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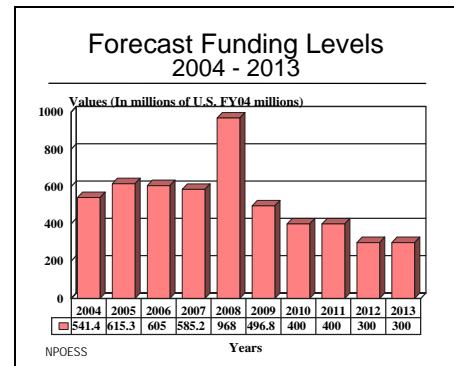
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National Polar-Orbiting Operational Environmental Satellite System (NPOESS) - Archived 12/2005

Outlook

- Forecast International projects the U.S. NOAA, U.S. DoD, and NASA will spend some US\$5.21 billion on developing, purchasing, and operating the NPOESS over the next decade
- Look for the U.S. Air Force to launch the first NPOESS satellite sometime in 2010



Orientation

Description. The National Polar-Orbiting Operational Environmental Satellite System (NPOESS) program merges U.S. polar-orbiting satellite programs (such as DMSP) previously operated by the U.S. Air Force and the U.S. National Oceanic and Atmospheric Administration (NOAA). NPOESS is a tri-agency program, with the NOAA, the U.S. Department of Defense (DoD), and NASA contributing. NPOESS will work in partnership with space agencies in Europe (EUMETSAT) and Japan (NASDA), and will leverage appropriate technologies from NASA programs to provide continuous satellite coverage of the Earth.

Sponsor

U.S. National Oceanic and Atmospheric Administration (NOAA)

14th Street & Constitution Avenue, NW
Room 6217
Washington, DC 20230
Tel: +1 202 482 6090
Fax: +1 202 482 3154
Web site: <http://www.noaa.gov>

U.S. Department of Defense
U.S. Air Force
Space & Missile System Center
Los Angeles, California (CA)

NASA
300 E Street, SW
Washington, DC

Status. The NPOESS is currently in research and development.

Total Produced. Not applicable at this time.

Application. The provision of meteorological, terrestrial, oceanographic, and solar-geophysical data to civilian and military users.

Price Range. The future unit cost of an NPOESS satellite has not been announced, but a rough assessment is around US\$900 million per satellite.

Contractors

Ball Aerospace & Technologies Corporation, <http://www.ballaerospace.com>, 1600 Commerce St, PO Box 1062, Boulder, CO 80301 United States, Tel: 1 (303) 939-6100, Fax: 1 (303) 939-6104, Email: info@ball.com, RDT+E (RDT&E)

Boeing Company, Corporate HQ, <http://www.boeing.com>, 100 North Riverside, Chicago, IL 60606 United States, Tel: 1 (312) 544-2000, Fax: 1 (206) 655-1177, Email: wwwmail.boeing2@boeing.com, RDT+E (RDT&E)

ITT Industries Inc, <http://www.ittind.com>, 4 West Red Oak Lane, White Plains, NY 10604 United States, Tel: 1 (914) 641-2000, Fax: 1 (914) 696-2950, RDT+E (RDT&E)

Northrop Grumman Corporation, Corporate Headquarters, <http://www.northropgrumman.com>, 1840 Century Park East, Los Angeles, CA 90067-2199 United States, Tel: 1 (310) 553-6262, Fax: 1 (310) 201-3023, Prime (RDT&E)

Raytheon Company, <http://www.raytheon.com>, 870 Winter St, Waltham, MA 02451-1449 United States, Tel: 1 (781) 522-3000, Fax: 1 (781) 860-2520, RDT+E (RDT&E)

Technical Data

Design Features. The following instruments have been identified as part of the instrumentation package of the NPOESS satellites:

Conical Scanning Microwave Imager/Sounder (CMIS). The CMIS is a 2.2-meter-aperture, passive microwave sensor that simultaneously operates over the 1- to 250-GHz range to provide both imaging and sounding (profiling) capability. Ground-based retrieval algorithms process the sensor data to produce a wide range of environmental data products, including:

- Ocean wind speed/direction
- Atmospheric temperature and moisture profiles
- Ocean/water imaging and characterization
- Cloud imaging and characterization
- Land imaging and characterization

The CMIS will reportedly replace the current SSM/I system.

Ozone Mapping and Profiler Suite (OMPS). OMPS is a sensor suite being designed to measure the total amount of ozone in the atmosphere and how the ozone concentration varies with altitude. OMPS is the next generation of operational ozone monitors. It will

replace the current ozone monitor designated the Solar Backscatter Ultraviolet Radiometer 2 (SBUV/2). OMPS will improve the performance of both the SBUV/2 and NASA's Total Ozone Mapping Spectrometer.

