sensor, Cross-Track Infrared Sounder, and Ozone Mapper/Profiler Suite, is under way. • Technical issues found on the Cross-Track Infrared Sounder and the Ozone Mapper/Profiler Suite will need to be addressed, but are not expected to affect the JPSS-1 launch date. • NOAA has not yet determined how it will accommodate sensors and subsystems that are part of the JPSS program but not included on the JPSS-1 satellite: the Search and Rescue Satellite Aided Tracking, the Advanced Data Collection System, or the Total Solar Irradiance Sensor.

Source: GAO analysis of NOAA and NASA data.

Although we recommended in May 2010 that NOAA expedite decisions on the cost, schedule, and capabilities of JPSS, NOAA has not yet done so. According to NOAA officials, uncertainty surrounding the agency's fiscal year 2011 budget has made it

difficult to establish a program baseline. However, NOAA has developed a requirements document and is obtaining an independent cost estimate. The agency expects to have a complete program baseline in place by February 2012. Until this baseline is in place, it is not clear what functionality will be delivered by when and at what cost. Given the critical development activities planned for 2012, it is imperative that NOAA move expeditiously to establish a credible program baseline.

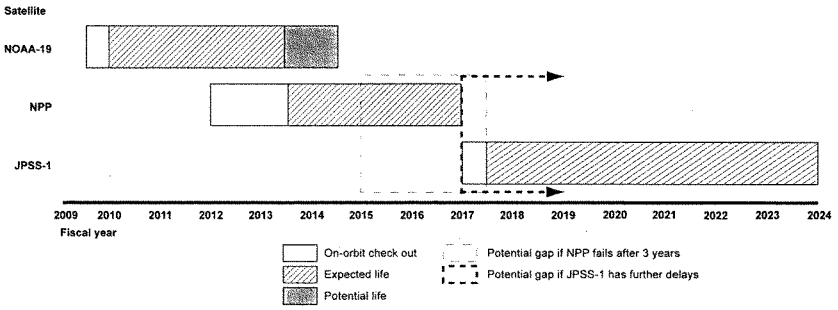
NOAA Faces A Potential Gap in Satellite Data Continuity and Is Considering Options to Minimize That Gap

NOAA is facing a potential gap in satellite data continuity. When NPOESS was first disbanded, program officials anticipated launching the JPSS satellites in 2015 and 2018 (while acknowledging that these dates could change as the program's plans were firmed up). Over the past year, as program officials made critical decisions to defer work on JPSS in order to keep NPP on track, the launch dates for JPSS-1 and JPSS-2 have changed. Program officials currently estimate that the satellites will launch in late 2016 and 2021.

There are two key scenarios that could lead to a gap in satellite data in the afternoon orbit between the end of life of the NPP satellite and the availability of the first JPSS satellite. Under the first scenario, NPP sensors may not last until JPSS-1 is launched. The NASA Inspector General reported that NASA is concerned that selected NPP sensors may last only 3 years because of workmanship issues.[12] The second scenario for a satellite data gap involves further delays in the JPSS-1 launch date. This could occur due to shortfalls in program funding or technical issues in the development of the satellite. Figure 1 depicts possible gaps.

[12] NASA Office of Inspector General, *NASA's Management of the NPOESS Preparatory Project*, IG-11-018 (Washington, D.C.: June 2, 2011).

Figure 1: Potential Gaps in Polar Satellite Data in the Afternoon Orbit



Source: GAO analysis of NOAA data.

According to NOAA, a data gap would lead to less accurate and timely weather prediction models used to support weather forecasting, and advanced warning of extreme events—such as hurricanes, storm surges, and floods—would be diminished. The agency reported that this could place lives, property, and critical infrastructure in danger. In addition, NOAA estimated that the time it takes to respond to emergency search and rescue beacons could double.

Given the potential for a gap in satellite data, NOAA officials are considering whether to remove functionality from JPSS-1 in order to allow it to be developed—and launched—more quickly. For example, program officials are considering increasing the time it takes for data processing centers to receive the data, removing the ground systems' ability to process some data, and removing sensors.

DOD Is Planning for DWSS; Critical Milestones Lie Ahead

DOD has developed draft plans for its DWSS program. The DWSS satellites will take over the morning orbit after the remaining DMSP

satellites reach the end of their respective lives.[13] The DWSS program will be comprised of two satellites—the first expected to be launched no earlier than 2018. Each will have three sensors: a Visible/Infrared Imager/Radiometer Suite, a Space Environment Monitor, and a microwave imager/sounder. DOD plans to formally review system requirements in December 2011 and to conduct a preliminary design review by September 2012. In addition, DOD plans to develop a requirements document and obtain an independent cost estimate during fiscal year 2012.

Although we recommended in May 2010 that DOD expedite decisions on the cost, schedule, and capabilities of DWSS, DOD has not yet finalized the functionality that will be provided by the DWSS program, or developed a cost and schedule baseline. For example, DOD has not yet decided what microwave sounder will be developed for DWSS, and whether it will merely meet legacy requirements or provide the full scope of functionality originally planned for NPOESS. Until DOD defines the scope of its program, including the capabilities each satellite will provide, both military and civilian users will be unable to prepare for DWSS satellite data and any data shortfalls.

NOAA and DOD Continue to Face Key Transition Risks

Over a year ago, we identified key transition risks facing NOAA and DOD, including the need to support the other agencies' requirements, ensure effective oversight of new program management, manage cost and schedule implications from contract and other program changes, and ensure the availability of key staff and capabilities, and we recommended that the agencies move to mitigate these risks. Today, the agencies continue to face key risks in transitioning from NPOESS to their new programs. These risk areas are discussed below.

[13] DMSP-17 and 18 are currently in morning orbits. DOD has two more DMSP satellites (called DMSP-19 and 20) and expects to launch them no earlier than 2012 and 2015, respectively.

- *Supporting the other agency's requirements.* As a joint program, NPOESS was expected to fulfill many military, civilian, and research requirements for environmental data. However, because the requirements of NOAA and DOD are different, the agencies may develop programs that meet their own needs but not the other's. Because both NOAA and DOD have not decided on the final functionality of their respective programs, each could choose to remove functionality that is important to the other agency and its users. This has started to occur. NOAA has already made decisions to remove a transmission capability that is important to the Navy. Other functions that are currently under consideration (such as delaying receipt of the data or removing ground processing functions) could also affect military operations. Agency officials reported that they formed a joint working group in July 2011 to discuss and mitigate these issues, but it is too soon to determine what progress has been made, if any. If the agencies cannot find a way to build an effective partnership that facilitates both efficient and effective decision-making on data continuity needs, the needs of both agencies—and their users—may not be adequately incorporated into the new programs.

- *Oversight of new program management.* Under its new JPSS program, NOAA plans to transfer parts of the NPOESS program to NASA, but it has not yet defined how it will oversee NASA's efforts. We have reported that NASA has consistently underestimated time and cost and has not adequately managed risk factors such as contractor performance.[14] Because of such issues, we listed NASA's acquisition management as a high-risk area in 1990, and it remains a high-risk area today.[15] NOAA officials reported that they are developing a management control plan with NASA and intend to perform an independent review of this plan when it is completed. This plan has now been in development for about 18 months, and neither NOAA nor NASA could provide a firm time frame for its completion. Without strong NOAA oversight of NASA's management

[14]See, for example, GAO, *NASA: Assessments of Selected Large-Scale Projects*, GAO-11-239SP (Washington, D.C.:, Mar 3, 2011).

[15]GAO, *High-Risk Series: An Update*, GAO-09-271 (Washington, D.C.: January 2009).

of program components, JPSS may continue to face the same cost, schedule, and contract management challenges as the NPOESS program.

- *Cost and schedule implications resulting from contract and program changes*: NASA has transferred the sensor development and common ground systems contracts from the NPOESS contract. However, NOAA has been in negotiations for at least 6 months with the NPOESS contractor regarding intellectual property rights for components of JPSS. The agency could not provide a time frame for when it expects this issue to be resolved. Until these issues are resolved, the full cost and schedule implications of contract and program changes will be unknown.

- *Ensuring key staff and capabilities*: The NPOESS program office was composed of NOAA, NASA, Air Force, and contractor staff with knowledge and experience in the status, risks, and lessons learned from the NPOESS program. This knowledge would be important to both programs after the transition period. According to NOAA and NASA officials, the JPSS program office is now fully staffed. On the other hand, the DOD program has only staffed approximately 80 out of 155 positions in its program office. In addition, NOAA officials acknowledged that they had estimated that a contractor workforce of approximately 1,600 would work on JPSS activities; however, only 819 are on board due to budget constraints. Unless DOD is proactive in ensuring that its program office is fully staffed and NOAA contractors are able to fill all necessary positions, the new programs may not be able to complete work as scheduled and satellite launches could be delayed.

In summary, the NPOESS program was disbanded in the hope that separate DOD and NOAA programs could prove more successful than the joint program, that costs and schedules might finally begin to stabilize, and that the continuity of satellite data critical to both military and civilian missions would be assured. However, over 18 months later, NOAA and DOD are still scrambling to establish their respective programs and to develop baseline cost and schedule

estimates for those programs. As a result, it still is not clear what the programs will deliver, when, and at what cost.

In addition, the agencies continue to face a number of transition risks, including the continued need to support each others' requirements and residual contracting issues. As NOAA makes difficult decisions on whether to remove promised JPSS functionality in order to mitigate a satellite data gap, it will be important to prioritize the functionality and to work with DOD to ensure that critical requirements are still met. Timely decisions on cost, schedule, and capabilities are needed to allow both acquisitions to move forward and to ensure that painful gaps in satellite data can be minimized. Until both NOAA and DOD can develop and finalize credible plans for their respective programs, and mitigate or minimize the risks, neither agency's users can plan for how to address this gap.

Chairman Broun, Chairman Harris, Ranking Member Miller, Ranking Member Edwards, and Members of the Subcommittees, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contact and Staff Acknowledgments

If you have any questions on matters discussed in this testimony, please contact David A. Powner at (202) 512-9286 or at pownerd@gao.gov. Other key contributors include Colleen Phillips (Assistant Director), Kate Agatone, Franklin Jackson, Fatima Jahan, and Lee McCracken.

Chairman BROUN. Thank you, Mr. Powner. I appreciate the witnesses all holding their statements to five minutes just like we had a great example from Mr. Miller holding your statement to five minutes—well, we will call it five minutes.

So anyway, I want to thank you all for your testimony. I am reminding Members that Committee rules limit questioning to five minutes, so please limit your questions to five minutes for the sake of expediency, and the witnesses will please answer in a short time so we can get through as many questions as possible because we still have votes looming. The Chair at this point will open the round of questions. The Chair recognizes himself for five minutes.

Section 103(a)(1) of the NASA Authorization Act of 2005 and Section 112(b)(1) of the Consolidated Appropriations Act of 2008 prevent NASA and NOAA from entering into a contract for development of a major program unless the respective Administrators determine that the technical, cost and schedule risks of the program are clearly identified and the program has developed a plan to manage those risks. The laws also direct NASA and NOAA to transmit a report to this Committee at least 30 days before entering into a contract for development under a major program. Has NOAA or NASA provided a baseline for JPSS as required by the NASA Authorization Act of 2005 and the Consolidated Appropriations Act of 2008?

Dr. SULLIVAN. Mr. Chairman, let us be clear, if we may, on the various usages of the word "baseline" because in some contexts it means different things. We have an established program estimate of the budget. We now have a firm requirements document, the Level 1 Requirements Document, and on the basis of those two parameters, we have moved forward with this program. I can't speak to when reports were submitted prior to May of this year when I came aboard as NOAA Deputy Administrator but I would be happy to look into those matters for you.

Chairman BROUN. Well, please do because the law requires a report to be submitted to the Committee 30 days before entering into a contract.

Mr. Scolese, could you answer that question, please?

Mr. SCOLESE. I will have to go off and take that for the record, sir. The plan was identified last year as we discussed, and I would have to go off and look at what was actually submitted.

(**Mr. Scolese's response submitted after hearing pertaining to material requested for the record by Chairman Broun:** *"Not yet, as the report is due when an initial program baseline is established. NOAA will submit a baseline for JPSS in accordance with the direction provided in the Consolidated and Further Continuing Appropriations Act, 201. NASA, as the acquisition agent under a reimbursable agreement with NOAA, will be assisting NOAA in the preparation of those report.*

Consistent with NASA Space Flight Program and Project Management Requirements (NPR 7120.5), and the requirement in the Consolidated and Further Continuing Appropriations Act, 2012, the baseline for the JPSS-1 mission will be established at its confirmation review (Key Decision Point C) in 2012.")

Chairman BROUN. Mr. Powner during his testimony said that no baseline has been provided, and he also discussed very eloquently why that baseline is extremely important. GAO is saying that no baseline has been provided. Can you give us some time frame of when we can expect that baseline, Dr. Sullivan?

Dr. SULLIVAN. Mr. Chairman, with the L1RD, the requirements document in hand, and when we have our independent cost estimate completed, which should be later this year, those two will be reconciled. Laying that against the first-quarter fiscal year 2017 current target launch date, we then can define for you a program path forward and we will get that to you as soon as we can. We will certainly reconcile that and accommodate that in the President's fiscal year 2013 budget request.

Chairman BROUN. I would appreciate that. I know that you have some problems, as Ranking Member Miller said. There are a lot of snakebites going on in this program, and we need to cure the snakebites and go forward and get the flying birds, and that is what I think all of us on both sides of the aisle are extremely interested in doing.

What are the differences between NPP and JPSS–1 and how much did the NPP cost, how much will JPSS cost and why is it so expensive to produce essentially a carbon copy, from my understanding, a satellite that is already built and prepared to launch in just a few weeks? Both of you, or either of you.

Mr. SCOLESE. Well, we work very closely together so hopefully you will see that in our answers as well. To answer the last part first, the JPSS–1 satellite is not an identical clone of NPP. As we talked, as was mentioned earlier, NPP is a technology demonstration satellite. Its prime purpose was and still is to go off and verify the technologies, make sure that the measurements can be made so requirements for lifetime were not there. It was to go off and verify that we could do and meet the requirements. As Mr. Powner pointed out, there is some concern——

Chairman BROUN. Mr. Scolese, I have got about 30 seconds left, and I asked you about cost, and that is the important thing.

Mr. SCOLESE. Well, the short answer then, sir, is that they are not identical. There is still additional work that needs to be done on the sensors to guarantee the seven-year life. And as far as the spacecraft is concerned, we did buy that fixed price so it is about the same price between NPP and JPSS–1, which is why you are not seeing a different price on that, but there is still development work on the sensors that has to be done.

Chairman BROUN. My time is expired. I now recognize Mr. Miller for five minutes.

Mr. MILLER. Mr. Chairman, I wouldn't have objected if you had taken another 20 seconds.

Dr. Broun asked about the first of Mr. Powner's takeaways. I want to ask more about the second and that is the contingency planning for gaps in the data. Dr. Sullivan pointed out that we have had just about every extreme event imaginable in the last year—droughts, floods, fires, tornados, hurricanes. All of that would have been—it would have been very helpful to have as accurate a forecast as possible. Presumably the satellite would not have helped with the earthquake, but otherwise all the extreme events, the more information we had for forecasting, the better. Fortunately, there has been no evidence of locusts to this point. But we are on our 15th named hurricane.

Dr. Sullivan, I know that we are pinning our hopes on the success and on the longevity of NPP but what are the other plans for

mitigating the potential gaps in coverage that we are facing over the next few years?

Dr. SULLIVAN. We continue to work hard on that, Mr. Miller, and we will work contingencies as we go forward. I would like to just emphasize two factors that really drive our concern to have the afternoon orbit filled. One is weather forecast models are run on 6-hour cycles, 7 a.m., 1 p.m. and then 7 p.m., 1 a.m., and as you can appreciate, a satellite that comes over just a few hours ahead of the 7 a.m. and 1 p.m. run give you fresh data, current data, a current snapshot of the earth similarly for the 7 p.m., 1 a.m. run, the afternoon data is very important.

Second point of importance about the afternoon orbit has to do with the earth itself and in particular for the continental United States to sample the atmosphere early in the morning when it tends to be a bit quiescent from the overnight hours and then sample it again in more energetic and active convetive phase of the day. Those two very different snapshots are invaluable information, if you will. They are important information content for the models. That is why if there is not a satellite active in the afternoon orbit, it is not just as simple as taking the morning orbit bird or taking some other satellite. The time of day actually matters.

We certainly will continue to use data from the morning orbit that is covered by the European MetOp satellite. We have and have had a number of bilateral and multilateral data exchange arrangements with other nations. Japan has a satellite coming along, GCOM–W1, that will host an instrument that bears some relevance to our needs. We are working on arrangements to take data from that satellite. Taking the data to our command center is one thing; making it possible technically in formatting and accuracy and precision to get that data into the numerical model is another not trivial technical challenge, but we are looking at that. So you name a nation that has a polar- orbiting satellite with a relevant instrument that has the accuracy, precision and stability needed to not degrade the forecast capability of our models and we will make every effort to take advantage of that data.

Mr. MILLER. Thank you.

Mr. Powner, it does appear that the gap in coverage is connected to funding problems but also obviously the management issues. I mean, we have now been dealing with the problems in this program when we had a Republican President, a Republican Congress; when we had a Republican President and Democratic Congress; a Democratic Congress and a Democratic President; and now a Democratic President and Republican Congress. It seems like this is a program—this program's problems are problems for all seasons.

The criticisms of GAO—I know GAO remains critical of this program, but your criticisms do seem much less harsh than they have in the past, and there are management issues remaining. I know most of your criticism is about the need for a baseline, but do you think that the new management, the joint partnership between NOAA and NASA, versus the old management structure, or are you pretty confident that that is the management structure that can this program on track?

Mr. POWNER. Clearly, if you look historically when DOD was in the picture, it is a much more streamlined management structure. I think everyone is happier on both sides. We feel a lot more comfortable with that. I do think we would like to see specifics about how the executive oversight will occur on the program because historically looking at NPOESS, the executive oversight was very poor. There was a question earlier, Chairman Harris, you asked about the problems of the past. The problems of the past were poor executive oversight and poor program management, too much technical complexity, and all those things we can't lose sight of and we need to stay on your toes from a program management point of view. So yes, we are more optimistic than we have been in the past but again, it is important to continue to keep everyone on their toes. Hearings like this clearly do that, so thank you, Ranking Member Miller.

Mr. MILLER. My time has expired and I yield back.

Chairman BROUN. Thank you, Mr. Miller.

Now I yield five minutes to my friend, Chairman Dr. Harris.

Mr. HARRIS. Thank you very much, Mr. Chairman, and again, I thank the panel for coming here today.

Dr. Sullivan, I just want to clear up one thing you said because, you know, it is obviously a heart-wrenching story you told about Joplin, but the polar satellites really have very little to do with tornado warnings, don't they? I mean, in your testimony, I think it says they are 3 to 7 day, and I assume you didn't give 3- to 7-day warnings to Joplin about that tornado.

Dr. SULLIVAN. In both the Tuscaloosa outbreaks in April and the Joplin outbreaks, Dr. Harris, we did indeed warn those communities 3 days in advance of——

Mr. HARRIS. But that is not what that person responded to was not the 3-day warning. They responded to the ground-based warnings that you have. Let us just be honest. I understand the importance of telling that story but this hearing is about polar satellites and what data we need from polar satellites, so let us get to the core of that.

You know, if I don't have enough money to buy all the bells and whistles on a car because the economy is bad, I leave out the moon roof, maybe the sound system, maybe get the stripped-down model. How much of the climate change, the long-term climate change sensors on that JPSS, how much are they costing of that project, and in fact, wouldn't eliminating the long-range climate sensors so that we can focus on the core mission, what I think the core mission of the weather service is, which is weather. Wouldn't that in fact shorten the time frame to launch that satellite and decrease the cost?

Dr. SULLIVAN. Those sensors were in fact demanifested at an earlier milestone. I think Mr. Scolese can give you the accurate dates that predates my coming back to NOAA. So they are no longer carried on the JPSS program budget.

Mr. HARRIS. Nothing at all to do with long-range climate?

Dr. SULLIVAN. No, sir.

Mr. HARRIS. Good for you.

Now, let me ask a question here. Mr. Powner, there is something disturbing in the GAO report because it says that part of this gap

is because some of the selected NPP sensors may only last three years because of workmanship issues. Am I missing something here? This isn't in space yet. We are going to launch something up that has a workmanship issue and therefore potentially creating a gap in our knowledge?

Mr. POWNER. Correct. There would have been questions about workmanship issues associated with several satellites. Their example is like CrIS, when you look at vibration testing, there was an issue with vibration testing, and we can go right on down the line. Many of these issues were highlighted over the years. The fundamental question is, due to some of those workmanship issues, it was originally to be a research satellite so it wasn't built with the rigor that you would expect with an operational satellite, so keep that in mind. Some of those things are questionable, and if you listen to some of the internal NASA engineers, there is a question about whether it will last, some of those sensors, the full five years.

Mr. HARRIS. So we are going to launch what amounts to a faulty satellite knowing that it is not going to—I mean, this is just mind-boggling to me. I mean, did we pay the people who did this workmanship? Did we pay the engineers who designed it? I don't get it. Maybe it is a rhetorical question.

Let me ask, Dr. Sullivan, let me just go back to this issue of the gap because aren't there—in fact, if this information is so valuable, and I know we share it with governments throughout the world, with other countries, so this information has value. Now, in the American system, when something has value, someone in the private sector's ears usually go up and say wait a minute, I might be able to provide this. I scoured your testimony. I don't see anything about how we might in fact involve the private sector in solving some of these issues that we have in getting this data gap filled.

Dr. SULLIVAN. I would be happy, Dr. Harris, to give you some information on requests for information that we have indeed put out to private sector companies exploring the possibility of providing data across the full spectrum of those mission needs.

Mr. HARRIS. Then why isn't it included in your testimony?

Dr. SULLIVAN. Omission on my part. It should have been——

Mr. HARRIS. Well, I mean, look, if this gap is so—what I need to know and I think the Committee needs to know is, you know, exactly all the things we are doing to fill that data gap, and that is a glaring omission, unless you believe that only the government can do the job. Now, that is—and I suspect that is the problem here.

Dr. SULLIVAN. I do believe, Dr. Harris, when it comes to the high precision, high accuracy and highly stable data of atmospheric sounding that is essential, that is truly the lifeblood of weather forecasting. We have seen no proposals or responders that demonstrate any sense of a market other than the United States government for instruments of that class.

Mr. HARRIS. Okay. Well, I have got to tell you, you know, medical instruments, you know, we also need a little accuracy and the government doesn't make any. You know, the private sector makes high-quality, dependable—when a constituent, a citizen in America's life is at stake, true life is at stake on a daily basis, we trust

the private sector to gain data for them, so I suggest that you consider that as well.

Thank you, Mr. Chairman.

Chairman BROUN. Thank you, Dr. Harris.

Now the Chairman will recognize another physician, Dr. Benishek, for five minutes. Dr. Benishek.

Mr. BENISHEK. Good morning. Thank you, Mr. Chairman.

I am just sort of amazed by the fact that these things are so expensive and we don't seem to be able to manage the construction on a reasonable basis. It seems that we went from four satellites to two and it is costing more money. How is that possible?

Mr. SCOLESE. Well, I am not sure that there is a very good answer for that. NASA and NOAA really took over this program at the restructuring and we had to go off and look at what we could do within the resources that we have available and what we could project, and that is how we ended up where we were. The original program, as was stated, started in 1994 as principally a Department of Defense and a NOAA program that was formulated and finalized, I believe, in the late 1990s, early 2000s. So we are really talking two different programs here.

Mr. BENISHEK. Well, it just seems that we are talking about $10 billion, and we went from four satellites to two. I don't know, how does it all get—how do we lose $5 billion? How do we go from, you know, $2.5 billion a satellite to $6 billion? I just don't see how it could be such a cost overrun.

Mr. SCOLESE. Well, I think we have to look at all the pieces that are in the program, and there is a ground system that is required to bring down the data or collect the data from the satellite. It comes down to the ground. That is a piece of the total program, so you can't just divide it by the number of satellites. It is also the ground system there and they provide them to—and you have to help me here, I think four locations for the civil program as well as for the DOD programs. So there is more than just the satellites that are in there. It is also the ground systems and it is the software that will then take that data and turn it into useful products.

Mr. BENISHEK. All right. What exactly are we getting with the new satellite that didn't have with the old satellite? What is the upgrades? What is new about it that is costing us so much money?

Dr. SULLIVAN. We are not really changing the set of measurements that we make, Mr. Benishek. The instruments that we have aboard or that are slated for NPP and JPSS are sounders, imagers, really the workhorse instruments that are the backbone of weather forecasting. The state of the art and the nature of current manufacturing, the complexity of those instruments increases incrementally every 10 or 20 years as the Nation goes into a new manufacturing phase for the polar satellites, but it is certainly not a mission creep and an expansion of what we are doing. The complexity in terms of spatial resolution, more fine-scaled measurement to support the accuracy of forecasting that we have today and the time limits of data again to sustain the accuracy of forecasting that we have today costs more nowadays than it did in the 1970s.

Mr. BENISHEK. All right. Mr. Harris, would you like to have the rest of my time?

Mr. HARRIS. No, that is fine.

Mr. BENISHEK. Then I will yield back.

Mr. HARRIS. [Presiding] I would like to recognize for five minutes the gentlelady from Florida.

Ms. ADAMS. Thank you, Mr. Chair.

You know, I was going through and listening to everything, and it says since the 1960s we have had the two separate operational polar-orbiting meteorological satellite systems. Since 2003 there have been hearings to find out, you know, maintain some form of oversight of the JPSS program, which found itself significantly over budget, behind schedule and considerably descoped. I am listening to your discussion today, and then it goes on and says in 1993 there was an attempt to streamline the programs. It brought them together, created the NPOESS, and then later on they say that the program was fraught with problems, delays, inefficiencies and severe cost overruns that in February 2010 the Office of Science and Technology Policy announced a fundamental reorganization of the program. So here we go.

Then it goes back in and gives a little bit more detail about in 2003 again the Committee began serious oversight because of the major performance problems, schedule delays for the primary imaging instruments, which caused significant overruns, all types of management structure that delayed rather than fostered decisions at critical moments. Again, fast forward, at a Science Committee hearing on June 17, 2009, witnesses testified before the Committee that the program leadership had deteriorated to the point that only White House intervention would assure that there would ever be any NPOESS satellites at all.

So we are sitting here and I am listening to all of this discussion, and I have a few questions. What percentage of your budget is devoted to the GOES and JPSS programs essentially being run by NASA?

Dr. SULLIVAN. I am sorry, Ms. Adams. Are you asking that question with respect to the NOAA budget or——

Ms. ADAMS. Yes, NOAA's budget. What percentage?

Dr. SULLIVAN. I can give you an estimate. We would be happy to provide you the precise figures.

Ms. ADAMS. Well, can you tell me, is it essentially a pass-through to NASA?

Dr. SULLIVAN. It is not a 100 percent pass-through of the appropriated funds. A sizable portion passes through for satellite acquisition but another portion stays with us for the ground system, for flight operations, for algorithm development. A portion of the total program that brings the data to the ground turns it into useful records that can be adjusted into the weather models. That portion is NOAA's direct responsibility.

Ms. ADAMS. Do we know if NASA is spending any of their funding on the JPSS program and how much it is?

Dr. SULLIVAN. We do know that the NOAA funding passed through to NASA for the JPSS program is being spent to develop JPSS. I can let Mr. Scolese speak to the current budget numbers.

Mr. SCOLESE. It is a fully reimbursable program so we are using NOAA funds.

Ms. ADAMS. So there is no cross-agency support funds being used?

Mr. SCOLESE. That is correct.

Ms. ADAMS. Okay. I am going to try to get as many of my questions answered as possible.

Mr. SCOLESE. One point, on NPP, which was a research satellite, NASA did and is paying for the bus and for the launch.

Ms. ADAMS. So you——

Mr. SCOLESE. But that was a different program. That wasn't originally part——

Ms. ADAMS. But it is part of the NOAA issues, correct?

Mr. SCOLESE. Well, it is going to——

Ms. ADAMS. So there is some funding, NASA's funding?

Mr. SCOLESE. For NPP, yes, that is correct.

Ms. ADAMS. Dr. Sullivan, it is fair to say that some JPSS sensors are more focused on providing data essential for weather forecasting, correct?

Dr. SULLIVAN. Yes, it is.

Ms. ADAMS. While others are focused on long-term climate science, correct?

Dr. SULLIVAN. No. The JPSS satellite is tailored to NOAA's weather-observing requirements.

Ms. ADAMS. So no sensors whatsoever?

Dr. SULLIVAN. No, ma'am.

Ms. ADAMS. Okay. That is not what we have been told, so I am just curious.

Dr. SULLIVAN. There were climate sensors in an earlier version of the JPSS program definition. They were descoped. I would have to verify the time for you but a year or more ago. They are in a budget line within NOAA to try to launch those sensors on other platforms but they are not part of the JPSS program.

Ms. ADAMS. So will they be launched on free flyers or something else?

Dr. SULLIVAN. We are still evaluating options to try to support those on free flyers or hitchhiker payloads on commercial buses, and we expect to have some results from those evaluations by the end of the year or early into 2012.

Ms. ADAMS. Will you have the costs associated with that?

Dr. SULLIVAN. Yes, we should.

Ms. ADAMS. I yield back.

Chairman BROUN. I thank you, Ms. Adams.

Now I recognize Dr. Benishek—not Dr. Benishek, Dr. Bucshon for five minutes. Go ahead, Dr. Bucshon.

Mr. BUCSHON. Mr. Chairman, I don't have anything specific so if you want me to yield back my time to you, I can do that.

Chairman BROUN. Very good. We will go through a second round of questions then, and because of votes now projected at 11:30, we will limit the round of questions to three minutes per Member, so I recognize myself for three minutes.

Let us assume that the government will be funded by CRs for the remainder of the year and most likely through all of 2012. Unfortunately, I think that is a real good bet. How will NOAA and NASA prioritize the work on JPSS if it only gets CR funded? Both of you.

Dr. SULLIVAN. Well, JPSS is certainly one of the highest priorities in NOAA's mission portfolio so it would get a very high ranking. It is not the only important and worthy thing the agency does

but I think you could see in our actions to date during fiscal year 2011 the importance that we place on it.

Chairman BROUN. And Mr. Scolese, I would assume same answer.

Mr. SCOLESE. Yes, sir, and I think I would just add that part of those funds will be used with NPP and what we discover with NPP in orbit will also play into that as well as the level of funds in the CR.

Chairman BROUN. Well, I certainly hope in spite of the warnings that we get from Mr. Powner about the workmanship from GAO that satellite lasts longer than it was originally designed to do.

What options does this program have for operating in the funding environment of continuing CRs, Dr. Sullivan?

Dr. SULLIVAN. I am not sure I understand your question, Dr. Broun.

Mr. BROUN. If we have continuing resolutions as I very firmly believe that we will have, what options do you have in that funding environment for continuing to try to get this program flying, get the birds in space so that we have this data that is necessary and hopefully so that these gaps will be as minimized as possible?

Dr. SULLIVAN. Well, within resources available under the CR, we would certainly focus on the long lead items and try to build in the capability to accelerate or continue to move at a steady pace. We would as we did in fiscal year 2011 keep a clear eye on contract viability and try to not have to go through not only the workforce churn but the incremental additional expense of terminating and then having to re-up contracts. I could ask Mr. Scolese to join in here with further comments if you would like.

Mr. SCOLESE. Yes. As you know, one of the most difficult things for a project manager, and I have been there, is uncertainty in what your budget is going to be because you are constantly replanning, and so that is the difficulty we will have to do. We will have to work with NOAA to try and establish our priorities and see if we can't stick with those, but the more replanning that we have to do, the more uncertainty there is, the more difficult it is to accomplish the goals that we all want to accomplish here.

Chairman BROUN. Well, I appreciate that, and I think there are things that you really need to look at because I think the high certainty is that we are going to have CRs for the rest of this Congress, and depending on what the election in 2012 gives us, who knows where we are going to go from there. Only the Lord himself knows. But I think we are going to have CRs. I think this is going to be a huge issue for you guys and so I think you all need to look at every single option that is available because I want to see these birds flying. I want to see it done in the most cost-effective way. I want us to be good stewards of the hard-earned money of taxpayers that they are giving to this program.

My time is expired and now I will recognize Mr. Miller for three minutes, and I took up almost 23 seconds in that one.

Mr. MILLER. I think I am still a little ahead of you in going over.

Dr. Sullivan, obviously you have received less funding for this program than what you forecast, what you expected, what you needed, what you were planning for, and you had to establish some priorities. How did you decide why the NPP satellite and the

ground station updates were the top priorities for NOAA in the fiscal year 2011 budget?

Dr. SULLIVAN. I would highlight two reasons, Mr. Miller. One was the time frame in which NPP is slated to fly and what we hope its life duration actually will be can serve as a very valuable data bridge. Secondly, it really still helps substantially in risk reduction, both improving the technology and the sensor designs that we have and that we intend for JPSS–1, and from a ground segment point of view, to be able to prepare to use the data operationally also puts us in a position to debug, to get ready for the long-term use of these instruments for the entire next generation of polar weather satellites, so it made good sense to us in a constrained funding environment to be sure we were ready to fly NPP with NASA, use the data operationally and get our feet wet, learn the lessons that we need to learn to really be able to use that system and evaluate its long-term future potential.

We, as a near second priority, also worked very hard with our NASA counterparts to keep key—keep momentum and viable contracts on the key long lead items for the JPSS portion of the program.

Mr. MILLER. With my remaining time, I will just point out that a century ago, I think 4,000 people in Galveston died in a hurricane because they had absolutely no forewarning that a hurricane was moving onto shore, was out there in Gulf, and actually hurricanes in which thousands of people died were fairly common throughout—until we developed our better forecasting abilities, and I know that this is a program we have all criticized. It has been worthy of our criticism. But the idea of launching a satellite into space and looking down at Earth and developing data from which we could forecast weather is actually kind of hard. Thank you.

Chairman BROUN. Thank you, Mr. Miller.

Dr. Benishek, you are recognized for three minutes.

Mr. BENISHEK. I will yield back the remainder of my time. Thanks.

Dr. SULLIVAN. Mr. Chairman, may I offer clarification to Ms. Adams?

Chairman BROUN. She is fixing to be recognized for three minutes, so we will see what she wants to do that three minutes of time.

Ms. Adams, you are recognized for three minutes.

Ms. ADAMS. Thank you, Mr. Chairman.

You know, we have talked a lot about continuing resolutions and everything else and the cost and everything else. With what is going on with JPSS, we haven't seen a request from the Administration, OMB or anything, an anomaly for the JPSS program. Why?

Dr. SULLIVAN. Well, I cannot speak for the OMB and the White House on that matter, Ms. Adams. I know we are in discussions actively with the Administration about ways in which we might jointly handle the program if indeed we go into extended continuing resolutions, and I am assured from my sources that it is recognized as a very high priority by the Administration, but I can't speak to their decisions on strategy and CRs.

Ms. ADAMS. How long does it take for POES and GOES satellites to check out after launch?

Dr. SULLIVAN. Well, the amount of time it takes currently is reflective of the length of time that we have been running the current NOAA K series of satellites, so it is a few months. If you will give me a moment, I can pull the exact data up for you. We estimate for NPP that that calibration, validation period will take a total of about 18 to 24 months to get to the point where we have the full, precise, what we call Environmental Data Records that are being pulled into numerical weather prediction models.

Ms. ADAMS. So for GOES and POES, I have about six months. Is that correct?

Dr. SULLIVAN. Yes, for the current series of satellites which we have learned multiple lessons on, we——

Ms. ADAMS. How long did it take in the very beginning to calibrate them?

Dr. SULLIVAN. It certainly was longer for the——

Ms. ADAMS. Can you get the Committee that amount?

Dr. SULLIVAN. We can get you what the first run was. We estimate for——

Ms. ADAMS. Let me ask another question here. So you believe that the reason for the length of time is because it is a newer system?

Dr. SULLIVAN. Yes.

Ms. ADAMS. And you didn't learn a lot from the first systems that you think it is going to take a lot longer this time?

Dr. SULLIVAN. We did learn a lot from the first systems but the algorithms, the actual software to accomplish the similar tasks is all new software.

Ms. ADAMS. If I remember correctly, you told my colleague here that it was essentially the same, just a little upgrade.

Dr. SULLIVAN. The software to handle the data streams are very different. We do expect to learn a lot between NPP and JPSS–1 and have a shorter calibration, validation period then.

Ms. ADAMS. Now, I would like to ask how confident GAO is that NASA and NOAA will be able to meet the late 2016 launch date for JPSS, given the past performances.

Mr. POWNER. I think it is fair to say if you look at the NPOESS program, we never hit a date, so we feel good about the current program management team that is in place and the executives who are overseeing this program. We are hopeful they are going to hit it but based on past performance, it is less complicated not having DOD in the picture. Okay, that is clear, and I think what is important is, let us get that baseline, manage to the baseline and deliver in late 2016. That is what is really key, to minimize that gap.

Chairman BROUN. Thank you, Ms. Adams. I assume you yield back since your time has run out.

Now the Chairman will recognize Dr. Bucshon if you have any questions. Okay.

Dr. Sullivan, as well as all the witnesses, I am going to ask the Members to present written questions for you and you can at that time, if you would, please, go ahead and answer Ms. Adams' question and fill in any gaps that may be there.

I thank you all for you all's valuable testimony today and I thank the Members for all you all's questions. The Members of either Subcommittee may have additional questions, as I have already

mentioned, and please respond quickly with those questions, as I am sure you will. The record will remain open for two weeks for additional comments from Members. The witnesses are excused.

I thank you all very much, and the hearing is now adjourned.

[Whereupon, at 11:15 a.m., the Subcommittees were adjourned.]

Appendix I:

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

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

Questions Submitted by Chairman Paul Broun, Subcommittee on Investigations & Oversight and Chairman Andy Harris, Subcommittee on Energy & Environment

Question 1: Please describe, in detail, the differences between NPP and JPSS-1.

Response 1:
The JPSS-1 satellite plans to carry the same instrument suite as NASA's Suomi NPP with modifications to instruments to meet JPSS Level 1 Requirements[1] and address issues gleaned from Suomi NPP operations. The modifications are intended to ensure mission assurance by improving reliability and manufacturability and correcting known instrument performance issues, such as more robust wiring. The JPSS instruments will be designed for a 7 year mission life.

Instruments on Suomi NPP	Instruments on JPSS-1
Visible Infrared Imaging Radiometer Suite (VIIRS) Cross-track Infrared Sounder (CrIS) Advanced Technology Microwave Sounder (ATMS)	VIIRS CrIS ATMS
Ozone Mapping and Profiler Suite (OMPS) – Nadir and OMPS–Limb	OMPS-Nadir only
Clouds and the Earth's Radiant Energy System (CERES)	CERES

With respect to the spacecraft bus, although Suomi NPP and JPSS-1 will fly on similar spacecraft buses, there are some significant differences between the two, to meet the JPSS-1 operational requirements:

- JPSS-1 will have a Ka-band communications link (in addition to an X-band communications link) to broadcast the mission data to the JPSS Ground System. This communication link makes the spacecraft compatible with the Ground System's worldwide receptor network to shorten the amount of time between data collection and subsequent transmission to the users.

[1] http://www.nesdis.noaa.gov/jpss/

June 7, 2012

- The JPSS-1 bus has an operational design life of seven years while the NASA Suomi NPP bus has a five year design life.
- JPSS-1 spacecraft bus will be built to a NASA mission class B standard versus Suomi NPP's class C. The Class B standards have more stringent mission assurance standards in order to improve the spacecraft reliability and lifetime.
- JPSS-1 spacecraft bus will include newer solar array and battery technology, and product line updates to the spacecraft computer, GPS receiver, and inertial reference sensor than is currently on the Suomi NPP spacecraft bus.

Question 1a: How much did NPP cost?

Response 1a:
The Suomi NPP is a NASA mission and NASA is the best source for this information. The former NPOESS program (now JPSS) developed the VIIRS, CrIS, OMPS-Nadir, and CERES instrument and delivered them to NASA for integration onto the Suomi NPP satellite. NASA provided the ATMS instrument, the satellite bus, and launch services.

Question 1b: How much will JPSS cost?

Response 1b:
The Administration and NOAA understand the critical importance of efficiently allocating limited resources, and are committed to maintaining a total Life Cycle Cost (LCC) through FY 2028 of $12.9 billion or less for the JPSS program. This LCC is a revision from the previously submitted LCC of $11.9 billion through FY 2024 reflecting an extended estimate of satellite performance. Considering this LCC, the Administration will continue to work with both NOAA and NASA to determine the best available options for program content going forward.

Question 1c: What are the differences in performance characteristics?

Response 1c:
NOAA does not anticipate major differences in performance characteristics between Suomi NPP and JPSS-1. JPSS-1 will provide operational continuity of measurements that Suomi NPP demonstrates with the exception of the OMPS Limb measurements that, as planned, will not be flown on JPSS-1. As noted above, NOAA/NASA will incorporate changes that would improve reliability of JPSS-1 based on experience with the Suomi NPP satellite.

NOAA is expecting significant improvements in the data from Suomi NPP/JPSS-1 over the heritage NOAA Polar-orbiting Operational Environmental Satellites (POES). The two most important parameters for weather prediction are temperature and moisture measurements.

The CrIS and ATMS sounding instruments on Suomi NPP/JPSS will provide atmospheric temperature data at higher horizontal and vertical resolution compared to current POES instruments. This significantly improved observation data from Suomi NPP/JPSS-1 is a driver for improving weather forecasts and to meet the National Weather Service's mission objectives, which call for providing "more accurate forecasts and earlier warnings to reduce loss of life, property, and disruption from high-impact events."

June 7, 2012

The VIIRS imager on Suomi NPP/JPSS will be a major improvement over the Advanced Very High Resolution Radiometer (AVHRR) currently being flown on POES. VIIRS will provide NOAA with the first opportunity for operational satellite imaging for ocean color which is essential to monitor ocean and coastal ecosystems, especially harmful algal blooms.

With respect to support to its ocean mission, VIIRS will provide ocean color information and sea surface temperature which will enable detailed descriptions of phytoplankton biomass, harmful algal blooms, sediment runoffs from watersheds into estuaries, ocean acidification, and coral bleaching.

The Arctic environment can be very harsh and the VIIRS instrument, with its greatly improved spatial resolution and more spectral channels (22 versus 6 AVHRR channels), will provide significantly better information to detect and monitor forest fires, volcanic eruptions, low cloud and fog detection, snow and ice, land surface temperature, and oil spills. VIIRS will provide vast improvements to monitoring, detection, and tracking of these conditions that can impact commercial activities such as oil and gas drilling, commercial fisheries, and marine and aviation transportation in the Arctic. VIIRS will also be used to monitor, forecast, and research Arctic hydrology, including snow extent, spring melt tracking, and ice jam flooding.

Question 2: How will NOAA prioritize the work on JPSS if it only receives Continuing Resolution (CR) funding for the remainder of 2011 and all of 2012?

Response 2:
The FY 2012 appropriations process concluded with $924 million for the JPSS Program in the Consolidated and Further Continuing Appropriations Act, 2012 (Public Law 112-55). At this level of funding, NOAA is able to work with NASA on ramping up the contractual efforts in order to support a launch of the JPSS-1 satellite in FY 2017. NOAA will prioritize work as follows:

- continue to fund Suomi NPP operations,
- maintain progress on JPSS instrument and spacecraft development,
- identify and procure JPSS-1 long lead items, and
- address obsolescence and IT security in ground system capabilities.

Question 2a: What options does the program have for operating with that funding environment?

Response 2a:
With the $924 million appropriated for JPSS in FY 2012, NOAA is working with NASA to prioritize the activities that can be accomplished. At this level of funding, NOAA is able to work with NASA on ramping up the contractual efforts in order to support a launch of the JPSS-1 satellite in FY 2017.