Atmospheric ozone measurements can be made using ultraviolet, visible, infrared, or microwave wavelengths. Selection of an optimal set of wavelengths for OMPS is still under way.

Cross-Track Infrared Sounder (CrIS). The CrIS has been described as a high-spectral-resolution/high-spatial-resolution infrared sounder for performing atmospheric temperature profiling. No other information is available regarding this equipment package, though it appears this system will replace the current SSM/T system.

Visible/Infrared Imager and Radiometer Suite (VIIRS). VIIRS is an advanced, modular, multichannel imager and radiometer. It will provide 28 environmental data records, including cloud/weather imagery, sea-surface temperature measurements, ocean color characterization, and land-surface vegetation indices.

Variants/Upgrades

NPOESS Lite. Initially, the NPOESS Program Office called for operating two NPOESS satellites, with the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) developing a satellite similar to NPOESS, so that three satellites would have equator descending crossing times of 0530, 0930, and 1330. While the EUMETSAT Metop satellite will carry some 11 instrument payloads, three critical NPOESS instruments – the VIIRS, CrIS, and CMIS – will not be on board. So important are the instruments that failure of any one would constitute a need to

replace the NPOESS satellite. Consequently, the NPOESS Program Office plans to procure a third satellite, the so-called NPOESS Lite satellite, to operate in tandem with Metop's 0930 crossing time.

The NPOESS Lite satellite will carry a reduced complement of instruments, including VIIRS and CMIS, which are required to meet U.S. horizontal resolution and data-refresh requirements for all-weather imaging in this orbit. The NPOESS Lite satellite will complement EUMETSAT's third Metop satellite flying in the 0930 orbit.

Program Review

Background. Over the past three decades, the United States has operated separate civil and military polar-orbiting environmental satellites: NOAA-controlled

Polar-Orbiting Operational Environmental Satellite (POES) program satellites, and DoD-run Defense Meteorological Satellite Program (DMSP) satellites.

These systems had been tasked with the same missions of collecting, processing, and distributing remotely sensed meteorological, oceanographic, and space environmental data.

To reduce duplication of effort and generate cost-savings, the National Performance Review recommended the two satellite programs be converged. In 1994, President Bill Clinton did just that. On May 5, President Clinton directed the U.S. DoD, the U.S. Department of Commerce (DoC), and the U.S. National Aeronautics and Space Administration (NASA) to establish a converged national polar-orbiting weather satellite program (Presidential Decision Directive/NSTC-2). The converged program, called the National Polar-Orbiting Operational Environmental Satellite System (NPOESS), combines the follow-on segments of the DoD's DMSP and the DoC's POES program.

On October 1, 1994, a tri-agency NPOESS Integrated Program Office (IPO) was established to manage the development and operations of the National Polar-Orbiting Operational Environmental Satellite System. NPOESS will provide military commanders and civilian leaders with weather and environmental information to effectively employ weapon systems and protect national resources. NPOESS will be the primary U.S. source of global weather and environmental data for operational military and civil use. The satellite system will provide visible and infrared cloud-cover imagery, as well as other atmospheric, oceanographic, terrestrial, and space environmental information.

NPOESS will be composed of two (possibly three) satellites in sun-synchronous, 450-nautical-mile polar orbit. Sun synchronous means the satellites cross the equator at the same local sun time on each of their 14 orbits per day.

On August 23, 2002, the NPOESS Integrated Program Office awarded a US\$4.5 billion contract to TRW Space & Electronics Group (now Northrop Grumman) to develop, produce, and operate the National Polar-Orbiting Operational Environmental Satellite System. Under the agreement, Northrop Grumman will develop and manufacture the NPOESS satellite and ground systems, as well as provide launch and support services for the system through Initial Operational Capability.

In December 2002, the U.S. Department of Defense and the U.S. Department of Commerce cut the fiscal year 2004 NPOESS budget. The US\$70 million budget cut will result in a 21-month delay in launching the first NPOESS satellite. Forecast International now expects the U.S. Air Force to launch the first NPOESS satellite sometime in 2010.

Recent Activity. In February 2004, Northrop Grumman received a contract modification to re-plan the NPOESS acquisition and operations contract. The contract modification adjusts the existing NPOESS agreement by delaying the availability of two satellites. The first satellite, NPOESS C1, will be available in November 2009 (instead of March 2008). The second satellite, NPOESS C2, will be available in June 2011 (instead of February 2009).