Reduced funding levels for FY 2012, combined with not receiving the $1.060 billion requested as a result of the FY 2011 appropriations process, means that there is a chance that a weather data gap will occur between the end of the Suomi NPP mission and when calibrated/validated

June 7, 2012

JPSS-1 data becomes available for use in the National Weather Service (NWS) numerical weather prediction models. According to NOAA estimates, if the Suomi NPP mission were to cease operations at the end of its projected life in 2016 and JPSS-1 becomes fully operational in 2018 (after undergoing calibration and validation activities), the potential data gap in the afternoon orbit could be up to 18 months for a weather data gap, or up to 24 months for a data gap to NOAA's environmental data. If a weather data gap occurs, weather forecasting would be immediately degraded, leading to shortened lead time of severe weather forecasts that help to protect lives and property.

Question 2b: What capabilities would NOAA give up on the JPSS satellites in order to accelerate their development, lower costs, and close the predicted gap in polar-orbiting weather satellite data?

Response 2b:
Any decision to change JPSS capabilities would be thoroughly reviewed to assess the impact to continued support of NOAA's core missions, such as weather forecasting; oceans, coasts and ecosystem monitoring; commerce and transportation; and climate monitoring. The Administration and NOAA understand the critical importance of efficiently allocating limited resources, and are committed to maintaining a total Life Cycle Cost (LCC) through FY 2028 of $12.9 billion or less for the JPSS program. In order to meet this lifecycle cost, it is possible that the program will need to make tradeoffs between enhanced capabilities, risk, and cost or may not be able to accommodate all currently planned instruments. We are working with NASA to develop options for program content going forward and will update the Committee once that analysis is complete.

The JPSS Program has made significant progress since February 2010 and has brought all sensor, spacecraft bus, and ground systems contracts under NOAA/NASA management control. At this stage of JPSS-1 development, there is no ability to accelerate development by giving up capabilities. Reduction in sensor capability would complicate the current procurement process because it would introduce new design changes and changes to hardware already completed. New changes to JPSS-1 would also risk lengthening the schedule and increasing the data gap. Eliminating a sensor would likely create a gap in associated observations for the duration of the JPSS-1 life.

As noted is response to question 2a, at the FY 2012 appropriated level NOAA is working toward a FY 2017 launch date for JPSS-1.

Question 2c: Will the Administration submit an anomaly request for additional JPSS funding?

Response 2c:
The need for an anomaly request was overtaken by the passage of H.R. 2112, the Consolidated and Further Continuing Appropriations Act, 2012 which the President signed into law (P.L. 112-55) on November 18, 2011.

June 7, 2012

The Administration indicated its strong support for the JPSS Program in its October 19, 2011 letter to the Appropriations Committees: *"The Administration also appreciates the significant increase provided in both the House and Senate Commerce, Justice, Science, and Related Agencies bills for the Joint Polar Satellite System. Robust funding for this project is essential so that the Nation does not risk significant degradation in weather forecasts and, in turn, negative impacts on public safety and critical industries."*

Question 3: How are management decisions made between NOAA, NASA Headquarters, and the Goddard Space Flight Center?

Response 3:
While NOAA retains overall responsibility of the JPSS Program, with NASA providing technical and acquisition expertise, the agencies have agreed to follow NASA Program and Project Management Processes and Requirements 7120.5, NASA Space Flight Program and Project Management, requirements processes for managing the program tailored to reflect NOAA's overall responsibility for the program. The detailed tailoring of NPR 7120.5 and process for decision-making is being documented in a Management Control Plan that will be signed by each agency which describes the hierarchy of authorities and the roles and responsibilities of managers at each level of authority. NOAA's Deputy Under Secretary for Operations and the NASA Associate Administrator co-chair the Agency-level Program Management Council with the NOAA Deputy Under Secretary as the final decision authority. This Agency-level Program Management Council provides overall senior executive oversight and management for the JPSS Program and assures that decisions are implemented in partnership with NASA.

With respect to programmatic direction and decisions, NOAA provides programmatic direction to NASA Headquarters for JPSS activities to be completed in order to implement the JPSS Level-1 Requirements Document. The JPSS programmatic direction is subsequently transmitted to the NASA JPSS Program which is located in the Greentech Building which is close to the NASA Goddard Space Flight Center (GSFC). The NOAA JPSS Program and staff are co-located with the NASA JPSS Program in the Greentech Building. This close proximity of the NOAA and NASA JPSS staff facilitates rapid discussion and disposition of decisions related to managing the JPSS program.

Question 3a: Does a management control document between NOAA and NASA for the JPSS program exist? If so, please provide a copy for the record.

Response 3a:
The JPSS Management Control Plan (MCP) was signed by NOAA and NASA in February 2012. The MCP identifies the roles and responsibilities of each agency and establishes the governance structure of the program. A copy of the JPSS MCP has been sent to the Committees.

Question 4: What percentage of NOAA's budget is devoted to GOES and JPSS – programs essentially being run by NASA?

Response 4:

June 7, 2012

In the FY 2012 Estimate, 31.4 percent of NOAA's funds were allocated to GOES-R ($615.622 million) and JPSS ($924.014 million) combined. Approximately 23 percent of NOAA's funds in the FY 2012 Estimate will be provided to NASA to support specific activities related to GOES-R and JPSS acquisition activities while the remaining funds will support NOAA activities relative to these programs.

NOAA provides funds on a reimbursable basis to NASA to accomplish specific tasks which is based on an annual work plan. The amount of money provided depends on the amount of appropriations NOAA receives and NASA's needs to achieve specific contractual obligations. Any funds provided to NASA remain under the control of the NOAA GOES-R System Program Director (SPD) and the NOAA JPSS SPD, and NOAA retains the authority to withdraw funds it provides to NASA.

Question 4a: What percentage of National Environmental Satellite, Data, and Information Service (NESDIS) is devoted to GOES and JPSS?

Response 4a:
In the FY 2012 Estimate, GOES-R was allocated $615.622 million, which comprised approximately 33 percent of the total NESDIS FY 2012 Estimate ($1.88 billion), while the JPSS request ($924.014 million) comprised approximately 49 percent of the total NESDIS FY 2012 Estimate.

Question 5: How much did Visible Infrared Imager Radiometer Suite (VIIRS) cost for the NPP satellite?

Response 5:
The VIIRS Flight Model-1 (FM-1) on the Suomi NPP satellite cost $391 million to develop. This includes both NOAA and Department of Defense (DoD) funds. This cost was determined by tallying the contractor reported costs from FY 2003-FY 2010 of $382 million, and estimated costs from FY 2011-FY 2016 of $9 million (includes support for on-orbit anomaly work).

Non-recurring expenses for the design of the original VIIRS instrument ($213 million) and pre-NPOESS prime contract studies ($74 million) conducted between FY 2000 to FY 2002 are not contained in these costs. The above costs exclude payload engineering and management, systems engineering and management, integration and test onto the spacecraft, and Northrop Grumman fee. The estimated costs of $9 million also exclude reserves and NASA and NOAA overhead expenses.

Development of the sensor was managed by the now-closed NPOESS Integrated Program Office (IPO).

Question 5a: How much will the VIIRS instrument cost for JPSS-1?

Response 5a:
The VIIRS FM-2 which will fly on JPSS-1 is estimated to cost $337 million. This cost was determined by tallying the contractor reported costs from FY 2003-FY 2010 of $144 million, and

estimated costs from FY 2011-FY 2023 of $193 million (includes support for on-orbit anomaly work).

Non-recurring expenses of $213 million for costs associated with the design effort of the original VIIRS instrument are not included in this estimate of total costs for VIIRS on JPSS-1. The above costs exclude payload engineering and management, systems engineering and management, integration and test onto the spacecraft, and Northrop Grumman fee. The estimated costs of $193 million also exclude reserves and NASA and NOAA overhead expenses.

Question 6: Have any requirements changed since the NPOESS program was dissolved?

Response 6:
The JPSS-1 satellite will still fly in the afternoon orbit that the first NPOESS satellite had been designated to fly in. The NPOESS satellite was a larger spacecraft bus and could accommodate more instruments. As such, there are some differences in how the requirements will be met. The JPSS Program requirements are documented in the JPSS Level 1 Requirements document which would have been included in the NPOESS Program. Given the Administration's goal of maintaining a lifecycle cost of $12.9 billion or less for the JPSS program, it is possible that the program will need to make tradeoffs between enhanced capabilities, risk, and cost or may not be able to accommodate all currently planned instruments. The Administration is working with both NOAA and NASA to develop options for program content going forward and will update the Committee once that analysis is complete.

Requirements changes reflected in the FY 2013 Budget request are:

- The NPOESS program had envisioned four data processing centers where data would be processed for civilian and military users. The number will be reduced from four to two "Centrals." JPSS will only support two Centrals: NOAA Satellite Operations Facility and the Air Force Weather Agency. The two Centrals that will not be supported are the Navy's Fleet Numerical Meteorology and Oceanography Center and the Naval Oceanographic Office. NOAA is working with the US Navy to find alternate means of getting JPSS data to them.
- Data latency will be increased from 30 minutes to 80 minutes for both JPSS-1 and -2, versus the previously planned 30 minutes by JPSS-2. This is due to changes in the ground system receptor network.
- The Total Solar Irradiance Sensor (TSIS) instrument and the Data Collection Sensor and Search and Rescue sensors can no longer be accommodated on the JPSS-1 spacecraft. NOAA and NASA are evaluating options for flying these instruments.
- The NPOESS program restructure resulted in the separation of satellite acquisition responsibility between DoD and NOAA. Under the JPSS program, NOAA is not responsible for satellite acquisition for the morning orbit, but will continue to engage DoD on the follow-on program, requirements definition and analysis of alternatives.
- The NPOESS program had planned to include the Microwave Imager/Sounder (MIS) instrument. JPSS will not fly this sensor but will obtain very similar data from the JAXA Advanced Microwave Scanning Radiometer-2 (AMSR2) on the Global Change

Observation Mission (GCOM). AMSR data was used as a surrogate for MIS testing and has been used operationally, so scientists and users are familiar with this data.

Question 7: How will the sensor differences in each of the orbits affect data integration and forecasting quality? Will the forecasting become degraded? If so, why would NOAA spend so much to upgrade sensors that are not being upgraded in the other two orbits?

Response 7:
Sensor differences in the early morning (DMSP), mid-morning (Metop) and afternoon (POES or JPSS) will not result in degradation of forecast quality or affect data integration. NOAA evaluates data from each deployed sensor using state-of-the-science quality control methods and will evaluate potential improvements to the forecasts.

NOAA has built its global numerical weather prediction (NWP) models around access to EUMETSAT Metop data (mid morning), NASA EOS data (afternoon) and NOAA POES data (afternoon). All of these satellites are aging and require replacement satellites. Suomi NPP will provide a bridge between JPSS-1 and NOAA's POES and NASA EOS, while EUMETSAT will launch Metop-B to replace Metop-A. The biggest risk to degradation of weather forecasting is a delay in the development and launch of the JPSS-1 satellite by second quarter FY 2017 so that it can provide data continuity before the end of access to useful data from the Suomi NPP satellite.

In the JPSS era, sensor differences in the early morning, mid-morning, and afternoon orbits will not impact NWS data integration and forecast quality. Forecasting quality will not be degraded, because the sensors that most affect the numerical weather prediction models in the mid-morning and afternoon orbits will have sensors with approximately the same capabilities. Recapitalization of the U.S. satellite instruments is necessary due to the aging of its current on-orbit systems (e.g., NASA AIRS and NOAA Advanced Microwave Sounding Unit (AMSU)). JPSS CrIS will replace AIRS, and ATMS will replace AMSU.

Early Morning Orbit: NOAA's numerical weather prediction models currently do not use data from the DMSP satellites in the early morning orbit. DoD is developing its requirements for the sensor suite for the follow-on weather program that will fly in this orbit. If DoD decides to fly sensors of similar quality as Suomi NPP/ JPSS in this orbit, the data could be useful to NWS weather forecasts; continuing DMSP-type or POES-type data would not be as beneficial.

Mid-morning Orbit: The Metop-A satellite already flies a higher resolution sounder, the Infrared Atmospheric Sounding Interferometer (IASI), that is comparable to measurements from the CrIS instrument that will be available from Suomi NPP/JPSS. IASI is superior to what is being flown on the NOAA POES. Metop's microwave sensors are slightly less capable than what ATMS on NPP/JPSS will provide. NWS already assimilates IASI data into its NWP. Metop will continue to provide these data from Metop-B and Metop-C. NOAA NWP model output will not be degraded by having continued access to Metop IASI data. EUMETSAT is currently evaluating the sensor suite that will fly on the satellites that follow the Metop series and EUMETSAT will likely pursue sensors that will be comparable to Suomi NPP/JPSS quality.

Afternoon Orbit: Suomi NPP/JPSS will continue to improve upon data currently being used from NASA EOS satellites and will be far superior to POES-type data. The primary use of Suomi NPP/JPSS sounders (e.g., ATMS, CrIS) is for global data assimilation by NOAA's National Centers for Environmental Prediction (NCEP). NCEP is prepared to use the ATMS and CrIS and expects them to provide information comparable to the Metop instruments, even though the instruments are not identical.

Question 8: If NOAA received all of the money requested in its budget request, would it be able to prevent a gap in coverage?

Response 8:
Given the appropriations in FY 2011 and FY 2012, a gap in coverage is likely. Full funding of the President's FY 2013 request is needed to prevent further delays to the launch schedule and to minimize any potential gap. According to NOAA estimates, if the Suomi NPP mission were to cease operations at the end of its projected life in 2016 and JPSS-1 becomes fully operational in 2018 (after undergoing calibration and validation activities), the potential data gap in the afternoon orbit could be up to 18 months for a weather data gap, or up to 24 months for a data gap to NOAA's environmental data. NOAA will make best efforts to minimize the gap.

Question 8a: What are the chances that VIIRS, or some other sensor, would once again encounter problems that would affect the project schedule?

Response 8a:
There is always a risk of encountering difficulties in development of the complex sensors that will fly on JPSS-1. NOAA and NASA have developed mitigation measures and appropriate processes so that the risk is mitigated. The means to manage this risk and keep it low is dependent on 1) a robust systems engineering capacity in the program, and 2) receipt of sufficient contingency reserve funds each year to immediately address technical issues as they arise. If the JPSS Program does not have sufficient contingency reserves, this could cause the risk of encountering instrument development problems to increase because the JPSS Program would have limited resources to mitigate risks and recover from unforeseen issues.

NOAA and NASA have developed a rigorous program management and oversight of all aspects of the JPSS-1 development effort so that technical challenges can be identified early and addressed before impacts become large. NASA has established contracts with the sensor manufacturers that built the Suomi NPP instruments and has worked to retain critical engineering talent while waiting for appropriations. This enables NASA to have direct oversight of the contractor's work. In contrast, with the NPOESS Program, there was little direct government technical oversight of the instruments and the instrument manufacturers reported to a systems prime contractor. Decisions were slow, and the ability to use government sensor experts to help rapidly mitigate risks and solve problems was limited.

NOAA and NASA benefit from Suomi NPP development risks being addressed and resolved. Now that Suomi NPP has been launched and the instruments are undergoing calibration and

validation, NASA and NOAA will incorporate any necessary modifications, based on instrument performance in space, into the development of JPSS-1 instruments.

Question 9: Given that your most optimistic plans still call for a gap in weather data in 2017 and it looks like the Federal Government will be enduring Continuing Resolutions for the foreseeable future, what plans is NOAA making to ensure the gap in weather data does not increase? Please detail these plans for the Committee.

Response 9:
The plans that NOAA develops as part of the annual President's Budget request to Congress in February reflects the work it plans to conduct for the following fiscal year which begins on October 1st. NOAA prioritizes its requirements to ensure that it can accomplish work between October 1st and September 30th of the following year to meet key capabilities required for weather forecasting. These plans are developed to ensure that these capabilities can be built and launched on time, within budget, while managing technical risk.

If funds are unavailable due to a Continuing Resolution or lack of support for amounts requested in the President's Budget request, NOAA will work with the Administration to assess the best ways of meeting the requirements within the CR constraints, which could involve lessening capability, functionality and performance to compensate for lack of adequate or timely Congressional appropriations.

Question 10: The Aerospace Corporation released a study entitled, "NPOESS Lessons Evaluation," on December 1, 2010. The study cited a failure of the Government team to effectively manage contractors, overly optimistic cost estimates and contractor performance, and even difficulties introduced by the NPP mission as reasons for the failure of the NPOESS program.

Question 10a: What is being done to make sure these same problems are not repeated?

Response 10a:
The Aerospace Corporation report highlighted conclusions that the Administration reached in February 2010 when the decision was announced to establish the JPSS Program. In fact, NOAA had determined that four key factors led to failure of the NPOESS Program, which were specifically addressed in the JPSS Program:

1. **Alignment with a proven acquisition center**

   The JPSS Program is aligned with the NASA GSFC and has access to expertise throughout the NASA enterprise.

2. **Need for clear lines of authority and responsibility of decision-making and program governance between the Government and contractors, and among the Government partners.**

Under the JPSS program, NASA has direct oversight of contractors and has several Government representatives in-plant during manufacturing and for mandatory inspection.

JPSS instruments are the second and significantly upgraded flight models based on the development of the Suomi NPP instruments which were the first flight models. NOAA/NASA and the contractors are taking advantage of all the lessons learned from NPOESS and Suomi NPP to avoid the same mistakes. There has been an upgrade in the developmental processes to support the operational mission of JPSS-1 versus the research mission of Suomi NPP and many of the risks identified during Suomi NPP development are either retired or close to being addressed and resolved. Flight experience on Suomi NPP will further reduce risk, and use of a similar Suomi NPP-type bus for JPSS-1 and use of the JPSS ground system for Suomi NPP and JPSS-1 allows for additional opportunities to garner lessons learned and promote synergy between the two programs. NPOESS had none of this maturity, nor the opportunity for synergy.

The NPOESS program's acquisition strategy was based on a high level of dependence on industry to provide oversight. The JPSS Program has adopted a more traditional approach to contracting with government management and oversight to ensure mission success.

Finally, NOAA is responsible for establishing the requirements and funding the program. The JPSS Management Control Plan indicates a clear role for NOAA as the lead agency for JPSS.

3. Frequent programmatic and technical reviews by internal and external experts.

The JPSS program is part of monthly NASA engineering and programmatic reviews, and monthly NOAA Program Management Council reviews. As the JPSS program finalizes its plans, it will subject the program to external reviews.

4. Realistic cost estimation was not pursued at key decision points. .

Realistic cost estimates and contractor performance are being incorporated in the JPSS Program budgeting. These estimates, when reconciled, will be used to provide a budget baseline.

Question 11: How many federal employees and contractors at NOAA are involved in the JPSS program?

Response 11:
Currently, the NOAA JPSS program has 32 civil servants and 60 support contractors. This is not the full complement of staffing that is required for a program of this complexity; NOAA is still in the process of filling key positions.

Question 12: What is the status of the ground stations for the JPPS program?

June 7, 2012

Response 12:
Substantial progress was made to install the JPSS ground system in time to support the October 28, 2011 Suomi NPP launch. The JPSS ground system infrastructure allows it to:

- **Communicate with and retrieve data from Suomi NPP and JPSS**
  - One X-band 13-meter antenna is in Svalbard, Norway (for Suomi NPP support)
  - Two distributed receptor network (DRN) Ka-band 4.2-meter antennas are in place at both McMurdo, Antarctica, and Svalbard, Norway (JPSS)
  - Backup reception for the 13-meter antenna is obtained via a service level agreement with Kongsberg Satellite Services (KSAT)

- **Command, Control, and Communicate with satellites**
  - Command, Control and Communications System is in place at NOAA Satellite Operations Facility (NSOF) in Suitland, Maryland.

- **Data processing facility for NWS and other operational users**
  - Interface Data Processing System (IDPS) is in place at:
    - NSOF in Suitland, Maryland
    - Air Force Weather Agency in Omaha, Nebraska

- **Product Processing and Quality Assurance**
  - IT equipment and satellite analysts are in place to begin to assess the data.

- **Long-term data archive**
  - Long-term archive through NOAA Comprehensive Large Array-data Stewardship System (CLASS) is in place and ready to accept data and make data available to customers.

Question 12a: What was the original plan for the ground stations?

Response 12a:
The February 2010 decision that established the JPSS Program envisioned that JPSS would adopt the NPOESS ground station plan for 15 globally distributed receptor sites, which would reduce data latency (i.e., time from measurement by the satellite to delivery of data to users from data processing systems) to 30 minutes for JPSS-2. By having data available at 30 minutes from observation to processing center, this would provide significant improvements in weather forecasting by having the most current data available for the numerical weather prediction models processing versus using data that was 2 hours old.

Question 12b: How many are anticipated?

Response 12b:
The original plan envisioned 15 globally separate locations that would support achieving the 30 minute data latency by the time JPSS-2 is launched. The FY 2013 Budget request reflects a data latency of 80 minutes for JPSS-1 and JPSS-2, which will be achieved by deploying two of the 15 sites originally planned.

June 7, 2012

Question 12c: Has that plan been altered?

Response 12c:
Yes, this plan had to be altered. Had the JPSS Program received the additional funds requested in FY 2011, it would have applied some of those funds to continue deployment of the global antenna network. However, when the additional funds were not appropriated, a revised plan was developed and implemented to focus on deploying two sites for JPSS-1. The FY 2013 Budget request reflects a data latency of 80 minutes for JPSS-1 and JPSS-2. This is better than current data latency of 120 minutes with NOAA POES, but not as fast as the 30 minute data latency envisioned with deployment of the global network.

Question 13: The ground system NOAA is investing in was originally supposed to support the early morning and afternoon orbit satellites. Now that DoD will have a separate satellite system in the early morning orbit, how is NOAA designing the ground system to accommodate the DoD satellites if they are unsure of the DoD satellites' requirements?

Response 13:
As noted above, an Interface Data Processing System is in place at the Air Force Weather Agency in Omaha, Nebraska where data from Suomi NPP and eventually JPSS-1 will be made available to DoD. The JPSS Program is in regular communication with DoD regarding their plans to implement the direction provided in the National Defense Authorization Act, 2012 and the Consolidated Appropriations Bill, 2012 to terminate the DWSS Program and develop plans for an alternate follow-on satellite program. At that time, NOAA and DoD will discuss what ground system support will be needed for its follow-on system.

Question 14: How is NOAA coordinating with the US Air Force and their plans for the future of the Defense Weather Satellite System (DWSS) program?

Response 14:
NOAA JPSS is working with DoD as it implements the Congressional direction provided by the National Defense Authorization Act, 2012 and the Consolidated Appropriations Act, 2012. These discussions include the best means to coordinate on a number of issues such as ground system, and spectrum management.

Question 14a: Are there any decisions regarding DWSS that are on the critical path for JPSS? If so, please detail these decisions.

Response 14a:
No, there are no decisions regarding DWSS that are on the critical path for JPSS-1. As noted above, NOAA JPSS will work with DoD to implement the Congressional direction provided by the National Defense Authorization Act, 2012 and the Consolidated Appropriations Act, 2012.

June 7, 2012

Question 15: How is NOAA coordinating with The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) for their future replacement polar-orbiting satellite?

Response 15:
NOAA and EUMETSAT have had longstanding cooperation and coordination that has spanned several decades.

For JPSS coordination, NOAA and EUMETSAT have established a Technical Working Group (TWG) between the two organizations. This TWG reports up to a Bi-lateral Working Group co-chaired by the Assistant Administrator for NOAA Satellite and Information Services and the Director General of EUMETSAT.

With a fully coordinated polar-orbiting system, NOAA and EUMETSAT technical staff and leadership engage on a regular basis, both informally and in the context of formal technical and bilateral meetings. Over the last three years, NOAA and EUMETSAT have developed the elements of a Joint Polar System agreement that will define the roles and responsibilities of each party in the JPSS era. This international agreement will be revised as the plans for NOAA's JPSS and the EUMETSAT Polar System Second Generation (EPS-SG) satellites are finalized. NOAA has provided input into the EPS-SG planning cycle, and has participated in requirements consultation workshops. In addition, NOAA maintains an onsite technical liaison at EUMETSAT HQ in Darmstadt, Germany to facilitate the coordination of our efforts.

Question 15a: Are there plans to change the relationship concerning the coverage and responsibilities for data sets?

Response 15a:
No. There are no plans to change coverage and responsibilities for data sets and exchange of data between NOAA and EUMETSAT from our respective orbits. EUMETSAT will provide data from Metop and eventually its EPS-SG satellites in the mid-morning orbit, and NOAA will provide data from POES and eventually Suomi NPP/JPSS-1 in the afternoon orbit.

However, whereas for the Metop satellites, NOAA had previously provided a suite of five instruments for flight on Metop, and EUMETSAT previously provided a Microwave Humidity Sounder for flight on POES satellites, this instrument exchange will not be the case for JPSS and EPS-SG satellites. Instead, EUMETSAT is currently planning to develop instruments independently within Europe, and NOAA will supply the full suite of instruments on JPSS. Nonetheless, NOAA and EUMETSAT will continue full and open exchange of data from their respective orbits.

Question 16: When will NOAA start planning for the next generation of polar-orbiting weather satellites?

Response 16:
NOAA has started early planning for next generation polar-orbiting satellites that will follow JPSS-2.

June 7, 2012

Question 16a: How does NOAA plan to improve upon previous experiences and avoid future gaps in coverage?

Response 16a:
NOAA plans to minimize risk to future gaps in coverage by leveraging proven instrument designs and relying on our successful long-term partnership with NASA to support risk reduction activities. Prior to the NPOESS partnership among DOC-NASA-DoD, NOAA and NASA partnered to build two very successful geostationary and polar-orbiting satellite programs that continue to provide critical data and services to NOAA. This partnership continues with the GOES-R Program and has recently begun with the Joint Polar Satellite System.

NOAA is also re-assessing the feasibility of using the approach that had been successfully implemented with the NOAA K through N-Prime, and GOES NOP Series of designing and building future satellites in a series to limit the cost and schedule delays resulting from non-recurring engineering and ramp-up and ramp-downs associated with stretching development efforts. Under this scenario NOAA would have satellites ready to launch as required prior to the end of the design life of the previous satellite.

Question 17: Please explain which is more important to severe weather forecasting, JPSS or the GOES satellites? Why?

Response 17:
Geostationary and polar-orbiting satellites are complementary data sources required to meet NOAA's forecast mission; neither is more important than the other for severe weather forecasting. These two systems, along with NWS observational systems such as NEXRAD radars, weather buoys, and surface observing systems, warn the Nation about unexpected severe weather, such as hurricanes, winter storms, and even solar storms.

Geostationary Operational Environmental Satellites (GOES) provide continuous monitoring from a fixed position more than 22,300 miles above the Earth. These satellites, orbiting together at the same rate as the Earth's rotation, beam down images and other measurements of air, land, water, and ice across the Western Hemisphere — allowing scientists to constantly monitor for severe weather such as tornadoes, heavy rainfall, and tropical storms. GOES provides data more frequently but over a fixed and more limited geographic area than the polar-orbiting spacecraft. Geostationary sensors are focused on near-term, rapidly developing systems over the continental United States and coastal waters. These satellites provide forecasters with constant monitoring of developing weather situations and systems, particularly valuable for observing developing thunderstorms and constant tracking of hurricanes and major storms. Additionally, GOES satellites are able to provide "rapid scan" capability where more frequent data can be provided for a particular weather system. The GOES-R satellite will provide continuity of coverage, and provide increased capabilities over current GOES satellites.

Polar Operational Environmental Satellites (POES) operate 540 miles above Earth, much closer than geostationary orbits. Because the Earth rotates while these satellites travel from the North Pole to the South Pole, they collect land, ocean, and atmospheric data from across the entire

globe. POES are the main sources of global observational data used to initialize weather prediction models that are essential for accurate weather forecasts. Polar-orbiting satellite data also provide imagery in areas not well covered by geostationary satellites such as Alaska and remote ocean areas for short-term forecasting. The Suomi NPP and JPSS satellites will provide continuity of coverage and enhanced observations for use in numerical weather prediction models.

Ultimately, geostationary satellites are critical for 1-3 day forecasts, severe weather watches and warnings, hurricane position and motion, and data on severe thunderstorms and high winds. On the other hand, polar-orbiting satellite data are essential for numerical weather prediction models for 3-7 day forecasts. The output from these models can forecast hurricane evolution and identify conditions conducive to both hurricane and tornado formation several days before this severe weather actually threatens lives and property.

Question 18: How would the capabilities of NPP or JPSS help make tornado or hurricane forecasting more accurate?

Response 18:
The key to improvements in tornado or hurricane forecasting from polar-orbiting satellites is the data it provides to the NWP models that indicate that conditions are ripe for severe weather activity.

Specific for tornado forecasting, Suomi NPP and JPSS capabilities will provide improvements in the 3-5 day prediction over current capability of the overall weather patterns that can lead to tornadoes. Three to five day forecasts are useful for Federal and State Emergency Managers and communities to prepare and remain vigilant.

For 0-6 hour warnings, geostationary satellite imagery and Doppler radars are the most critical observations. Due to the higher resolution of JPSS imagery, these images of opportunity complement geostationary imagery to provide critical details of developing storm systems that may not be seen by radar due to coverage gaps or terrain masking. Furthermore, the advanced sounders will provide important high vertical resolution temperature and water vapor profiles, which can be used to provide information on the potential of severe weather prior to convective development. For example, a study demonstrated that the NASA AIRS sensor (similar to CrIS) was able to show over Joplin, Missouri extreme instability almost three hours prior to the horrific F5 tornado that claimed more than 150 lives. JPSS is in the early afternoon orbit, which is about 0 – 6 hours prior to most outbreaks of tornadoes. While tornadoes can occur at any time of day, due to solar heating, most tornadoes – especially large outbreaks – tend to occur in the afternoon or early evening, local time.

With respect to hurricane forecasting, since most hurricanes originate in the tropics and over the oceans, output from global models and supporting global observations are necessary to forecast hurricane track. Suomi NPP (and JPSS) data are of particular value in providing atmospheric data for the computer forecast models as well as identifying areas of warm sea surface temperature, critical to determine the potential strengthening or weakening of hurricanes and other tropical systems.

Compared to the current operational NOAA-19 satellites, the advanced microwave and infrared sounders will provide substantially improved atmospheric temperature and water vapor information throughout the atmosphere. Knowledge of atmospheric temperature and water vapor is a key driver for predicting circulation patterns and regions of atmospheric instability leading to severe storm development days in advance.

Question 19: Given current fiscal constraints, what is NOAA's plan to improve severe weather forecasts in the near future?

Response 19:
NOAA remains committed to saving lives and livelihoods, and launched a Weather-Ready Nation initiative in response to the Nation's increasing vulnerability to weather-related disasters. In essence, the initiative paves the way for a new model of doing business that emphasizes an environment of services in which products and warnings are coupled with NWS partner efforts to better prepare the American public for environmental events. One aspect of this effort has been to initiate a national dialog on achieving a Weather-Ready Nation. NOAA hosted a national symposium on severe weather in Norman, Oklahoma, in December 2011 that specifically addressed this effort.

NOAA is also continuing its efforts to improve severe weather forecasting through such programs as the Hurricane Forecast Improvement Project and Dual-polarization radar. In FY 2013, the National Weather Service is requesting strategic investments to accommodate increased satellite observations with an increase for the Telecommunications Gateway, the communication hub for weather data, and in the Ground Readiness Project for updating the IT infrastructure.

Question 19a: If there is a plan, when would the new forecasts be available, how much will this new plan cost, and how will current forecasts be improved?

Response 19a:
NOAA is constantly working to improve our forecasts through training of our forecasters, research, development and infusion of new science and technology, both internally and with the external community. There is no single way in which to improve severe weather forecasts. The four foundational pillars – observations, computer models, research, and our people – all must advance to improve forecasts and warnings.

Three near-term examples of planned improvements include Hurricane Forecast Improvement Project (HFIP), Dual-pol radar and enhanced super-computing. HFIP improvements continue to be realized in a demonstration mode. In FY 2012, NOAA's HFIP program received $13.0 million for research to improve modeling and forecasting, as well as $4 million for research supercomputing that enables HFIP research on modeling and forecasting.

Dual-pol radar implementation should be completed in FY 2013 and should result in greatly increased ability to detect tornadoes, hail, and improvements to flash flood lead times; the FY 2012 Dual-pol budget is $5.8 million.

The next operational computer is scheduled to come on-line in September 2013; the budgeted annual cost is approximately $19 million in addition to a two-year supplementary funding of $10 million to cover the cost of maintaining the current computer and preparing for the new one.

Question 20: Is NOAA carrying funds to cover termination liability costs associated with the termination of NPOESS contracts? If so, how much?

Response 20:
Funds sufficient to reimburse Northrop Grumman Aerospace Systems for the partial termination of the NPOESS contract (ground operations and major instruments) were obligated on the U.S. Air Force NPOESS contract and remain available for that purpose.

US Air Force contracting officials indicate that $84M remains available on the NPOESS contract for the termination costs and approximately $42M of that amount will cover the termination costs associated with contracts that have transitioned to NASA as part of the JPSS program.

As a result, NOAA does not need to 'carry' funds to cover the termination liability costs associated with the termination of the NPOESS contracts since it already has funds available on the NGAS contract to cover its liabilities.

Question 21: What are NOAA's contingency plans if the NPP launch is unsuccessful?

Response 21:
The Suomi NPP satellite was successfully launched on October 28, 2011. However, in the event the instruments on the Suomi NPP satellite do not provide useful data for the planned 5 year time period that is needed, NOAA will continue to rely on existing on-orbit polar-orbiting satellites as long as possible to support our operational mission. These satellites include the NOAA-19 satellite in the afternoon orbit and NASA's Aqua satellite which are nearing the end of their design lives.

NOAA will continue to receive data from the mid-morning polar orbit from our European partners, but this will not mitigate the loss of the afternoon orbit and the accuracy of our weather forecasts will be degraded. NOAA – working with the Administration and Congress, NASA, industry, and our international partners – will examine all feasible options to minimize anticipated gaps in polar-orbiting satellite coverage.

NOAA is already working with NASA and its contractors to build JPSS-1 as quickly as possible. This is a very complex project, and NOAA and NASA are analyzing the impact of receiving the FY 2012 appropriation of $924 million for the JPSS Program. At this level of funding, NOAA is able to work with NASA on ramping up the contractual efforts in order to support a launch of the JPSS-1 satellite in FY 2017.

Question 22: It appears that some of the sensors NOAA hoped to fly on JPSS will now be free flyers. Please provide a list of these sensors, how much funding NOAA is currently

devoting to them, and how they compare to other NOAA satellites (JASON, ACE replacement) in terms of priority.

Response 22:
The satellites and instruments in NOAA's satellite portfolio represent the highest priority in NOAA's annual budget request for space-based environmental data and have been subject to thorough reviews within the Administration's annual budgeting process.

Satellite Systems	FY 2012 PBR ($M)	FY 2012 Estimate ($M)
GOES-N	33.967	32.4
GOES-R	617.390	615.6
Polar Systems (POES)	34.816	32.2
Jason-3	53.0 (1)	19.7
Polar Systems (JPSS)	1,070.0 (2)	924.0
DSCOVR	47.3	29.8
COSMIC-2	11.3	0
Capabilities	**FY 2012 PBR ($M)**	**FY 2012 Estimate ($M)**
Restoration of Climate Sensors (TSIS, CERES)	30.4 (3)	25.9
SARSAT	0 (4)	0
A-DCS	0 (5)	0

1. This is US portion (50% of total cost). EUMETSAT pays for the remaining 50% of total cost of Jason-3 program.
2. JPSS Program is responsible for integration and launch of TSIS, SARSAT, A-DCS. Development of SARSAT and A-DCS is paid for elsewhere.
3. Supports acquisition of TSIS Flight Model 1, CERES FM-6.
4. SARSAT development paid for by the French Space Agency and Canadian Department of National Defence and delivered to JPSS Program for integration and launch.
5. A-DCS development paid for by the French Space Agency and delivered to JPSS Program for integration and launch.

The Administration's focus has been on bringing stability to the JPSS budget, however, this should not diminish the importance of GOES-R, the other core satellite constellation system.

The other satellite programs provide complementary data that are required to meet NOAA's mission requirements. For example, the Jason satellite provides data that are used by weather forecasters and oceanographers for a number of uses[2] including monitoring intensification of hurricanes, fisheries management, and large ocean gyres carrying marine debris in the Pacific Ocean.

[2] Altimeter Data for Operational Use in the Marine Environment. http://www.aoml.noaa.gov/phod/cyclone/data/pubs/oceans-99-paper.pdf

June 7, 2012

The DSCOVR satellite will replace the NASA Advanced Composition Explorer (ACE) research satellite that was launched in 1997 and is well past its design life. The data from the DSCOVR will support monitoring of the Sun and will provide data critical for warnings of space weather events that could damage power grids, telecommunications infrastructure, and satellites if these events were not detected in time.

Suomi NPP accommodates the sensors measuring the Earth's radiation budget (CERES). Suomi NPP will carry both OMPS-Nadir and OMPS-Limb, while only OMPS-Nadir was planned to fly on JPSS-1. The TSIS, Advanced Data Collection System (A-DCS) and SARSAT instruments could not be accommodated on either the Suomi NPP or JPSS-1 satellites due to limited mass, power, and volume. NOAA and NASA are evaluating options for flying these instruments.

Question 23: Page three of NOAA's written testimony states: "The NPOESS Program was dissolved in early 2010 because it had an ineffective program management structure and it experienced developmental challenges resulting in delays in acquisition schedules and cost overruns, which resulted in significant slips in the launch date of the NPP satellite as well as the first NPOESS satellite."

Question 23a: Please explain the "delays in acquisition schedules and cost overruns" due the "ineffective program management structure" and "developmental challenges".

Response 23a:
NOAA recognized that the major challenge of NPOESS was jointly executing the program between three agencies with different technical objectives, acquisition procedures, engineering and management philosophies, risk tolerance, and approaches to managing budget adjustments. Trying to find common ground on a single program (with a single common platform and a uniform set of instruments) proved to be an extraordinarily difficult task.

An Independent Review Team (IRT) confirmed NOAA's own conclusion that the differing processes and objectives among the Tri-agency partners guaranteed that the NPOESS program as constructed had little chance of success. The restructured JPSS program addresses these challenges by assigning responsibility for different orbits to different agencies. The platforms for the respective orbits will be developed and procured so as to leverage off the strength of each agency, and also to best harness the experience each agency has in continuing and improving on legacy measurements. Each agency will take the appropriate acquisition planning and implementation actions to meet the needs for their respective orbits. The agencies will continue to partner in those areas that have been successful in the past, such as a shared ground system and operation of both morning and afternoon platforms by NOAA. The restructured programs will also eliminate the NPOESS tri-agency structure that has made management and oversight difficult, contributing to the poor performance of the program.

The IRT noted that the NPOESS program was isolated from a proven and established acquisition center. The NPOESS program also lacked timely access to technical expertise, broad mentoring and development opportunities for staff, and rigorous checks and balances of engineering and program processes. The Administration's decision addressed these concerns by aligning the

restructured JPSS program with an established acquisition center. NASA's Goddard Space Flight Center is NOAA's acquisition agent for the afternoon orbit.

Question 24: Page five of NOAA's written testimony states: "The Nation is at risk of having degraded weather forecasts and other important services because of a projected gap in access to critical NOAA polar-orbiting data. This projected gap is due to the lack of adequate, timely, and stable appropriated funds to develop and launch the JPSS satellite by mid-2016, before NPP has reached the end of its projected life."

Question 24a: This appears to be at odds with your statement on page three, which attributes "delays in acquisition schedules and cost overruns" to the "ineffective program management structure" and "developmental challenges" of NPOESS. Please explain.

Response 24a:
The reference on page five refers to the impact of the FY 2011 Full-Year Continuing Resolution and the requirement for funding at or near the President's FY 2012 Budget request of $1.070 billion for the JPSS Program.

The delays in acquisition schedules, cost overruns, and an ineffective program management structure refers to the NPOESS program prior to the Administration's 2010 decision to restructure the program. The President's Budget in FY 2011 requested $1.060 billion, which would have allowed launch of the JPSS-1 satellite in 2015, avoiding a gap between Suomi NPP and JPSS-1. DOC allocated an additional $89.7 million to the $382.2 million provided by the FY 2011 full year Continuing Resolution to maintain contract viability. However, this level of funding was still below the Administration's FY 2011 budget request and is what caused the launch to slip to first quarter FY 2017.

NOAA and NASA are analyzing the impact of receiving the FY 2012 appropriation of $924 million for the JPSS Program. At this level of funding, NOAA is able to work with NASA on ramping up the contractual efforts in order to support a launch of the JPSS-1 satellite in FY 2017.

Question 25: Page eight of NOAA's testimony states: "NPP instruments will provide more advanced data and capabilities than are currently available on the NOAA POES satellites. In some instances, NPP will provide new capabilities not currently available from NOAA POES."

Question 25a: Please explain what you mean by NPP instruments providing "more advanced data and capabilities than are currently available on the NOAA POES satellites," as well as the "new capabilities not currently available from NOAA POES."

Response 25a:
The two instruments that are important for improvements to numerical weather prediction model output will be the Suomi NPP/JPSS infrared and microwave sounders (CrIS and ATMS respectively). Each of these instruments will have more channels than the legacy POES instruments (HIRS, AMSU and MHS), thereby enabling higher resolution and increased accuracy in measuring atmospheric temperature and moisture. The CrIS sensor has over 1300

spectral bands instead of the POES HIRS 19 channels which will provide higher resolution. The ATMS has much better spatial resolution and global coverage than the POES AMSU. Together, these instruments provide significantly improved atmospheric temperature and water vapor information. The accuracy of forecasts is strongly dependent on the accuracy of atmospheric temperature and water vapor information.

The Suomi NPP/JPSS infrared imager (VIIRS) has new capabilities compared to the POES AVHRR, including higher resolution to detect cloud, land surface and sea surface temperature variations. The VIIRS is an imager with 22 channels, compared to POES AVHRR 6 channels, and much improved spatial resolution and global coverage due to its wider swath. The AVHRR's old technology resulted in spatial resolution degradation from 1 kilometer (km) near nadir to an equivalent 6 km at end of scan, whereas VIIRS has a resolution of 375 meter near nadir and only reducing to 800 meters at the end of scan. As a result, the AVHRR imagery is blurred and features are difficult to detect, while VIIRS sharp imagery is retained. VIIRS has on-board shortwave calibration, which significantly improves the long-term stability of the products. Additionally, VIIRS will provide:

- Improved fire detection due to higher spatial resolution and higher sensor saturation level.
- VIIRS would provide AVHRR-like channels at 375 meter resolution and will improve our ability to detect and study small scale features like contrails and fog (valley fog).
    - The availability of the near-infrared channel makes VIIRS more suitable for retrieving aerosol over land, at least over dark vegetated areas. The POES AVHRR lacks this channel.
- A channel in the deep blue part of the visible spectrum will allow for detecting aerosols over bright surface.
- Ocean color (AVHRR does not have this capability) to monitor phytoplankton and harmful algal blooms for monitoring health of oceans and coastal ecosystems.
- A day-night band is not on AVHRR. VIIRS will allow monitoring of extreme events such as volcanic ash, dust, oil slicks, fire, smoke, and rapid changing snow cover under lunar illumination, which is about 50 percent of the time.
- More detailed and higher quality radiometric information for sea surface temperature (SST) retrievals.
    - SST is used for multiple applications such as tracking fish stock distribution and location, monitoring hurricane intensification, and coral reef bleaching.
- Higher spatial resolution to observe smaller-scale volcanic cloud phenomena which are critical to safeguarding the aviation community from encounters with ash in the airspace.
- Improved qualitative and quantitative ash and sulphur dioxide detection because of the 8.5 micrometer channel.
- Due to the combination of VIIRS and CrIS, greatly improved capability for retrieving critical volcanic ash cloud properties (height, loading, particle size) will be available from Suomi NPP/JPSS.