Funding

U.S. AIR FORCE RDT&E FUNDING

	<u>FY03</u>		<u>FY04</u>		<u>FY05(Req)</u>		<u>FY06(Req)</u>	
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>
RDT&E (U.S. Air Force)								
PE#0603434F								
Project 4056	-	232.08	-	264.68	-	0.00	-	0.00
PE# 0305178F								
Project 4056	-	0.00	-	0.00	-	307.67	-	236.56
	<u>FY07(Req)</u>		<u>FY08(Req)</u>		<u>FY09(Req)</u>			
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>		
RDT&E (U.S. Air Force)								
PE#0603434F								
Project 4056	-	0.00	-	0.00	-	0.00		
PE# 0305178F								
Project 4056	-	224.50	-	103.63	-	85.92		

Source: U.S. Air Force Fiscal Year 2005 RDT&E Descriptive Summary

All US\$ are in millions.

Recent Contracts

<u>Contractor</u>	<u>Award (US\$ millions)</u>	<u>Date/Description</u>
Ball Aerospace	65.2	May 1999 – Ball Aerospace was awarded a contract to produce two flight production units that support the Ozone Mapping and Profiler Suite of the NPOESS. Completion date is September 2009. (F04701-99-C-0044)
ITT Industries	73.0	Aug 1999 – ITT Industries was awarded a contract to provide for Phase II algorithm and design development, investigation and analysis, and construction of three flight production units in support of the Cross-Track Infrared Sounder (CrIS) sensor for the NPOESS. Delivery date of the protoqual unit was April 1, 2004. Expected delivery date of second flight production unit is July 1, 2005; third flight production unit, July 1, 2007; fourth flight production unit (option), July 1, 2009. U.S. Air Force, Space and Missile Systems Center, Los Angeles AFB, CA, is the contracting agency. (F04701-99-C-0061)
Raytheon Company	152.9	Nov 2000 – Raytheon was awarded a US\$152,872,700 contract to provide for Phase II algorithm and design development. Raytheon will also construct three flight production units in support of the Visible/Infrared Imagery and Radiometric Suite sensor of the NPOESS. Expected contract completion date is March 31, 2015. (F04701-01-C-0500)
Boeing	130.8	Jul 2001 – Boeing Satellite Systems (BSS) was awarded a US\$130.8 million contract by the NPOESS Integrated Program Office for two conical microwave imager/sounder (CMIS) weather instruments. The contract includes options for up to four additional weather instruments, which, if exercised, would bring the contract value up to US\$298 million.
ITT Industries	10.5	Dec 2001 – ITT Aerospace was awarded a contract modification to provide for implementation of standard spacecraft interfaces between the NPOESS and the CrIS. This work is expected to be completed by September 2009. The U.S. Air Force, Space and Missile Systems Center is the contracting agency. (F04701-99-C-0061, P00028)
Northrop Grumman	4,500.0	Aug 2002 – The U.S. Department of Defense, U.S. Department of Commerce, and NASA awarded TRW Space and Electronics (now part of Northrop Grumman) a contract to produce and operate the NPOESS. The effort will include completing development of the NPOESS sensor payloads; sensors and integration support for the NPOESS Preparatory Project test mission; development and delivery of support, data processing, and ground control hardware and software; development of the NPOESS space segment and integration with the launch segment; ongoing test, validation, and calibration activities; production of two NPOESS spacecraft; and operation of the NPOESS constellation through FY11. Work is expected to be completed by November 2015. The National Environmental Satellite, Data and Information Service is the contracting agency. (F04701-02-C-0502)