The OMPS ozone sounder is more capable than the Solar Backscatter Ultraviolet Instrument (SBUV2) on POES. It will provide more accurate ozone information for monitoring the ozone hole.

CERES measures the Earth's radiation budget for climate studies. There is no similar capability on POES.

Question 25b: Please detail the increased capabilities NPP offers over POES, as well as any capabilities that are degraded.

Response 25b:
The response above details the improvements that Suomi NPP will provide over POES. With respect to degradation from Suomi NPP over POES, the only degradation is that there is no water vapor channel on VIIRS. The water vapor channel is used to derive Polar Winds and to improve cloud heights determination; however, a combination of data from the CrIS and VIIRS instruments will help mitigate for this loss.

The Suomi NPP spacecraft bus cannot accommodate the SARSAT and A-DCS instruments. By not having SARSAT on Suomi NPP, there is a risk of a gap in global satellite-assisted search and rescue capabilities. The A-DCS function has proven to be invaluable for transmitting data from remote locations such as migratory whales, ocean buoys, and remote weather stations back to management agencies and research centers.

Question 26: Page eight of NOAA's testimony states: "NOAA has completed negotiations with JAXA (Japan Aerospace Exploration Agency) to acquire data from the first GCOM satellite (GCOM-W1) which is scheduled for launch in 2012. These measurements will partially fulfill requirements that would have been provided by the technically-challenging Microwave Imager Sounder previously planned for the NPOESS program."

Question 26a: Please explain what you mean by the Japanese measurements "partially" fulfilling "requirements that would have been provided by the technically-challenging Microwave Imager Sounder previously planned for the NPOESS program." Which requirements will not be fulfilled?

Response 26a:
The NPOESS program had retained an instrument called the Microwave Imager Sounder (MIS). The imager portion of MIS provided images in all weather conditions (overcast, clear, cloudy), sea surface temperature, soil moisture, ocean surface winds, total water vapor content, rainfall rates, snow and ice cover and concentration. The sounder portion provides atmospheric temperature and water vapor profiles. The ATMS microwave sounder on Suomi NPP will provide the atmospheric temperature and water vapor profiles, while GCOM AMSR2 will provide the MIS-like imager products noted above. One requirement not fulfilled is mesospheric temperature profiles (above 50 km). NOAA believes that most of its requirements will be fulfilled by data from GCOM-W1 mission. The DWSS mission had retained a requirement for a Microwave Sensor which would measure soil moisture, atmospheric temperatures, moisture profiles, precipitation, and sea surface winds. NOAA had intended to leverage data from the DWSS to augment its data requirements prior to the cancellation of the DWSS program in FY 2012.

June 7, 2012

Question 27: Dr. Sullivan, you were asked at the hearing if any of the sensors on JPSS or NPP have anything to do with long-range climate data collection and you responded no. I understand you may have misspoken. Can you please clarify your answer from the hearing?

Response 27:
The OMPS-Nadir instrument planned for the JPSS-1 satellite will continue and enhance the measurement of stratospheric ozone. Depletion of the Antarctic ozone layer has been linked to increases in ultraviolet radiation. A causal relationship been established between increases in UV radiation and increases in skin cancers and ocular cataracts. While the measurement of the stratospheric ozone is a climate-related issue, there are strong links of this climate parameter to the protection of human health. There are suggestions that there are a variety of biological consequences such as damage to plants, and reduction of plankton populations in the ocean's photic zone may result from the increased UV exposure due to ozone depletion.

In addition, the JPSS Program is responsible for launch of the Clouds and the Earth's Radiant Energy System (CERES) sensors, and NOAA and NASA are exploring launch opportunities for the Total Solar Spectral Irradiance Sensor.

Question 28: During the hearing you were asked about NOAA's policy on obtaining data from the private sector to fill the potential gap between the NPP satellite failure and the first JPSS satellite coming on line. You stated that NOAA has put out requests for information to for that kind of data, although you had not included that in your testimony. Can you please provide the Committee with these requests for information?

Response 28:
On December 20, 2007, NOAA issued a request for information (RFI), followed by an Industry Day on January 28, 2008, to identify interested parties capable of providing commercial solutions to meet space-based Earth and space weather observation requirements of the United States Government. The solutions NOAA sought were for the types of observations where funding and/or technical approaches were not clearly spelled out. NOAA did not seek solutions for the imager or sounder mission planned for Suomi NPP and JPSS. However, NOAA requested input for all other capabilities. Based on industry response, NOAA determined that commercial solutions were potentially feasible. From September 2008 to September 2009, NOAA solicited more detailed information through a Request for Quotation, and awarded 22 contracts to industry, each one worth $25,000 to provide written documentation proving the technical feasibility, commercial business case, and the validity of the commercial price for 12 different requirements for Earth and space weather observations. NOAA documented its findings from the RFI and RFQ in a Report to Congress on NOAA Use of Commercial Data in 2010.[3]

In May 2011, NOAA issued an RFI seeking commercial partnering opportunities in DSCOVR and follow-on commercial solar-wind missions. Responses are being evaluated for consideration in future planning.

Question 28a: Have any of these RFI's yielded any promising options?

[3] http://www.space.commerce.gov/library/reports/2010-03-commercial-observations.pdf

June 7, 2012

Response 28a:
The RFI and RFQ results yielded high interest from industry in identifying lower and in some instances higher costs, commercial solutions as compared with government-developed solutions. For example, in a few cases, industry provided lower cost satellite and launch vehicle options. In some cases, the industry required up front funding from the government. However, all solutions were determined to be higher risk than proven government developed missions, due to lack of redundancy, lack of experience, or too little technical detail given in the proposal. Specific proposal information was all marked proprietary and competition sensitive.

As described in the Report to Congress referenced earlier, NOAA purchases data from commercial sources to meet specific mission needs. Examples of such data purchases are the multi-year data buys from GeoEye for SeaWiFS data, up until the system ended useful service, to support monitoring coastal ecosystems and coral reef health, and monitoring and predicting harmful algal blooms. In addition, NOAA purchases high resolution data to support its coral reef and coastal mapping mission, and synthetic aperture data to support its sea ice monitoring mission to ensure safe maritime navigation through ice infested waters.

Question 29: Given that the origin of this program dates back to 1994, it has now taken over 17 years to arrive at this juncture in the NPOESS-JPSS life cycle. At present time, many questions still remain about the viability and efficiency of this program's execution, and its long-term prospects.

Question 29a: Can you please provide the Committee with a detailed explanation of what steps NOAA has already taken, and what steps it plans to take, to meet the underlying long-term national satellite observation needs?

Response 29a:
NOAA has taken the following steps to ensure that the Nation's long-term polar-orbiting observing needs are met:

- NOAA has partnered with NASA, a proven acquisition center, to acquire and implement the JPSS program. This arrangement shifts the responsibility for integration, development and oversight of the space and ground segments back under the direct oversight of the government instead of another contractor.
- NOAA has requested a budget with reserves, and a confidence level, commensurate with a program of this complexity and in accordance with NASA's best practices and standards.
- The requirements process has been simplified with only NOAA providing the final decision on the requirements for the program.
- NOAA has simplified the satellite architecture to use a smaller spacecraft based on a commercial platform.
- Appropriate review boards have been established to provide independent reviews of the management and technical aspects of the program.

In addition to these steps NOAA will integrate the actions identified in 29b into its long-term strategy for JPSS.

Question 29b: What specific lessons from the 17-year program history does NOAA intend to integrate into any long-term strategy for life after JPSS-2?

Response 29b:
While there are many lesson learned from the NPOESS program, as well as the current JPSS program, the primary lessons NOAA intends to integrate into future missions beyond JPSS-2 include:

- Developing priorities for its requirements.
- Developing a robust, operational constellation for key observations from the polar-orbit to minimize the potential for gaps in coverage.
- Prioritize funding for missions leveraging existing foreign partnerships and pursue new partnerships so that NOAA can continue to meet its requirements.
- Developing new capabilities in an evolutionary manner to avoid cost and risk associated with significant advancement in technology.

June 7, 2012

Questions Submitted by Rep. Brad Miller
Ranking Member, Subcommittee on Energy & Environment

Question 1: What are NOAA's plans for non-NPP accommodated sensors that were originally part of NPOESS but will not fly on the NPP bus?

Response 1:
NOAA and NASA are actively assessing the feasibility of accommodating the TSIS, search and rescue (SARSAT), and data collection relay system (A-DCS) instruments on a free-flyer, commercial spacecraft, or platforms of opportunity in the near future and possibly accommodating them on future JPSS spacecraft.

Question 2: What is the plan to ensure the continuity of the nation's long-term commitment to solar monitoring (i.e. TSIS) as was part of the NPOESS program goals?

Response 2:
NOAA had established the "Restoration of Climate Sensors" to fund development of critical data continuity sensors for delivery back to the NPOESS program, after these capabilities had been de-manifested from the NPOESS Program as part of the 2006 Nunn-McCurdy certification. Funds to launch the Climate Sensors would be borne by the JPSS Program. NOAA and NASA are analyzing the impact of receiving the FY 2012 appropriation of $924 million on the JPSS Program of Record.

This Restoration of Climate Sensors program, started in 2007, initiated the procurement of the Total Solar Spectral Irradiance Sensor (TSIS), the Clouds and the Earth's Radiant Energy System (CERES), and the Ozone Mapper and Profiler Suite (OMPS)-Limb. In addition, funding was included in the FY 2012 Administration's budget request for JPSS to operate the instruments and produce the required measurements to ensure continuation of the respective climate data records.

The FY 2013 Budget requests a technical transfer to move management and funding of the Restoration of Climate Sensor Program to the JPSS program, in order to more accurately reflect the actual costs of the JPSS program and achieve acquisition and management efficiencies.

Question 2a: Is there a concern that solar and climate data could be lost, or a risk of significant gaps in the record?

Response 2a:
Yes, there is concern of a gap. The Total Solar Irradiance record is most at risk, given the March 4, 2011 launch failure of the NASA GLORY mission. GLORY was going to be the bridge between the existing NASA SORCE mission and TSIS Flight Model-1. The Earth Radiation Budget data continuity requirement is covered by CERES Flight Model-5 which is currently flying on Suomi NPP, and CERES Flight Model-6 which is being built to fly on JPSS-1. The FY 2013 budget request includes funds to complete development of CERES Flight Model-6.

June 7, 2012

Question 3: With the launch vehicle failure of the Glory mission, what is the contingency plan for continuing the solar irradiance record?

Response 3:
NASA has committed to continue to operate the SORCE mission to maintain the current operational data set so that post-launch calibration and validation with TSIS can occur. NOAA is working with the science community to evaluate other sources that would potentially mitigate the Total Solar Irradiance gap, if SORCE fails before TSIS Flight Model-1 launches. Unfortunately, these other data sources are poor substitutes for the current observations, and will cause increased errors in the data set, limiting its usefulness to the climate science community. The FY 2013 budget request includes funds to complete development of TSIS Flight Model-1, and provide for NOAA and NASA evaluation of a suitable launch for TSIS.

June 7, 2012

Questions Submitted by Rep. Randy Neugebauer

Question 1: With such unreliable financial projections, I find it hard to justify spending seemingly unknown amounts of money that we don't have for the JPSS program. Given our nation's financial situation, with over $14 trillion in debt, how can we justify continuing to throw money at a program that has historically not proved to be a wise or effective steward of taxpayer dollars?

Response 1:
The JPSS Program is not the failed NPOESS Program. The JPSS Program began during the second half of 2010 and is in the midst of finalizing key management and budget documents by which the program's success will be judged. The JPSS Program has the necessary management oversight of contracts to provide early detection and resolution of technical issues, streamlined decision-making, and validated requirements that the Program is designed to meet. The program has delivered an operational ground system for Suomi NPP, launched the Suomi-NPP satellite, has all of the JPSS-1 mission elements under contract, and is making progress on the development of the five instruments.

The year 2011 has established itself in the record books as an historic year for weather-related disasters with the 2011 hurricane season coming to a close with ten $1-billion-plus disasters. Total damages from weather- and water-related events since January for the United States are approaching $50 billion and climbing (Lott, et al 2011). 2011 is tied as the fourth deadliest tornado year for the United States since modern recordkeeping began in 1950, with 548 people killed as of November 6, 2011. April 2011 ranks as the most active tornado month on record with 875 tornadoes, breaking the previous record of 542 set in 2003. More tornadoes occurred on April 27 of this year than any other day in the past 61 years. On May 22, a large portion of Joplin, Missouri was devastated by an EF-5 (winds greater than 200 mph) tornado, resulting in over 150 fatalities and over 1,000 persons injured. The Joplin tornado was the deadliest this year and is ranked 7th among the deadliest tornadoes in U.S. history.

The United States is impacted by many forms of severe weather. The weather that spawns tornadoes and severe thunderstorms requires both up-to-the-minute satellite observations of clouds and other weather phenomena that may produce damaging winds and precipitation (best supplied by geostationary satellites) and forecasts of 1-3 days for general warnings. On the other hand, hurricanes also require both geostationary satellite observations to determine storm position and polar-orbiting satellite data for input into numerical weather prediction models for the longer-term weather forecasts of 3-7 days. I agree that the Nation faces significant fiscal challenges. Accurate weather forecasts are needed to support decisions of how best to protect life and property of the Nation's citizens and businesses and to avoid unnecessary expenditures for weather events that never materialize such as evacuating vulnerable populations for an event that did not warrant such an action.

Specific for tornado forecasting, Suomi NPP and JPSS capabilities will provide improvements over current capabilities in the 3-5 day prediction of the overall weather patterns that can lead to tornadoes. Three to five day forecasts are useful for Federal and State Emergency Managers and

communities to prepare and remain vigilant. Due to the higher resolution of JPSS imagery, these images of opportunity complement geostationary imagery to provide critical details of developing storm systems that may not be seen by radar due to coverage gaps or terrain masking. With respect to hurricane forecasting, since most hurricanes originate in the tropics and over the oceans, output from global models and supporting global observations are necessary to forecast hurricane track. Suomi NPP (and JPSS) data are of particular value in providing atmospheric data for the computer forecast models as well as identifying areas of warm sea surface temperature, critical to determining the potential strengthening or weakening of hurricanes and other tropical systems.

Question 2: Are there any forecasting tools that could temporarily offset any gaps in coverage for weather forecasting that would result from delays or changes to the JPSS program?

Response 2:
There are no forecasting tools that are able to mitigate the loss of satellite data. Satellites are a critical part of the observing system that feeds information to forecast models and provides timely real-time observations for forecasters. To carry out its operational mission, NOAA must maintain a comprehensive and integrated operational observing system, with near-100 percent reliability, available 24 hours a day and 365 days a year.

NOAA satellites provide both global coverage (polar-orbiting) and constant viewing (geostationary) of U.S. geographical areas. Polar-orbiting satellites are a critical part of the global observing system. Their information enables global weather forecasts by providing observations over oceanic areas and at high altitudes not covered by other observing systems. Global forecasts are necessary to generate regional forecasts used by the Nation's Weather Enterprise, including National Weather Service (NWS) operations, Department of Defense (DoD) and other Government agencies, commercial users, climatologists and University and environmental research communities.

Other critical components of the forecast system are operational computational capabilities and implementation of advanced scientific techniques, which depend on available operational computer capability. Advanced data assimilation techniques can extract more information from available observations. The operational forecast system performs only as well as its weakest link, so a balance between observations, computational capability, and capability for advanced scientific techniques is critical for success.

Question 2a: If full and long-term funding were to be provided to the program, how certain would you be that there would be no such gaps in coverage?

Response 2a:
NOAA and NASA are analyzing the impact of receiving the FY 2012 appropriation of $924 million for the JPSS Program. At this level of funding, NOAA is able to work with NASA on ramping up the contractual efforts in order to support a launch of the JPSS-1 satellite in FY 2017.

June 7, 2012

The shortage of FY 2011 funding resulted in delays to the program such that there is now a high likelihood of a gap beginning in 2016, the projected end of life for the Suomi NPP mission. With the $924 million appropriated to JPSS in FY 2012, the program currently plans to launch JPSS-1 in the second quarter of FY 2017. Stable and long-term funding is needed to prevent further delays to the launch schedule and to minimize the duration of any gaps in coverage.

Question 3: What alternatives has NOAA investigated to lower potential costs?

Response 3:
NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) has tasked all of its programs to develop a strategy for acquiring data from foreign satellite providers, when feasible, to support NESDIS program and policy objectives. NOAA is also working with international partners to mitigate costs. For example, NOAA and EUMETSAT are working on ways to reduce costs through cooperating on our respective polar orbiting satellite programs, JPSS and EPS 2nd Generation. Additionally, NOAA is working with the Japan Aerospace Exploration Agency (JAXA) to acquire and process data from its Global Change Observation Mission (GCOM). The cooperation with EUMETSAT and JAXA alleviates the need for NOAA to fund and develop its own instruments to obtain these data. However, these partnerships cannot fully replace all the data received from NOAA's polar-orbiting satellites in the afternoon orbit.

Question 3a: Have you explored options for private and commercial interests to get involved with the program?

Response 3a:
Yes, NOAA has investigated commercial industry's ability to meet our needs to potentially lower the cost of acquiring the data needed to support NOAA's requirements. Alternatives we looked at were commercial data purchase, hosting government sensors on commercial satellites, and commercial launches. For example, NOAA is looking for potential commercial options to launch and host the TSIS FM1 instrument that is currently under development.

As described in the Report to Congress referenced earlier, NOAA purchases data from commercial sources to meet specific needs in order to accomplish its mission. An example of such data purchases are the multi-year data buys from GeoEye for SeaWiFS data, up until the system ended useful service, to support monitoring coastal ecosystems and coral reef health, and monitoring and predicting harmful algal blooms. In addition, NOAA purchases high resolution data to support its coral reef and coastal mapping mission, and synthetic aperture data to support its sea ice monitoring mission to ensure safe maritime navigation.

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

Questions Submitted by Chairman Paul Broun, Subcommittee on Investigations & Oversight and Chairman Andy Harris, Subcommittee on Energy & Environment

Q1. Please describe, in detail, the differences between NPP and JPSS-1?

- *How much did NPP cost?*

A. The estimated life cycle cost to NASA for NPP is $895 million. In addition, the NPOESS program provided three instruments that are estimated to cost $656 million, excluding the non-recurring development costs from the NPOESS program.

The total estimated cost of the NPP satellite, including launch, is $1551 million.

- *How much will JPSS cost?*

A. NASA establishes a cost baseline for programs and projects at Key Decision Point (KDP) C, which follows the Preliminary Design Review (PDR). PDR for JPSS-1 is scheduled for December 2012, with KDP C following in January. At that point a formal baseline will be established for the ground and flight elements required for the JPSS-1 mission. NOAA will provide the formal baseline to Congress after the KDP C.

- *What are the differences in performance characteristics?*

A. The NPP and JPSS-1 satellites are very similar in design. As such, we expect their performance to be comparable except for JPSS-1's improved reliability over NPP arising from NASA and NOAA's experience gained from NPP, allowing the agencies to correct issues in design, manufacturing, and test processes.

Though the NPP and JPSS-1 spacecraft buses are largely alike, there are some significant differences:

- JPSS-1 has a Ka-band communications link (in addition to an X-band communications link) to broadcast the mission data to the JPSS Ground System. This communication link makes the spacecraft compatible with the Ground System's worldwide receptor network to shorten the amount of time between data collection and subsequent transmission to the users.
- JPSS-1 has an operational life of seven years versus NPP's five years in order to meet NOAA's Level 1 requirements.
- NASA is building JPSS-1 to NASA mission class B standards versus NPP's class C. The Class B standards have more stringent mission assurance standards in order to improve the spacecraft reliability and lifetime.
- JPSS-1 has many changes to address obsolescence from the time that NPP was built a decade ago. These changes include newer solar array and battery technology, and product line updates to the Spacecraft computer, GPS receiver, and inertial reference sensor.

Significant differences between the NPP and JPSS-1 instruments are:

- NPP has two Ozone Mapping and Profiler Suite (OMPS) sensors: one viewing Earth nadir and the other viewing the Earth limb. JPSS-1 has only the nadir sensor per the Nunn-McCurdy NPOESS descope review decision.
- There were many small to medium changes made to the JPSS-1 instruments to address issues identified during the build and test of the NPP instruments. These include changes to improve reliability (e.g., cuts and jumpers eliminated from circuit cards, static-sensitive parts replaced, launch lock thermal tolerance increased), to improve manufacturability (e.g., brazed joint structure changed to single piece structure), and to correct performance waivers (e.g., eliminating optical crosstalk, improving calibration target for better accuracy, reducing electromagnetic sensitivity).

Q2. How are management decisions made between NOAA, NASA Headquarters, and the Goddard Space Flight Center?

A2. NASA and NOAA have been partners for more than 40 years in developing the United States' polar and geosynchronous weather satellites. With the President's direction last year to restructure the National Polar-orbiting Operational Environmental Satellite System (NPOESS), NASA and NOAA have returned to this successful partnership structure, with NOAA maintaining overall responsibility of the JPSS

program and NASA providing technical expertise and serving as the program acquisition agent.

NASA and NOAA use the NASA Program and Project Management Processes and Requirements, NPR 7120.5, as the framework for managing JPSS. The relative roles between NASA Headquarters and GSFC are the same under JPSS as under typical NASA Science missions, while the headquarters functions are managed cooperatively between NASA and NOAA. NASA and NOAA co-chair both of the decision-making boards (Science Directorate Program Management Council and Agency Program Management Council) required to approve readiness to proceed at each of the Key Decision Point milestones. Both NASA and NOAA sign and control the Level 1 Requirements Document, which defines the requirements for the program, and the Program Plan/Management Control Plan, which defines how the program operates. The ultimate decision authority for the program lies with NOAA.

- Does a management control document between NOAA and NASA exist for the JPSS program? If so, please provide a copy.

The Program Plan/Management Control Plan for JPSS will define the working relationships between NOAA and NASA, and between NASA Headquarters and Goddard Space Flight Center. This document is currently undergoing final review and NOAA will provide it once complete.

Q3. How much did The Visible Infrared Imager Radiometer Suite (VIIRS) cost for the NPP satellite?

A3. Since NOAA's NPOESS program developed the VIIRS instrument flown on NPP, NASA defers to NOAA on this question.

- How much will the VIIRS instrument cost for JPSS-1?

The KDP C, which will establish the project's formal baseline, is scheduled for January 2013. NOAA will provide the formal baseline to Congress after the KDP C.

Q4. Does all of the funding for NASA's work on the JPSS program come directly from NOAA? If NASA provides funding for JPSS, please indicate the amount and what budget line it comes from.

A4. All the funding for NASA's work on JPSS comes from NOAA. JPSS is a fully reimbursable program, similar to GOES-R and the earlier POES weather program. NOAA funds the work performed by NASA Centers in support of these programs. NASA Headquarters has one full-time Program Executive for JPSS and varying portions of senior management providing oversight of the Center activities, which are funded by NASA's Agency Management and Operations budget.

Q5. How many Federal employees and contractors at NASA are involved in the JPSS program?

A5. Currently there are 75 civil servants and 137 support contractors involved in JPSS. We expect to increase to 111 civil servants and 204 support contractors in FY12, assuming full funding of the FY12 budget.

Q6. Reassigned to NOAA

Q7. How does the JPSS acquisition model for NOAA compare to the acquisition model used by NASA to procure Landsat imagery satellites for the Department of the Interior?

A7. NASA has developed both the operational weather satellites for NOAA and the Landsat satellites for the Department of the Interior (DOI) for more than 40 years. Historically, the weather satellites have been developed for NOAA under reimbursable agreements. On the other hand, NASA has developed Landsat satellites, including the now in-development Landsat Data Continuity Mission (LDCM)/Landsat 8, within the NASA appropriation and then transferred operations to USGS. With the President's FY 2012 budget request, NASA and DOI have proposed to develop Landsat 9 on a reimbursable basis similar to our successful historical approach with NOAA weather satellites. This both aligns ownership of the mission requirements and funding within the sponsoring agency and allows NASA to act as the acquisition agent for DOI.

Questions Submitted by Ranking Member Brad Miller, Subcommittee on Energy & Environment

Q1. The NPOESS program had a history of cost over-runs and schedule delays that continued up to the day it was ended. How is NASA managing development of the JPSS flight and ground elements differently to reduce the likelihood of continued over-runs and delays?

A1. NPOESS had a complicated management structure. While NOAA and DoD have similar weather system requirements, they differ in some areas, which made designing a single system for both uses a challenge. Additionally, NASA served as a third independent partner. The NPOESS prime contractor was responsible for development of all the instruments, ground system and spacecraft, and acted as the system integrator for all of these elements. Government oversight of the individual elements under development was limited. The Program Office for NPOESS was located in Silver Spring, MD, rather than in a spacecraft acquisition center and therefore lacked the proper personnel, processes and experience.

For the JPSS program, NASA is the acquisition agent for a single customer, NOAA, with clearly defined priorities. NASA is acting as the system integrator and is contracting with each of the instrument, ground and spacecraft providers directly, allowing for rigorous technical and financial government oversight of each element. NASA has located the JPSS Program Office at Goddard Space Flight Center, which is NASA's primary acquisition center for Earth-observing spacecraft and thus has the relevant expertise. This structure builds on the successful partnership between NASA and NOAA for the previous polar and geosynchronous weather satellites.

In establishing the JPSS program, we have reduced the number of government organizations with decision authority over NOAA's primary afternoon orbit requirements and eliminated layers of management between the Program and the contractor as it affects this orbit. These changes simplify priority-setting, decision-making, and accountability.

The JPSS program has simplified the satellite architecture to use a smaller spacecraft bus based on a commercial platform, eliminating much of the risk of the new development in the NPOESS C1 spacecraft. The program has also undertaken a review of instrument and spacecraft spare hardware, and is making plans to procure critical and long-lead spare items to reduce the impact in the event of a hardware failure during development.

NASA and NOAA have also established an independent Standing Review Board that will chair major reviews for JPSS starting in FY 2012, providing an independent assessment of the management and progress of the JPSS program to NASA and NOAA management.

Q2. The NPOESS Program had a complicated executive and program management structure. Explain how the JPSS executive and program management structure is different, and why it will be more effective.

A2. NOAA is the only organization providing strategic direction for the JPSS program, whereas three different agencies each provided strategic direction for NPOESS. Decision-making is not stymied because of conflicting priorities or budgeting strategies. NASA has established a new Joint Agency Satellite Division (JASD) within the Science Mission Directorate at Headquarters to manage all of the NOAA satellite developments within NASA. JASD has ready access to all of NASA senior management, providing quick resolution to any issues as they develop.

Areas of authority are also clearly delineated. NOAA provides the interface with the user community and international partners and gives direction to NASA, which provides the acquisition and technical expertise to oversee the instrument, spacecraft, and ground system contracts. Under the NPOESS program, the prime contractor had direct control of the instrument and ground system development, which allowed few opportunities for the government to provide input and direction. Under JPSS, there is more program and acquisition oversight by the government on instrument and ground system development, since NASA has direct management of these contracts. NASA and NOAA report to the NOAA/NASA Agency Program Management Council (PMC) every month. NOAA co-chairs this council with NASA, and NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) has a monthly Management Status Review with NASA to ensure the project stays on track.

Q3. The NPOESS instruments scheduled to fly on NPP have been described as less than perfect. How is NASA managing development of the instrument differently to ensure performance meets requirements?

A3. The new JPSS Program assigned program management to GSFC, which has extensive experience in managing flight projects and developing instruments. GSFC has a large, competent staff of engineers who have knowledge and experience in all aspects of instrument development. GSFC also has unique test and analysis facilities that support instrument development.

GSFC has recruited and assigned personnel with extensive experience in the development of spaceflight instruments to manage the instruments. The Flight Project Instrument Management and Systems Engineering team includes senior personnel with a successful history in developing instruments for GOES, HST, SDO, TRMM, EOS, and Landsat. In addition, we have stationed government engineering and mission assurance personnel in the contractor's VIIRS, CrIS, OMPS, and ATMS facilities to oversee and guide instrument development.

As part of the transition from NPOESS, the JPSS team completed a review of all instrument anomalies, concerns, waivers, and risks associated with the NPP instruments. We worked methodically through these issues, determining which were relevant to the JPSS instruments, assessing the consequence of each, and determining the options to address or mitigate the issues. As a result of this process, approximately two-thirds of the issues from the NPP instruments have been eliminated for the JPSS instruments. Plans are underway to determine how to further reduce the risk of the remaining issues, and we expect many of them will be retired at the time of the launch, leading to improved performance and reliability of the JPSS-1 mission. Further improvements are already planned for the JPSS-2 instruments.

The JPSS team has also conducted an extensive review of how well the instruments comply with NASA spaceflight engineering and mission assurance guidelines. Through a gap analysis process, we have identified differences between the previous processes used for instrument development and what the NASA standards recommend. We are also working methodically through this gap analysis to determine how best to address the differences. We have developed an Instrument Mission Assurance Requirements (IMAR) document that will be applicable to all future hardware builds. This IMAR will ensure that future developments use NASA-approved electronic parts, materials, and workmanship standards. It will dictate when government inspections are required. It also ensures that the instrument contractors have a robust mission assurance program with appropriate government insight. JPSS is also analyzing the instrument test programs to determine their compliance with NASA environmental verification and test standards; changes are now being implemented to make the instrument thermal-vacuum and electro-magnetic compatibility test programs more robust and bring them in line with NASA standards.

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

Questions Submitted by Chairman Paul Broun, Subcommittee on Investigations & Oversight and Chairman Andy Harris, Subcommittee on Energy & Environment

Q1. Has NOAA satisfied GAO's inquiries concerning the new structure, budgets and timeline for the JPSS program?

A1. Although the JPSS management control plan—which will likely describe the structure of the program—has been in development for about 21 months, it has not yet been signed, and neither NOAA nor NASA could provide a firm time frame for its completion. The JPSS cost and schedule baseline is still under development; thus, the expected cost of the JPSS program, and its anticipated launch dates, have not yet been finalized. The JPSS program estimates that its program baseline will be completed no earlier than July 2012.

Questions Submitted by Representative Randy Neugebauer

Q2. With such unreliable financial projections, I find it hard to justify spending seemingly unknown amounts of money that we don't have for the JPSS program. Given our nation's financial situation, with over $14 trillion in debt, how can we justify continuing to throw money at a program that has historically not proved to be a wise or effective steward of taxpayer dollars?

A2. NOAA plans for the JPSS program to provide weather and climate data continuity in the afternoon orbit. According to NOAA, a gap in these data would lead to less accurate and timely weather prediction models used to support weather forecasting; and advanced warning of extreme events—such as hurricanes, storm surges, and floods—would be diminished. The agency reported that this could place lives, property, and critical infrastructure in danger. However, because NOAA has not yet established a cost or schedule baseline for JPSS, it is not yet clear what will be delivered, by when, and at what cost. In May 2010, we recommended that NOAA expedite decisions on the expected cost, schedule, and capabilities of its planned satellite program. The JPSS program estimates that its program baseline will be completed no earlier than July 2012.

Appendix II:

Additional Material for the Record

ADDITIONAL MATERIAL FOR THE RECORD: "NASA'S MANAGEMENT OF THE NPOESS PREPARATORY PROJECT," NASA'S OFFICE OF INSPECTOR GENERAL

JUNE 2, 2011

AUDIT REPORT

OFFICE OF AUDITS

NASA'S MANAGEMENT OF THE NPOESS PREPARATORY PROJECT

OFFICE OF INSPECTOR GENERAL

National Aeronautics and Space Administration

REPORT NO. IG-11-018 (ASSIGNMENT NO. A-10-012-00)

Final report released by:

Paul K. Martin
Inspector General

Acronyms

ATMS	Advanced Technology Microwave Sounder
CERES	Clouds and the Earth's Radiant Energy System
CrIS	Crosstrack Infrared Sounder
DMSP	Defense Meteorological Satellite Program
DOD	Department of Defense
DWSS	Defense Weather Satellite System
FY	Fiscal Year
GAO	Government Accountability Office
GOES	Geostationary Operational Environmental Satellites
GRAIL	Gravity Recovery and Interior Laboratory
IPO	Integrated Program Office
JPSS	Joint Polar Satellite System
MMS	Magnetospheric Multiscale
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Project
NPR	NASA Procedural Requirements
OMPS	Ozone Mapping and Profiler Suite
POES	Polar-orbiting Operational Environmental Satellite
PPBE	Planning, Programming, Budgeting, and Execution
VIIRS	Visible Infrared Imaging Radiometer Suite

OVERVIEW

NASA'S MANAGEMENT OF THE NPOESS PREPARATORY PROJECT

The Issue

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) Program, considered a national priority essential to meeting civilian and military weather forecasting, storm tracking, and climate monitoring requirements, was created in May 1994. The NPOESS Preparatory Project (NPP) was conceived as a risk reduction mission, providing an opportunity to demonstrate and validate new instruments; processing algorithms; and command, control, communications, and ground processing capabilities prior to launching the first of six planned NPOESS satellites. The NPP satellite was designed to carry the same instruments as NPOESS and to measure such properties as atmospheric and sea surface temperatures, humidity, land and ocean biological productivity, and cloud properties.

To manage the NPOESS Program a tri-agency Integrated Program Office (IPO) was formed and staffed by the Department of Defense (DOD), the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), and NASA. In 1999, NASA entered into an Initial Implementation Agreement with the IPO to jointly develop and manage NPP for the benefit of all involved organizations. The Final Implementation Agreement, executed in September 2004, stipulates that the individual agencies are responsible for the funding, management, and development of specific portions of NPP on a "no exchange of funds basis."[1] Because of this stipulation, each partner is responsible for all costs incurred for the mission segments under its area of responsibility.

Originally, the NPP satellite was to launch in 2006, providing NASA a platform for continuing its collection of global climatology data and creating a bridge between the NASA Earth Observing System's Terra and Aqua satellites – launched in 1999 and 2002, respectively, and designed with 6-year life spans – and the NPOESS satellites.[2] NPP's launch has now slipped to October 2011.

[1] The Initial Implementation Agreement identified partner responsibilities for the formulation phase of the effort. The Final Implementation Agreement addressed the implementation phase. A copy of the Final Implementation Agreement, effective September 17, 2004, is in Appendix B.

[2] On December 18, 1999, NASA launched Terra to begin collecting a new 18-year global data set on which to base future scientific investigations about Earth. On May 4, 2002, NASA launched Aqua to measure variables of the Earth's water cycle involving water's liquid, solid, and vapor forms. Terra and Aqua continue to operate, exceeding their designed 6-year operational life spans.

On February 1, 2010, NPOESS cost overruns and schedule delays led to a White House decision to dissolve and restructure the overarching Program. To preserve the critical operational weather and climate satellite system, NPOESS was divided into the NASA-NOAA Joint Polar Satellite System (JPSS) and the Defense Weather Satellite System (DWSS). Following the restructuring of the NPOESS Program, the value of NPP to assure continuity of essential weather and climate measurements significantly increased in importance.

We initiated this audit to determine how well NASA managed NPP to accomplish its technological objectives, meet its schedule milestones, and control costs. We also evaluated whether NPP management identified, reported, and mitigated risks. Details of the audit scope and methodology are in Appendix A.

Results

Although NASA met its schedule and technical requirements for producing the NPP spacecraft and the instruments for which it was responsible, the other IPO partners were unable to deliver their three scientific instruments to NASA in a timely manner. As a result, NPP has experienced a 5-year launch delay and a 54 percent increase in costs. Originally planned for an October 2006 launch with a life-cycle cost of $560 million, NPP is currently scheduled to launch in October 2011, and the life-cycle cost estimate has grown to $864 million.[3] Due to these delays, NASA incurred an additional $304 million in associated costs – money that could have been used for other NASA projects had NPP launched in 2006. Moreover, if the NPP launch is delayed to February 2012 – the next available launch window due to launch facility scheduling – the Project will sustain additional launch services and support costs (for example, maintaining personnel) of about $35 million. Finally, because of technical issues encountered during development and testing, NPP management is concerned that the instruments provided by the IPO may not continue to operate throughout the planned 5-year mission.

Despite Effective Project Management, NPP Costs Continue to Grow. We found that NASA had implemented sound project management principles in carrying out its NPP responsibilities. Specifically, NASA management delivered the spacecraft and the instruments for which it had responsibility on schedule and within established milestones.[4] NASA's responsibilities for NPP include providing the spacecraft and the Advanced Technology Microwave Sounder (ATMS), integrating all instruments onto the spacecraft, and providing and managing launch services.[5] Responsibilities assigned to

[3] The life-cycle costs and other costs cited throughout the report are costs to NASA and do not include DOD or NOAA costs.

[4] This report uses the terms spacecraft and satellite interchangeably to refer to NPP.

[5] Following the Nunn-McCurdy Certification of NPOESS in June 2006, NASA and NOAA recommended in a joint whitepaper that the Clouds and the Earth's Radiant Energy System (CERES) instrument that NASA built for the first NPOESS satellite be moved onto NPP to provide continuity of coverage with identical instruments on Terra and Aqua.

the IPO included providing the Crosstrack Infrared Sounder (CrIS), the Visible Infrared Imaging Radiometer Suite (VIIRS), and the Ozone Mapping and Profiler Suite (OMPS).

Due to the late delivery of instruments from the IPO, NASA project managers were confronted with unanticipated delays that caused the Agency to expend approximately $304 million that could have been used for other projects had the instruments been delivered on time and the 2006 launch date met. Moreover, the late deliveries of IPO instruments have compressed final system integration and testing activities and could delay the October 2011 launch, further increasing the launch services and support costs NASA is responsible for funding. In addition, NPP is the last of three remaining missions scheduled to launch on a Delta II launch vehicle.[6] These three missions currently share Delta II maintenance and facility costs. However, these recurring costs will be borne solely by NPP if, as expected, the other two missions proceed on schedule and NPP's launch is further delayed.

Moreover, in addition to risk reduction for NPOESS, NPP was intended to fill a gap between the expected operational life of NASA's Earth Observing System and the launch of NPOESS, thereby assuring continuity in the collection of essential weather and climate data. However, this aspect of NPP's mission could be compromised by further launch delays if NASA's Terra or Aqua satellites fail. In addition, NPP management is concerned that the operational life of the instruments supplied by the IPO may be reduced to 3 years from the original design expectation of 7 years due to the challenges the IPO encountered in their development.

Finally, because the Final Implementation Agreement between NASA, the IPO, and NOAA was executed on a "no exchange of funds" basis, each partner is responsible for all costs incurred for the mission segments assigned to it. Accordingly, NASA had to absorb the costs caused by the late delivery of instruments from the IPO. Although NASA identified late delivery of instruments by the IPO as a likely and significant risk to NPP's cost and schedule as early as January 2005, it did not seek to modify the Agreement to hold the IPO accountable for the delay costs, believing that doing so would be inconsistent with the collaborative intent of the Agreement and would only serve to further delay the Project.

Management Action

We recommended that when assessing future collaborative efforts with external partners, the Associate Administrator for the Science Mission Directorate carefully consider the technical and oversight capabilities of partner agencies and the risks associated with

[6] The other two missions are the Gravity Recovery and Interior Laboratory (GRAIL) and Aquarius. GRAIL is designed to fly two spacecraft in tandem orbits around the Moon in order to measure its gravity field. Aquarius intends to provide the first-ever global maps of salt concentrations in the ocean surface needed to understand heat transport and storage in the ocean.

agreements executed on a "no exchange of funds" basis. If a decision is made to move forward with such an agreement, NASA should ensure that its budget includes reserve levels commensurate with the associated risk.

In response to a draft of this report, the Associate Administrator for the Science Mission Directorate concurred with our recommendations and stated that the Directorate will seek to structure future partnerships to align responsibilities with technical expertise and acquisition capability while exploring reimbursable funding arrangements or a means to secure timely delivery of critical project components. In addition, the Associate Administrator stated that in partnerships executed on a "no exchange of funds" basis, NASA will track the programmatic risks and adjust reserves accordingly (see Appendix C for full Agency response).

We consider the Associate Administrator's comments to be responsive to our recommendations. The recommendations are resolved and closed.

CONTENTS

INTRODUCTION
Background 1
Objectives 7

RESULTS
NPP Has Been Adversely Impacted by Factors Outside NASA's Control 8

APPENDIX A
Scope and Methodology 15
Review of Internal Controls 17
Prior Coverage 17

APPENDIX B
Final Implementation Agreement 18

APPENDIX C
Management Comments 26

APPENDIX D
Report Distribution 28

INTRODUCTION

Background

History of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) and the NPOESS Preparatory Project (NPP). Polar-orbiting satellites provide data and imagery for weather forecasters, climatologists, academics, Government agencies, and the military to map and monitor changes in weather, climate, the oceans, and the environment. Since the 1960s, the United States has operated two polar-orbiting meteorological satellite systems: the Polar-orbiting Operational Environmental Satellite (POES) series, managed by the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), and the Defense Meteorological Satellite Program (DMSP), managed by the Department of Defense (DOD). Currently, one POES and two DMSP satellites are positioned to observe Earth in early morning, midmorning, and early afternoon polar orbits.[7]

With the expectation that combining the NOAA and DOD programs would reduce duplication and result in significant cost savings, in May 1994 President Clinton directed NOAA and DOD to merge the two satellite programs into a single program capable of satisfying both civilian and military requirements.[8] This combined system, known as NPOESS, was considered critical to the United States' ability to maintain the data continuity required for weather forecasting and global climate monitoring.

To manage the NPOESS Program, a tri-agency Integrated Program Office (IPO) was formed consisting of NOAA, DOD, and NASA personnel. Each agency was assigned lead responsibility for specific aspects of the NPOESS Program: NOAA for management of the merged system and satellite operations; DOD, through the Air Force, for providing the majority of the acquisition personnel and acquisition infrastructure; and NASA for facilitating development and incorporation of new technologies into the merged system.

NPP was conceived in 1998 as a risk reduction mission for the larger NPOESS Program. The NPP satellite was designed to carry several NPOESS instruments and provide the NPOESS Program with an opportunity to demonstrate and validate those instruments; processing algorithms; and command, control, communications, and ground processing capabilities prior to the first NPOESS satellite launch. In addition, launch of the NPP satellite would assure continuity of key climate measurements between the end of the

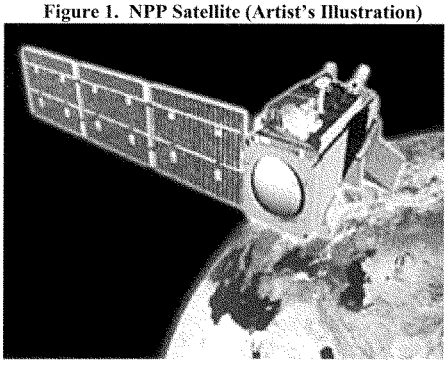
[7] The satellites are in a sun-synchronous polar orbit, which means that they pass over their targets on Earth at roughly the same local time. For example, if a morning satellite flies over Washington, D.C., at 6 a.m. Eastern time, then roughly 3 hours later it will fly over California at 6 a m. Pacific time, and later that day over Tokyo at 6 a.m. Japan Standard Time.

[8] Presidential Decision Directive/NSTC-2, May 10, 1994.

expected operational life of two existing NASA Earth-observing satellites, Terra and Aqua, and the first operational NPOESS satellite.[9]

In November 2003, NPP was baselined at a life-cycle cost of $560 million with an expected launch date of October 31, 2006. Since that time, the Project has been rebaselined two times, with a current life-cycle cost estimate of $864 million and a launch date of October 2011.[10]

Figure 1. NPP Satellite (Artist's Illustration)



Source: NASA Release No. 08-98, "Mission Operations Readiness Review for NPOESS Preparatory Project Completed," December 16, 2008, available online at http://www.nasa.gov/topics/earth/features/NPOESS_prep_project.html (accessed May 5, 2011).