<u>Contractor</u>	<u>Award (US\$ millions)</u>	<u>Date/Description</u>
Northrop Grumman	48.7	Sep 2002 – TRW received a contract to make the hardware and software modifications necessary to incorporate the FT1394a data interface into the Cross-Track Infrared Sounder and the Visible/Infrared Imager/Radiometer Suite (VIIRS) sensors supporting the NPOESS program. This effort also includes integration of redundant latches and telescope launch locks into the VIIRS sensors. This work will be completed by March 2005. The Headquarters Space and Missile Systems Center is the contracting agency. (F04701-02-C-0502)
Northrop Grumman	15.7	Sep 2003 – Northrop Grumman Space and Mission Systems Corporation received a contract modification to integrate the Ozone Mapping Profiler Suite sensor onto the NPOESS preparatory project satellite scheduled for launch in FY06. This and associated work under the contract will be completed by November 2015. The National Environmental Satellite, Data and Information Service is the contracting agency. (F04701-02-C-0502, P00021)
Northrop Grumman	60.2	Oct 2003 – Northrop Grumman Space and Mission Systems Corporation received a contract modification from the NPOESS Integrated Program Office under which Northrop will incorporate an equitable adjustment due to late delivery of the 1394a chipsets. The contract modification also transfers responsibility for the development, space qualification, and delivery of the 1394a high speed firewire databus/chipsets to Northrop Grumman Space Technology from the NPOESS IPO. Northrop Grumman will complete work under the agreement by November 2015. The NPOESS IPO is the contracting agency. (04701-02-C-0502, P00023)
Northrop Grumman	391.2	Feb 2004 – Northrop Grumman Space and Mission Systems Corporation receives a contract modification to provide for the replan of the acquisition and operations contract for the National Polar-Orbiting Operational Environmental Satellite System (NPOESS). This replan adjusts the program to match the funding profile by effecting the following schedule changes: availability of the NPOESS C1 satellite shifts from March 2008 to November 2009 and availability of the C2 satellite shifts from February 2009 to June 2011. This action also provides for 10 engineering changes that reduce technical risk and enhance system capabilities. This work will be complete by June 2011. The NPOESS Integrated Program Office, Silver Spring, MD, is the contracting activity. (F04701-02-C-0502, P00026)
Northrop Grumman	5.3	Jun 2004 – Northrop Grumman Space and Mission Systems Corporation receives a contract modification to the National Polar-orbiting Operational Environmental Satellite System (NPOESS). Under the modification, called the Svalbard Initial Mission Recovery (SIMR) Modification, the Svalbard, Norway, ground station will recover data from the Navy's Wind Sat/Coriolis mission provide routing of mission data for NASA missions, and options to recover data for Commerce's Polar Orbiting Operating Environmental Satellite mission. SIMR will also serve as a risk-reduction effort for the NPOESS preparatory project data reception and routing. This work will be completed by October 2006. The National Environmental Satellite and Information Service, Silver Spring, MD, is the contracting activity. (F04701-02-C-0502)

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
May	1994	Presidential order creating an IPO in charge of development of the NPOESS
Oct	1994	NPOESS IPO established; NOAA chosen as lead agency
	1999	The U.S. Air Force Space and Missile Systems Center awards NPOESS program definition and risk reduction contracts to teams led by Lockheed Martin Space Systems and TRW Space and Electronics Group (now Northrop Grumman)
Nov	2000	Raytheon receives a contract to construct three flight production units in support of the Visible/Infrared Imagery and Radiometric Suite sensor for the NPOESS
Jul	2001	Boeing receives an award from the NPOESS IPO for two conical microwave imager/sounder (CMIS) weather instruments
Aug	2002	NPOESS IPO awards TRW Space and Electronics Group (now Northrop Grumman) a contract to develop, produce, and operate the National Polar-Orbiting Operational Environmental Satellite System
Dec	2002	The U.S. Department of Defense and U.S. Commerce Department cut the FY04 NPOESS budget by US\$70 million. The cut will result in a 21-month delay in launching the first NPOESS satellite
Feb	2004	Northrop Grumman receives a contract modification to re-plan the NPOESS acquisition and operations contract by delaying the availability of two satellites
	2010	Look for U.S. Air Force to launch the first NPOESS satellite

Worldwide Distribution

NPOESS is a U.S. Department of Defense, NOAA, and NASA program.

Forecast Rationale

The National Polar-Orbiting Operational Environmental Satellite System (NPOESS) program merges U.S. polar-orbiting satellite programs previously operated by the U.S. Air Force and the U.S. National Oceanic and Atmospheric Administration (NOAA). The NPOESS is a tri-agency program, with the NOAA, the U.S. Department of Defense (DoD), and NASA contributing. The NPOESS will work in partnership with space agencies in Europe (EUMETSAT) and Japan (NASDA), and will leverage appropriate technologies from NASA programs to provide continuous satellite coverage of the Earth.

As indicated in the **Ten-Year Outlook** chart, Forecast International projects the U.S. NOAA, U.S. DoD, and

NASA will spend some US\$5.21 billion on developing, purchasing, and operating the NPOESS over the next decade. The U.S. Department of Defense's need to provide its military commanders with weather and environmental information in order to employ weapon systems is driving NPOESS funding.

The next-generation NPOESS will be a major improvement over the Defense Meteorological Satellite Program (DMSP) satellites currently used by the U.S. military. Today, it takes DMSP satellites 3 to 4 hours to transmit data to a U.S. military commander. Once up and running, NPOESS satellites will be able to transmit data to U.S. commanders within 30 minutes.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR FUNDING (US\$ in millions)													
Designation	System	Thru 03	<u>High Confidence Level</u>				<u>Good Confidence Level</u>			<u>Speculative</u>			Total 04-13
			04	05	06	07	08	09	10	11	12	13	
NPOESS	METEOROLOGICAL SATELLITE (NPOESS INTEGRATED PROGRAM OFFC)	606.10	541.38	615.31	604.99	585.24	968.02	496.79	400.00	400.00	300.00	300.00	5211.730