During the period NPP was being planned and developed, the larger NPOESS Program experienced significant cost overruns and delays. By September 2005, the Program had exceeded its baseline by more than 15 percent, and again in January 2006 by more than 25 percent. As required by law, the Program formally notified Congress of these increases.[11] As a result of these cost overruns, in June 2006 the Under Secretary of Defense for Acquisition, Technology and Logistics reduced the scale of NPOESS from six to four satellites.

[9] NASA launched Terra on December 18, 1999, to begin collecting a global data set for future scientific investigations of Earth's climate. NASA launched Aqua on May 4, 2002, to measure variables of the Earth's water cycle. Terra and Aqua were designed with expected operational lives of 6 years. Both have exceeded these expectations and were still operating as of May 2011.

[10] The life-cycle costs and other costs cited throughout the report are costs to NASA and do not include DOD or NOAA costs.

[11] The Department of Defense Authorization Act for Fiscal Year 1983 (Public Law 97-252) requires congressional notification if a program's costs increase by more than 15 percent.

Over the next 3 years, NPOESS experienced additional cost and schedule slippage. Because of expected delays in the launch of NPOESS satellites, in March 2009, the NPOESS Program Executive Committee elevated NPP from a "risk reduction mission" to a "critical operational mission," meaning that the data will be used by the scientific community for numerous weather prediction models.

In June 2009, an Independent Review Team concluded that without significant managerial and funding adjustments, the NPOESS Program was unlikely to succeed and that, accordingly, there was an extreme risk to continuity of climate and weather data.[12] On February 1, 2010, President Obama announced the dissolution and restructuring of NPOESS into the Joint Polar Satellite System (JPSS) and the Defense Weather Satellite System (DWSS).

The following is a timeline of significant events in the development of NPP.

- **May 1994** – Presidential Decision Directive creating NPOESS.
- **May 1995** – NASA, NOAA, and DOD sign Memorandum of Agreement for NPOESS, which allows for a NASA research satellite to test NPOESS instruments.
- **August 1998** – The NASA Office of Earth Science reviews options for a satellite to follow the Terra and Aqua missions and serve as a demonstration satellite for NPOESS.[13]
- **November 1999** – NASA and the IPO sign Initial Implementation Agreement for NPP.
- **November 2003** – NPP is baselined at $560 million with a launch date of October 31, 2006.
- **September 2004** – NASA, IPO, and NOAA execute the Final Implementation Agreement for NPP.
- **January 2006** – NPOESS costs increase in excess of 25 percent leading to a reduction in the scale of the Program.
- **June 2006** – As a result of changes and delays associated with NPOESS, NPP's October 2006 launch date is postponed to a date "to be determined."

[12] NPOESS Independent Review Team, Final Report, June 1, 2009, available at http://democrats.science.house.gov/Media/file/Commdocs/hearings/2009/Oversight/17jun/IRT_NPOESS_report.pdf (last accessed May 3, 2011).

[13] On August 1, 2004, NASA merged the Offices of Earth Science and Space Science to form the Science Mission Directorate.

- **February 2008** – NPP receives its first official rebaseline to a cost of $803 million and a June 2010 launch date.
- **March 2009** – The Program Executive Committee for NPOESS decides that NPP, rather than serving as a demonstration as originally planned, will provide data for operational use.
- **June 2009** – An Independent Review Team concludes that the NPOESS Program has an extraordinarily low probability of success and that continuity of data collection is at significant risk.
- **February 2010** – The President announces the dissolution and restructuring of NPOESS into JPSS and DWSS.
- **May 2010** – The launch date for NPP is set for October 25, 2011, with a life-cycle cost of $864 million.
- **January 2011** – NASA's Science Mission Directorate's Program Management Council reviews NPP and reaffirms the $864 million life-cycle cost and the October 25, 2011, launch date established in May 2010.

Management of NPP. Responsibility for the development of NPP's instruments is divided between NASA and the IPO. As originally planned, NASA was responsible for providing one instrument – the Advanced Technology Microwave Sounder (ATMS) – the spacecraft, integrating the instruments provided by the IPO onto the spacecraft, and providing and managing launch services. The IPO was responsible for developing and delivering to NASA three instruments: the Crosstrack Infrared Sounder (CrIS), the Visible Infrared Imaging Radiometer Suite (VIIRS), and the Ozone Mapping and Profiler Suite (OMPS).[14] Under the 2006 launch schedule, the IPO was to deliver these instruments to NASA by February 2005.

The Final Implementation Agreement between NASA and its NPP partners, executed in September 2004, stipulates that the individual agencies are responsible for the funding, management, and development of the portions of NPP assigned to them on a "no exchange of funds basis."[15] Because of this stipulation, each partner is responsible for all costs incurred for the mission segments under its area of responsibility.

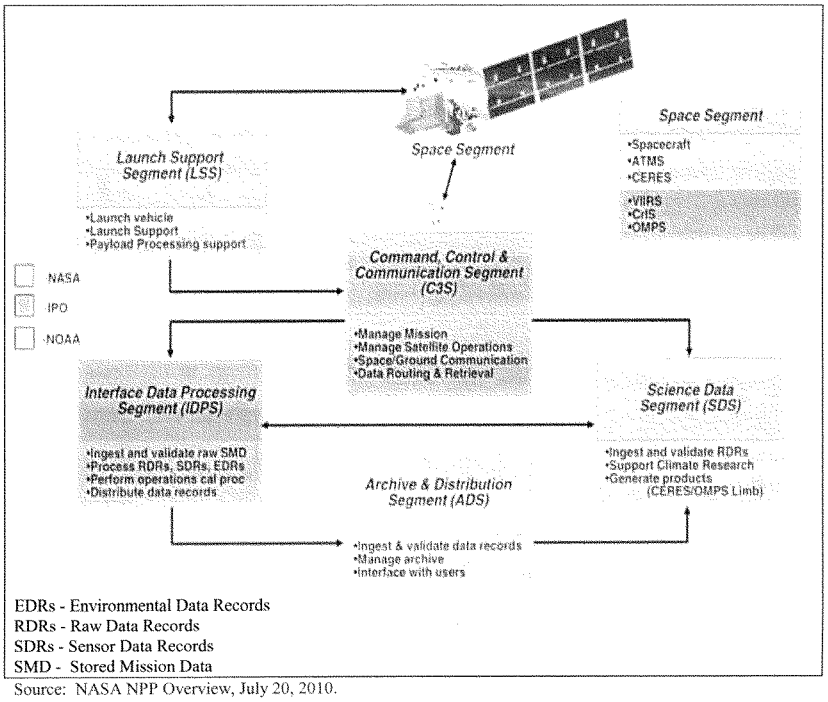
The NPP spacecraft platform was built for NASA by Ball Aerospace Technology Corporation (Ball Aerospace) under a fixed-price contract for $189.1 million and the ATMS by Northrop Grumman Aerospace Systems (Northrop Grumman) pursuant to a $197 million cost-plus-award-fee contract. In 2008, NASA added a sensor and an

[14] The OMPS consists of a Limb Sensor, a Nadir Sensor, and a Main Electrical Box.

[15] The Final Implementation Agreement is reproduced in Appendix B.

additional instrument – the Clouds and the Earth's Radiant Energy System (CERES) – to its portion of NPP. The CERES instrument was built for NASA by Northrop Grumman unrelated to NPP and had been in storage since 1999. NASA prepared CERES for flight on the NPP satellite at a cost of approximately $19 million.[16] The NPP spacecraft, instruments, and partner responsibilities are illustrated in Figure 2.

Figure 2. NPP Mission Segments and Responsibilities



Source: NASA NPP Overview, July 20, 2010.

NPP was initially baselined in November 2003 with a life-cycle cost estimate of $560 million and a launch date of October 31, 2006. Due to late delivery of instruments from the IPO, NPP was rebaselined in February 2008 to a life-cycle cost estimate of $803 million and a launch date of June 2010 – a 43 percent cost increase and a 3-year schedule delay.

[16] The full cost of CERES was $52.4 million – $27.6 million from NOAA, $19.4 million from NPP, and $5.4 million from the Science Mission Directorate.

NPP was subject to a second rebaseline review in November 2010. On January 21, 2011, the Science Mission Directorate's Program Management Council approved NPP's second rebaseline, with a revised life-cycle cost estimate of $864 million ($61 million increase) and a launch date of October 25, 2011 (additional delay of 2 years). The current project schedule provides for completion of ground system integration and testing 14 days prior to the October 25 launch date. Assuming the Project meets the launch date, NPP will have incurred a 5-year launch delay and a 54 percent overall life-cycle cost increase since the initial Program Commitment Agreement in 2003. Table 1 summarizes the intended and actual delivery dates for the instruments and spacecraft, as well as the rationale for the delays.

Table 1. Instrument Delivery Dates and Rationale for Late Deliveries

Instrument	Provider	Original Delivery Date	Actual Delivery Date	Delay (months)	Rationale
ATMS	NASA	January 2004	October 2005	21	Due to the late delivery of the other instruments, NASA delayed development to phase delivery accordingly.
CrIS	IPO	April 2004	June 2010	74	Multiple failures during vibration testing. Circuit design failures took 1.5 years to resolve.
VIIRS	IPO	September 2004	December 2009	63	Technical failures and design issues.
Spacecraft	NASA	November 2004	June 2005	7	Modifications to the spacecraft from addition of CERES and significant delays with the VIIRS and CrIS.
OMPS	IPO	February 2005	November 2008	45	Suffered from funding issues because of VIIRS and CrIS.
CERES	NASA	October 2008	October 2008	0	Added by NASA to ensure continuity of data collected by Aqua.
Ground System	IPO	March 2006	July 2009	40	System integration and testing identified performance issues, data loss, and inconsistencies in the technical baseline.

NPP is the last mission scheduled to launch aboard a Delta II launch vehicle. If the launch is delayed, the Project could find itself responsible for full costs of maintenance of the Delta II launch facilities and operations, which would cause additional increases to the overall mission cost. If NPP misses the October 2011 launch date and launches in February 2012 (the next available launch date due to launch schedule conflicts), NASA estimates the cost of the Project will increase by approximately $35 million for a total $899.3 million in life-cycle costs.

Objectives

The overall objective of this audit was to determine how well NASA managed NPP to accomplish its technological objectives, meet its schedule milestones, and control costs. We also evaluated whether NPP management identified, reported, and mitigated risks. See Appendix A for details of the audit's scope and methodology, our review of internal controls, and a list of prior coverage.

NPP HAS BEEN ADVERSELY IMPACTED BY FACTORS OUTSIDE NASA'S CONTROL

Although NASA met its schedule and technical requirements for the NPP spacecraft and instruments for which it was responsible, the IPO was unable to deliver its instruments to NASA in a timely manner and the Project therefore experienced significant schedule disruption. As a result, NASA incurred approximately $304 million in additional costs for NPP – money that otherwise would have been available to fund other NASA projects. Because the NPP Final Implementation Agreement was executed on a "no exchange of funds" basis, NASA rather than the IPO absorbed these costs. Moreover, delays and cost overruns suffered by the larger NPOESS Program further increased NASA's costs for NPP, and the resultant restructuring of NPOESS delayed NPP's launch; additional delays could result in a gap in data collection. In addition, because NPP is the last mission scheduled to use a Delta II launch vehicle, delay of the launch beyond October 2011 would result in NASA absorbing additional cost increases for launch services. Finally, the IPO instruments' development challenges may affect the viability of NPP's 5-year mission.

NPP's Development and Launch Was Compromised by the IPO's Late Delivery of Instruments

We determined that NASA took appropriate steps to ensure NPP was on schedule and met technical requirements. Specifically, managers implemented an earned value management system to track the development of ATMS and CERES and, in accordance with NASA requirements, implemented risk management procedures to identify, analyze, track, and communicate associated risks.[17] By November 2005, NASA had completed ATMS, had integrated it onto the spacecraft, and was on schedule for the planned October 2006 launch. However, the IPO failed to deliver its three instruments to NASA for integration by November 2005 as planned. When the IPO still had not delivered the instruments by June 2006, it became apparent to NASA management that an October 2006 launch would not be possible.

To the extent possible, NASA management took steps to mitigate the impact of the IPO delivery delays. Specifically, rather than wait to perform risk reduction tests on the IPO instruments during the integration phase of the Project as originally planned, NASA performed these tests when the individual instruments were delivered to it. The IPO delivered the OMPS Nadir Sensor in November 2008, the VIIRS instrument in January

[17] NASA Procedural Requirements (NPR) 8000.4A, "Agency Risk Management Procedural Requirements," December 16, 2008.

2010, and the CrIS instrument in June 2010, and all instruments had been integrated onto the NPP spacecraft by September 2010.

Final Implementation Agreement Makes Each Partner Responsible for Individual Mission Segments

The Final Implementation Agreement between NASA, the IPO, and NOAA was executed on a "no exchange of funds" basis and does not impose financial liability on a partner that encounters challenges that directly increase costs for another partner. Accordingly, regardless of fault, each partner is responsible for all costs incurred for the mission segments under its area of responsibility.

Under the Agreement, NASA is responsible for the spacecraft, the ATMS instrument, instrument integration, launch support, and the science data segment.[18,19] The IPO is responsible for the CrIS, VIIRS, and OMPS instruments; the command, control, and communications segment; and the interface data processing segment. Technical problems and late delivery of the CrIS and VIIRS instruments and the OMPS Nadir Sensor directly affected NASA, increasing contract costs by $74.7 million and delaying NPP's launch by 5 years. Specifically, NASA incurred an additional $62.6 million in costs under the spacecraft contract with Ball Aerospace and approximately $12 million more under the ATMS contract with Northrop Grumman as a result of late deliveries of the IPO instruments and associated launch delays.

"Article V – Amendment and Termination" of the Final Implementation Agreement provides that the agreement "may be amended at any time upon the mutual consent of the parties." NASA managers responsible for NPP told us that as technical problems and launch delays increased, they discussed with NASA Headquarters officials whether they should seek to amend the Final Implementation Agreement to include language that would make the responsible partners liable for funding the cost of any delays; however, the Agreement was not revised.

When we asked NASA officials why they did not seek to revise the Agreement, they stated that parties enter into this type of agreement in the spirit of collaboration, recognizing that such agreements can produce mutual benefits that would not be possible when working alone. NASA officials said that including language to make partners liable for the cost of delays would be contrary to the collaborative intent of the agreements and could result in a partner's refusal to participate. This, in turn, would have a detrimental impact on NASA's ability to accomplish missions that require effective partnerships to meet shared requirements. Ultimately, NASA Headquarters officials said they did not

[18] The Implementation Agreement did not include the CERES instrument, which was added to the Project in 2008 by NASA.

[19] The science data segment is a research tool for assessing and verifying the quality of NPP data.

pursue an amendment to the NPP Implementation Agreement because the IPO was already expending the majority of its funds on NPP and any effort to recoup the additional delay costs from the IPO would likely have led to additional delays.

We reviewed memorandums of agreement for other NASA partnerships, including NASA's Geostationary Operational Environmental Satellites (GOES and GOES-R) and Aquarius missions to determine whether they included cost-sharing provisions in the event of schedule delays caused by partner organizations.[20] We found that similar to the NPP Implementation Agreement these agreements do not include such provisions.

Delays and Cost Overruns for NPOESS Further Increased NASA's Costs for NPP

By January 2006, the baseline for NPOESS had been exceeded by at least 25 percent. As a result, five sensors originally planned for the NPOESS satellites were eliminated from the NPOESS Program and accordingly from NPP. However, NASA scientists believed that the ozone monitoring capabilities of one of the eliminated sensors – the OMPS Limb Sensor – were critical to NPP's science mission. In addition, another of the eliminated sensors would have collected data relating to the Earth's radiation balance. In order to maintain continuity of this data, NASA decided to include the CERES instrument on the NPP satellite rather than on a later NPOESS flight as had originally been planned. Accordingly, in June 2008 NASA rebaselined NPP to include the OMPS Limb Sensor and the CERES instrument with a launch readiness date of June 2010.

By the fiscal year (FY) 2010 Planning, Programming, Budgeting, and Execution (PPBE) review, the NPP budget had increased by $304 million to $864 million, a 54 percent increase since the 2003 Program Commitment Agreement.[21] We determined that $213 million of this increase is attributable to the IPO's failure to provide instruments in a timely manner. NASA's decision to take responsibility for the OMPS Limb Sensor after it had been eliminated from the NPOESS Program and to add CERES cost NASA an additional $12 million and $19 million, respectively. The remaining approximately $60 million is attributable to improvements and other adjustments NASA made to the Project while it was awaiting delivery of the instruments from the IPO (see Table 2).

[20] GOES and GOES-R collect weather data while Aquarius measures global sea surface salinity.

[21] The PPBE process is a methodology for aligning resources in a comprehensive, disciplined, top-down approach.

Table 2. NPP Cost Increases (in millions, rounded)			
NPP Cost Increases	**Cost at MCR November 2003***	**Increase from MCR to PPBE FY10**	**NPP Total Life-Cycle Cost**
Delay Costs	$ -	$ 212.61	$ 212.61
NASA Costs and Opportunities:			
Ground System Updates	$ 29.70	$ 14.62	$ 44.32
ATMS Improvements	$ 154.50	$ 40.68	$ 195.18
OMPS Limb/Re-Manifest	$ -	$ 12.20	$ 12.20
CERES Addition	$ -	$ 19.38	$ 19.38
Project Support	$ 51.60	$ 25.87	$ 77.47
Spacecraft Updates	$ 137.00	$ 2.28	$ 139.28
Contingency Costs	$ 53.90	$ (35.91)	$ 17.99
Budget Restructures:			
Mission Science Team	$ -	$ 9.07	$ 9.07
General and Administrative; Maintenance and Operations; and Institutional Investments	$ 14.30	$ (2.40)	$ 11.90
Full Cost	$ 41.80	$ 5.96	$ 47.76
Launch Services	$ 77.30	$ (0.13)	$ 77.17
Total	$ 560.10	$ 304.23	$ 864.33

*MCR - Mission Confirmation Review

Source: NPP Deputy Project Manager, Resources

Launch Delay to 2012 Would Increase NPP's Launch Services Costs

NPP will be launched on a Delta II rocket. Currently, only two other missions, Aquarius, planned for launch in June 2011, and the Gravity Recovery and Interior Laboratory (GRAIL), planned for launch in September 2011, are scheduled to use a Delta II launch vehicle before that program is scheduled to be retired. The three missions equally share the post-production support costs and launch services contract costs of the Delta II program through the end of calendar year 2011.[22] In addition, NPP and Aquarius, which will both launch from Vandenberg Air Force Base in California, share launch pad maintenance costs until June 2011.

[22] Post-production support costs ensure that subcontractors with the knowledge and expertise needed to manufacture or repair subcomponents are available if needed.

Both Aquarius and GRAIL are expected to launch on schedule. If NPP does not, the Project will face increased launch costs. Because of a crowded launch schedule in late 2011, if NPP misses its October 2011 launch date, the next possible launch date is February 2012, which will cost NASA about $35 million in additional costs. These costs comprise approximately $4.8 million per month in Project costs (for example, maintaining personnel) for a total of $19.2 million. Moreover, NPP would also bear a portion of the maintenance costs for the Vandenberg Delta II launch pad (approximately $14 million per year), Delta II post-production support costs (approximately $7 million per year), and launch services contract costs (approximately $14 million per year). These additional costs attributed to the launch vehicle and services are estimated to be $15.8 million for a February 2012 launch. If the launch is further delayed, NASA's costs would continue to increase.

Delay in NPP Launch Schedule Could Result in a Gap in Data Continuity

As previously noted, the President announced the restructuring of NPOESS into JPSS and DOD's DWSS on February 1, 2010. With regard to JPSS, NASA acts as the acquisition agent and is responsible for procuring and launching the satellites. NOAA is responsible for operating, collecting, and distributing the data collected by the satellites as well as funding and providing JPSS requirements. To mitigate the risk of a gap in climate data collection between the Terra and Aqua satellites and launch of the JPSS satellites, NPP needs to launch as soon as possible.

However, as part of the restructuring of NPOESS, ground system contracts were to be transferred from the Air Force to JPSS. This caused further delays in delivery of the NPOESS/NPP ground system to NASA for integration. In addition, NASA and NOAA had to work with the Air Force and Northrop Grumman to obtain the instrument and ground system hardware and contracts. In November 2010, the ground system hardware and contracts were transferred to JPSS.

NPP management stated that it typically takes 15 months to perform ground system integration and testing after integration of the last instrument, which for NPP occurred in June 2010. Although in theory this schedule would allow for an October 2011 launch, NPP management told us that they expect to encounter ground system integration issues that may take longer to resolve and that therefore could cause the launch to be delayed beyond October.

Concern that the Quality of the IPO Instruments May Affect the NPP Mission

The IPO was responsible for development and delivery of the CrIS and VIIRS instruments and the OMPS Nadir Sensor. According to NPP management, these instruments were developed in "an undisciplined environment" and experienced technical and structural challenges that compromised their integrity. For example, continuing challenges with development of the VIIRS instrument caused the IPO to turn to the Goddard Space Flight Center for assistance, and the CrIS instrument experienced a broken frame during a vibration test and additional parts were damaged during repair. The potential life expectancy of both VIIRS and CrIS was 7 years, 2 years beyond NPP's planned 5-year mission. However, because of the challenges in development and testing, NPP management has expressed concern that the design life of these instruments could be reduced to 3 years, which would threaten NPP's 5-year mission plan.

Challenges Associated with Collaborations

In 2010, the National Research Council's Committee on Assessment of Impediments to Interagency Collaboration on Space and Earth Science Missions found that "candidate projects for multiagency collaboration in the development and implementation of Earth-observing or space science missions are often intrinsically complex and, therefore costly, and that a multiagency approach to developing these missions typically results in additional complexity and cost."[23] The Committee also found that "advocates of collaboration have sometimes underestimated the difficulties and associated costs and risks of dividing responsibility and accountability between two or more partners; they also discount the possibility that collaboration will increase the risk in meeting performance objectives."

The Government Accountability Office (GAO) has reported on several projects on which NASA experienced challenges with partners not meeting commitments within planned funding levels and established schedules.[24] NPP was specifically cited as one such project. Other NASA projects the GAO discussed included Aquarius and the Magnetospheric Multiscale (MMS). Aquarius experienced delays in development that increased NASA's costs by $35.5 million and extended the launch schedule 23 months. For MMS, a lack of funding for instrument production by an international partner cost NASA $6 million to transfer the work to a domestic partner.

[23] "Assessment of Impediments to Interagency Collaboration on Space and Earth Science Missions," 2010, National Research Council Assessment, available at http://www.nap.edu/catalog.php?record_id=13042#toc (last accessed May 3, 2011).

[24] "NASA: Assessments of Selected Large-Scale Projects" (GAO-11-239SP, March 2011).

Recommendations, Management's Response, and Evaluation of Management's Response

When assessing future collaborative efforts with external partners, we recommend that the Associate Administrator for the Science Mission Directorate take the following actions:

Recommendation 1. Carefully consider the technical and oversight capabilities of partner agencies and the risks associated with agreements executed on a "no exchange of funds" basis.

Management's Response. The Associate Administrator for the Science Mission Directorate concurred with the recommendation and stated that the Directorate will seek to structure future partnerships in a way that aligns responsibilities with both technical expertise and acquisition capability. The Associate Administrator also stated that the Directorate will "studiously avoid other similarly misaligned partnerships" with interagency program offices and explore the use of reimbursable funding arrangements for non-space agency partners that would allow the Directorate to secure timely delivery of critical project components.

Evaluation of Management's Response. Management's proposed actions are responsive; therefore, the recommendation is resolved and closed.

Recommendation 2. If a decision is made to move forward with such an agreement, ensure that the budget includes reserve levels commensurate with the associated risk.

Management's Response. The Associate Administrator for the Science Mission Directorate concurred with the recommendation. However, in his response he commented that a "no exchange of funds" agreement may be the only practical course for agencies that have trouble funding their own deliverables and therefore are likely to have even more trouble funding costs incurred by NASA due to delays on the partners' end. The Associate Administrator said NASA would track these programmatic risks and adjust its reserve levels accordingly.

Evaluation of Management's Response. Management's proposed actions are responsive; therefore the recommendation is resolved and closed.

APPENDIX A

Scope and Methodology

We performed this audit from June 2010 through May 2011 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

We reviewed planning, financial, and scheduling documents; NPP contracts; and risk management plans, as well as criteria for project management, and earned value management. We conducted interviews with project officials to determine whether NASA effectively managed NPP in support of NPOESS/JPSS to accomplish its technological objectives while meeting established milestones and controlling costs. We also reviewed internal controls as they related to the overall audit objective. The budget documents available for review were the November 2003 Program Commitment Agreement; the "Program Operating Plan 06-1 New Obligation Authority/Cost Summary" for FY 2006; and the "Planning, Programming, Budgeting, and Execution 10-1 New Obligation Authority/Cost Summary" for FY 2010, which we also reviewed to determine whether NPP was controlling costs. In addition, we reviewed the NASA Science Mission Directorate's Program Management Council Project Decision Agreement, January 21, 2011.

We reviewed the NPP Project Plan (GSFC 429-02-01-07, July 12, 2005) and compared it to the Monthly Status Reports through September 2010. We found that NPP management, to the extent possible and within the confines of the September 2004 Final Implementation Agreement between NASA, the IPO, and NOAA, effectively monitored and managed the Project. In addition, we reviewed NASA project management criteria, NPR 7120.5D, "Space Flight Program and Project Management Requirement," March 6, 2007, to determine whether the Project was within NASA guidelines.

We reviewed the NPP Risk Management Plan (GSFC 429-99-01-04, January 21, 2000); interviewed the NPP Project Manager, NPP Deputy Project Manager, Mission Systems Engineer/Risk Coordinator, NPP Chief Engineer, and Chief Safety and Mission Assurance Officer; and reviewed the NPP risk database to determine whether NPP management was effectively identifying, reporting, monitoring, and mitigating risks in accordance with NPR 8000.4A, "Agency Risk Management Procedural Requirements," December 16, 2008, which is required to be implemented by every NASA project.

We reviewed instrument, spacecraft, and launch services contracts and interviewed NPP Contracting Officers, Senior Program Officials of the Launch Services Program/Program Business Office, and the Chief of Procurement for Launch Services.

In addition, we interviewed the JPSS Deputy Program Manager and the JPSS Chief Engineer to determine any impacts to JPSS due to the delayed launch of NPP and confirmed that a delay in NPP's launch would increase the risk of a data gap if the current operational satellites became nonoperational.

Use of Computer-Processed Data. We used an NPP Project Risk Information Management eXchange report to determine that NPP had a risk database and that it was implemented in accordance with NPR 8000.4A. However, we did not validate the accuracy of the data in the NPP Project Risk Information Management eXchange report.

We also used a management-prepared NPP Budget New Obligation Authority Summary of life-cycle costs and cost increases. We verified the costs by comparing them with other source documents (see list below). From the comparison, we determined that the management-prepared NPP Budget New Obligation Authority Summary data was credible.

- NPP New Obligation Authority Budget Plan from the 2003 Mission Confirmation Review Presentation
- Program Operating Plan 03-1 Working Summary
- NPP New Obligation Authority Summary Program Operating Plan 04-1 Final
- NPP FY 2009 Budget Request
- NPP Mission Science Team Reconciliation of Guideline and Program Operating Plan 06-1 New Obligation Authority Submit
- NPP Spacecraft Contract PPBE Program Operating Plan 10-1 Cost Requirement
- ATMS Instrument Contract History
- Program Operating Plan 06-1 New Obligation Authority/Cost Summary
- PPBE 10-1 New Obligation Authority/Cost Summary
- NPP FY 2008 Congressional Budget
- NPP FY 2011 Office of Management and Budget Submission Narrative Update, January 2011
- NPP Monthly Launch Slip Estimate

Review of Internal Controls

We reviewed NPP policies, procedures, and internal controls to determine whether NPP had implemented appropriate internal controls related to NPP management, risks, lessons learned, and administration of contracts for compliance with NASA regulations. We found that NPP management had implemented an effective process to identify, document, evaluate, mitigate, and administer contract responsibilities in accordance with NASA and NPP oversight criteria. Specific internal controls reviewed included:

- NPP Project Plan, GSFC 429-02-01-07, July 12, 2005
- NPP Risk Management Plan, GSFC 429-99-01-04, January 21, 2000
- NPR 8000.4A, "Agency Risk Management Procedural Requirements," December 16, 2008
- NPR 7120.6, "Lessons Learned Process (Revalidated w/change 1, 01/22/10)"
- NPR 7120.5D, "NASA Space Flight Program and Project Management Requirement," March 6, 2007
- ANSI/EIA-748-B-2007, "Earned Value Management Systems," September 10, 2007

Prior Coverage

During the last 5 years, NASA has not issued a report of particular relevance to the subject of this report. The GAO has issued five reports, listed below, that describe significant impacts to NPP due to escalating costs, schedule delays, and ineffective management of the NPOESS Program and its restructure to JPSS as the cause for NPP launch delays and cost growth. Unrestricted reports can be accessed over the Internet at http://www.gao.gov.

"NASA: Assessments of Selected Large-Scale Projects" (GAO-11-239SP, March 2011)

"Polar-Orbiting Environmental Satellites: Agencies Must Act Quickly to Address Risks That Jeopardize the Continuity of Weather and Climate Data" (GAO-10-558, May 2010)

"NASA: Assessments of Selected Large-Scale Projects" (GAO-10-227SP, February 2010)

"Polar-Orbiting Environmental Satellites: With Costs Increasing and Data Continuity at Risk, Improvements Needed in Tri-agency Decision Making" (GAO-09-564, June 2009)

"Environmental Satellites: Polar-orbiting Satellite Acquisition Faces Delays; Decisions Needed on Whether and How to Ensure Climate Data Continuity" (GAO-08-518, May 2008)

FINAL IMPLEMENTATION AGREEMENT

FINAL IMPLEMENTATION AGREEMENT

BETWEEN

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

OFFICE OF EARTH SCIENCE (OES)

AND

NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (NPOESS) INTEGRATED PROGRAM OFFICE

AND

THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) NATIONAL ENVIRONMENTAL SATELLITE DATA INFORMATION SERVICE

FOR THE

NPOESS PREPARATORY PROJECT (NPP)

I. PURPOSE

The Office of Earth Science (OES) of the National Aeronautics and Space Administration (NASA), the National Oceanic And Atmospheric Administration's (NOAA) National Environmental Satellite Data and Information Service (NESDIS), and the National Polar orbiting Operational Environmental Satellite System (NPOESS) Integrated Program Office (IPO), hereby agree to enter into a partnership to jointly implement a mission called the NPOESS Preparatory Project (NPP) to accomplish the following objectives:

1. Demonstrate and validate:
   a. A global imaging radiometer and a suite of two sounding instruments, associated algorithms, and data processing
   b. An ozone mapping and profiling instrument, associated algorithms, and data processing
   c. A NPP Command, Control and Communications segment (C3S), an Interface Data Processing Segment (IDPS), an Archive and Distribution Segment (ADS), and a Science Data Segment (SDS)

2. Provide continuity of the calibrated, validated and geo-located EOS Terra and Aqua systematic global imaging radiometry, sounding observations, and ozone mapping and profiling observations for NASA Earth Science research.

1

NPP will provide scientific measurements which meet a subset of the NASA Earth Science Enterprise science needs, as well as those of the NPOESS Program. It is planned to launch in 2006, with a mission duration on-orbit of at least 5 years. The instruments flown on this mission will also be flown and operated on the NPOESS.

This Final Implementation Agreement (FIA) identifies the respective partners' responsibilities to be used for the implementation phase of the mission, and supercedes the NPP Initial Implementation Agreement (IIA), dated November 21, 1999. This is in accord with the policy and procedures set forth in Appendix 1 of the "Memorandum of Agreement" Between the Department of Commerce, Department of Defense and the National Aeronautics and Space Administration for the National Polar-orbiting Operational Environmental Satellite System, dated May 26, 1995.

NOTE: "NPP Mission Data" in this document includes instrument raw data records, sensor corrected data records, and environmental data records with supporting ancillary data, telemetry, etc required to process the data.

Ia. AUTHORITY

The NPOESS IPO and NOAA/NESDIS are authorized to enter into this agreement pursuant to 15 USC § 313 and 49 USC § 44720, since it supports NOAA's mission to predict and forecast weather and climate. NASA is authorized to enter into this agreement pursuant to the sections 203 (c) (5) and (6) of the National Aeronautics and Space Act, 42 USC §2473 (c) (5) and (6).

II. RESPONSIBILITIES

NASA OES and IPO will jointly manage the project, and NOAA/NESDIS will manage the ADS. NASA OES, NOAA/NESDIS and NPOESS IPO assume the following division of responsibilities.

NPOESS IPO will:

1. Provide and manage the development of the Cross-track Infrared Sounder (CrIS), Visible-Infrared Imager Radiometer Suite (VIIRS) and the Ozone Mapping and Profiler Suite instruments, and deliver them to the NPP spacecraft contractor.

2. Provide and manage the development of C3S and IDPS.

3. Provide and manage the Missions Management Center (MMC) for NPP pre-launch, launch, early orbit, and operations phases of the mission.

4. Provide the resources and facilities to exercise command and control of NPP during launch, early orbit and on-orbit acceptance testing, in conjunction with NASA OES planning and management.

2

5. Exercise Satellite Control Authority (SCA) after NPP on-orbit acceptance, and for the remainder of the mission. SCA is the authority to direct, approve, perform and/or delegate all Satellite command and control activities to maintain the Satellite in a mission-capable operating configuration.

6. Plan satellite launch and on-orbit acceptance activities in cooperation with OES.

7. Provide and manage the development and operation of the ground assets needed to support mission operations, including data receiving systems, primary telemetry and command systems, network services for data and data products, and the IDPS. IPO will provide these assets and services for the life of the mission.

8. Provide for NPP mission data and data product's global, continuous production and distribution beginning at satellite acceptance.

9. Provide support to OES for NPP operational readiness testing, pre-launch, launch, on-orbit satellite acceptance, and the transitional engineering.

10. In conjunction with OES, jointly conduct operational readiness testing with all ground elements.

11. Support NPP instrument and system calibration and validation during hardware development, integration and test, pre-launch, launch, satellite acceptance, and transition phase in cooperation with NASA.

12. Provide prototype software (algorithms and support tools) to OES for integration into the NASA-built NPP in-situ ground system's Direct Broadcast terminal.

13. Provide technical representation for OES-managed NPP reviews and products.

14. Provide for NPP instrument contractor support after handover from NASA to IPO.

15. In cooperation with NASA, provide command and control, telemetry, and mission data recovery from the Svalbard Ground Station to the US point of presence.

NASA's OES will:

1. Provide and manage overall mission systems engineering.

2. Provide and manage the development and procurement of the spacecraft bus, including the integration and test of the instruments onto the satellite, and a spacecraft simulator for use by IPO.

3. In conjunction with IPO, jointly conduct operational readiness testing with all ground elements.

3

4. Provide and manage the development and procurement of the Advanced Technology Microwave Sounder (ATMS). Support transition of ATMS follow-on production responsibility to the IPO system integration contractor.

5. Provide and manage the development of the SDS.

6. Provide and manage launch services.

7. Manage SCA planning and execution, in conjunction with IPO at the MMC, during pre-launch, launch and on-orbit acceptance testing until Satellite turnover.

8. Coordinate transition of the NPP mission operations to the IPO after on-orbit satellite acceptance is complete.

9. Provide emergency NPP anomaly resolution support as available, to the IPO after on-orbit acceptance and through mission life.

10. Provide scientific research to evaluate the quality of the IDPS-produced NPP EDRs for climate research, and provide updated algorithms to the NPOESS IPO for potential inclusion in the IDPS.

11. Provide scientific support for NPP instrument and system calibration and validation during hardware development, integration and test, pre-launch, launch, satellite acceptance, and transition phase, as necessary.

12. Conduct calibration and validation for NASA-provided instrument.

13. In cooperation with IPO, coordinate communications services and backup connectivity requirements needed to support NPP operations. Support IPO in obtaining backup command and telemetry capability via TDRSS and the White Sands Ground Station.

14. Provide technical representation for IPO-managed NPP reviews and products.

NOAA/NESDIS will:

1. Provide the NPP ADS for long-term archive and timely distribution of all NPP Mission Data.

2. Provide ADS access, interface, and data for the NPP SDS in accordance with ICDs to be negotiated between NASA OES and NOAA/NESDIS.

3. Coordinate with NASA and IPO on all scheduling, pre-launch development, testing and reviews of the ADS in the end-to-end mission.

Program Management:

OES and IPO will jointly assume program management responsibilities, and develop integrated performance milestones to be achieved for the implementation and operation

4

of the mission. Potential changes involving the NPP launch readiness date, costs, or system performance will be promptly communicated between the parties (e.g., Tri-Agency Steering Committee/NPOESS Executive Committee). Any proposed changes in instrument performance parameters that affect NPOESS operational or OES scientific data products requirements will be mutually agreed to by the parties or their designees. The NPP Project and the IPO will jointly report status at appropriate reviews.

All pre-launch, launch and on-orbit activities will be conducted from an IPO-provided MMC. The Satellite will transition from on-orbit acceptance testing to nominal Satellite operations approximately 90 days after Satellite launch. OES and the IPO will mutually determine exactly when the Satellite transition occurs. At that time, SCA authority will be formally transferred from OES to the IPO.

OES and IPO will accept a voting member from the other party on the Fee Determination Board for the NPOESS and ATMS contracts through acceptance of the NPP Satellite, and remainder of the mission as necessary. With respect to the NPP Satellite, OES will accept a member from IPO in the milestone payment determination process.

OES and IPO will document and implement a single joint Configuration Control Board for all elements of the NPP mission pertaining to Level II requirements, element interfaces (Interface Requirements Documents), and NPP instrument specifications.

OES and IPO will maintain a shared Master Schedule, at the instrument and major end-item level, which supports the launch date in this document. Any changes in this delivery schedule of these items will be communicated to the parties or their representatives.

OES and IPO will consult promptly with each other on all issues involving interpretation or implementation of this Final Implementation Agreement. Any outstanding issues will first be referred to the Program Managers of the parties, then to the appropriate FIA signatories, or their designees.

OES, NOAA and IPO will share cost, schedule and mission justification information with all parties of the NPP Program, as necessary.

III. FUNDING

This program will be executed on a no exchange of funds basis. All activities pursuant to this FIA are subject to the availability of appropriated funds, and no provision herein shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act, 31 U.S.C. §1341. This FIA is not a funding document, and does not represent the obligation or transfer of funds.

Each party shall support the other in the appropriation process and shall reconsider this agreement should conditions merit.

5

IV. PRINCIPAL POINTS OF CONTACT

The principal points of contact with responsibility for implementing this FIA are listed below:

For NASA: Mr. Andrew Carson
NPP Program Executive
Office of Earth Science
National Aeronautics and Space Administration
Code YF
300 E Street SW
Washington, DC 20024
(202) 358-1702

For IPO: Peter Wilczynski
NPP Program Manager
Integrated Program Office
8455 Colesville Road, Suite 1450
Silver Spring, MD 20910
(301) 713-4786

For NOAA: Charles Wooldridge
NESDIS Chief of Staff
1335 East-West Highway
SSMC1, Room 8340
Silver Spring, MD 20910
(301) 713-3578

For Air Force: Major Deborah Werling
Weather Satellite Element Monitor
SAF/USAE
1060 Air Force Pentagon
Washington, DC 20330
(703) 588-7387

V. AMENDMENT AND TERMINATION

This FIA may be amended at any time upon the mutual consent of the parties. Amendments must be in writing, and signed by the authorized representatives of the parties.

This FIA will terminate automatically upon completion of the NPP. The parties may amend this FIA pursuant to the preceding paragraph to extend the termination date. A party may terminate its participation in this FIA at its sole discretion, subsequent to providing 120 days advance written notice to the other parties.

6

VI. EFFECTIVE DATE

This FIA shall be effective upon the date of the last signature below, and shall remain in effect through the end of the mission life.

Concur:

John D. Cunningham
System Program Director
NPOESS Integrated Program Office
Date: 28 Jul 2004

Approved:

Ghassem R. Asrar
Associate Administrator for
Earth Science,
National Aeronautics and
Space Administration
Date: 7/28/04

Gregory W. Withee
Assistant Administrator for
Satellite and Information Services
National Oceanic and
Atmospheric Administration
Date: 20 Aug 04

Robert S. Dickman
Deputy for Military Space
Office of the Under Secretary
of the Air Force
Date: 17 SEP 04

7

APPENDIX B

Acronyms

ADS	Archive and Distribution Segment
ATMS:	Advanced Technology Microwave Sounder
C3S:	Command Control and Communications Segment
CrIS:	Cross track Infrared Sounder instrument
EDR	Environmental Data Record
EOS:	Earth Observation System
ERBS:	Earth Radiation Budget Sensor instrument
FIA:	Final Implementation Agreement
IDPS:	Interface Data Processing Segment
IIA:	Initial Implementation Agreement
IPO:	Integrated Program Office
LEO:	Launch and Early Orbit
MMC:	Mission Management Center
NASA:	National Aeronautics and Space Administration
NESDIS:	National Environmental Satellite, Data Information Service
NOAA:	National Oceanic and Atmospheric Administration
NPOESS:	National Polar-orbiting Operational Environmental Satellite System
NPP:	NPOESS Preparatory Project
OES:	Office of Earth Science
RDR:	Raw Data Record
SCA:	Satellite Control Authority
SDS:	Science Data Segment
SMD:	Stored Mission Data
VIIRS:	Visible-Infrared Imager Radiometer Suite instrument

8

MANAGEMENT COMMENTS

National Aeronautics and Space Administration
Headquarters
Washington, DC 20546-0001

MAY 31 2011

SMD/Strategic Integration and Management Division

TO: Assistant Inspector General for Audits

FROM: Associate Administrator for Science Mission Directorate

SUBJECT: OIG Draft Report, "NASA's Management of the NPOESS Preparatory Project" (Assignment No. A-10-012-00)

The Science Mission Directorate appreciates the opportunity to review and provide comments on your draft audit report entitled "NASA's Management of the NPOESS Preparatory Project" (Assignment No. A-10-012-00). In the draft report, the Office of the Inspector General (OIG) makes two recommendations directed to the Science Mission Directorate. NASA's response to the OIG's recommendations follows.

Recommendation 1: When assessing future collaborative efforts with external partners, the Associate Administrator for the Science Mission Directorate should carefully consider the technical and oversight capabilities of partner agencies and the risks associated with agreements executed on a "no exchange of funds" basis.

Management's Response: Concur. The Science Mission Directorate (SMD) will seek to structure future partnerships in a manner that carefully aligns responsibilities with both technical expertise and acquisition capability. In the case of the NPOESS Preparatory Project, NASA's partnership was not with an agency, but with an interagency program office that had its own now well-documented responsibility misalignments. SMD will studiously avoid other similarly misaligned partnerships with interagency program offices in the future. Where the prospective partner is not a space agency, NASA will explore the use of reimbursable funding arrangements or means and terms of collaboration that allow SMD to secure the timely delivery of critical path items. The process of planning, drafting, and negotiating agreements with prospective partners affords an opportunity for thorough consideration of equity and capability alignments and risks, as well as review by other NASA Headquarters offices that can provide useful advice on such matters.

Recommendation 2: If a decision is made to move forward with such an agreement, ensure that the budget includes reserve levels commensurate with the associated risks.

Management's Response: Concur. The "no exchange of funds" principle may often be the only practical course, as partner agencies having trouble funding their deliverables are likely to have even more trouble funding costs incurred by NASA due to delays on their end. Especially in cases of "no exchange of funds" partnerships, NASA will track the associated programmatic risks and adjust reserve levels accordingly.

Thank you again for the opportunity to review and comment on the draft audit report.

Charles Kray
for Edward J. Weiler

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