

## National Polar-Orbiting Operational Environmental Satellite System (NPOESS)

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) is a Tri-Agency program jointly administered by the Department of Defense, the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA). The program is managed by an NPOESS Executive Committee through an Integrated Program Office (IPO) and is being acquired under U.S. Air Force acquisition authority. NPOESS will provide a national remote sensing capability to acquire and disseminate global and regional environmental data for a period of at least ten years.

NPOESS contains the following segments:

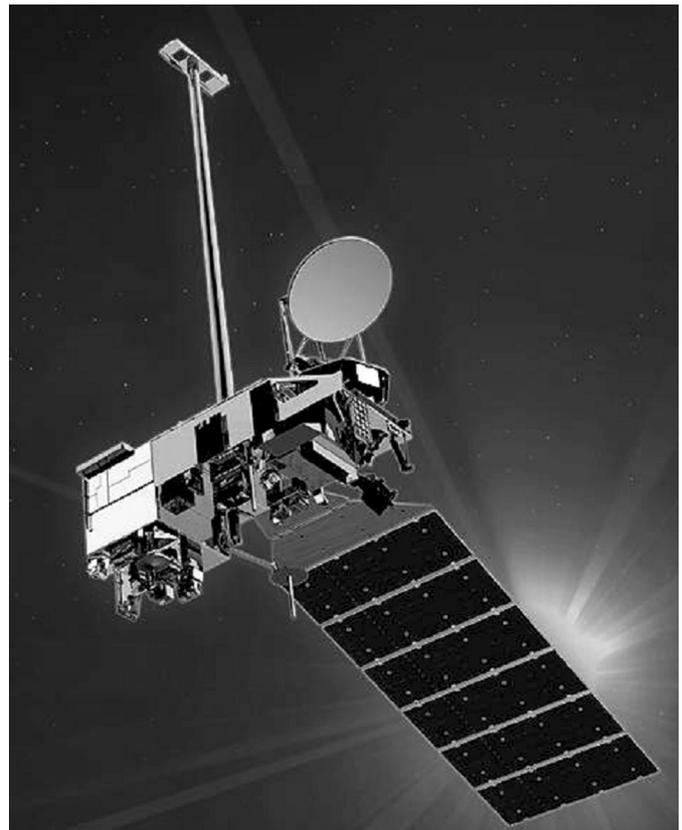
- A space segment comprised of the satellites, payload components, and ground support equipment, and operated in a sun-synchronous, near-polar orbit at a nominal 833 km altitude.
- A command, control, and communications segment, providing for spacecraft control and state-of-health monitoring and supporting the delivery of data to designated centralized facilities and field terminals.
- An Interface Data Processor Segment (IDPS) comprised of data processing functions for centralized facilities.
- A Field Terminals Segment (FTS) comprised of software that receives direct real time mission data from the Space Segment and generates weather products for field terminal users.
- Launch Support, which is comprised of the resources to accomplish launch operations and to place the satellite in the correct orbit.

NPOESS Milestone I occurred in FY97. The Program Definition/Risk Reduction (PDRR) phase was structured around system architecture studies, sensor and algorithm development, and other risk reduction efforts prior to the award of the Shared System Performance Responsibility (SSPR) contract. During PDRR, multiple contracts were awarded for each higher risk sensor and/or suite of sensors, and for system studies. The final SSPR contractor was selected and the program entered into the Acquisition and Operations Phase after a Key Decision Point (KDP)-C decision in August 2002.

A key risk reduction activity is the NPOESS Preparatory Project (NPP), which is a joint Integrated Program Office/NASA space flight of selected critical imaging and sounding sensor systems. This flight, scheduled for FY06, will provide NPOESS with a risk reduction demonstration and NASA with selected sensor data to provide continuity with the current environmental and weather satellites.

### TEST & EVALUATION ACTIVITY

The test strategy utilizes Modeling and Simulation (M&S) and combined Developmental Test/Operational Test for early insight into the system's potential operational performance, followed by dedicated Multi-service Operational Test and Evaluation (MOT&E).



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During dedicated MOT&E, operational testers will conduct tests on production-representative hardware and software, supplemented as required with data from validated and accredited M&S.

The test concept includes two Operational Assessments (OAs). OA1 occurred in FY02 in support of KDP-C and will be updated prior to Critical Design Review (CDR) in FY05. OA2 will occur in FY06 in support of the NPP risk reduction effort. The MOT&E will be conducted once two satellites, the C3S/IDPS, and a sufficient number of field terminals are fielded, nominally in the FY11 timeframe.

The IPO has developed a Memorandum of Agreement (MOA) with the Services on the issue of Field Terminal interoperability and funding. Under this MOA, the IPO will provide two direct data links to Field Terminal users, one for High Rate Data (HRD) in X-band at 20 Megabits per second (Mbps), and one for Low-Rate Data (LRD) in L-band at 3.5 Mbps for more austere users. The IPO plans to demonstrate prototype NPOESS HRD and LRD terminals as a guide to users in modifying or replacing their existing terminals, and will fund and distribute non-proprietary HRD and LRD versions of Field Terminal software over the life of the system. Under this MOA, individual agencies will fund, procure, and manage their own Field Terminals to satisfy their user needs.

The concept of a tri-Agency Combined Test Force was refined to correspond with the current acquisition strategy and to better define the Air Force Operational Test and Evaluation Command's (AFOTEC's) role in each of the Test and Evaluation (T&E) activities within the overall NPOESS operational test concept. Although AFOTEC will be the lead agency for all Operational Test and Evaluation events, it will combine efforts with other Service Operational Test Agencies, NOAA, and NASA during MOT&E to make the most efficient use of expertise and resources.

NPOESS is making satisfactory progress toward operational effectiveness and suitability, but there are issues with field terminal acquisition and Environmental Data Record quality that must be resolved prior to CDR in FY04. Furthermore, there is schedule risk with the planned FY06 NPP flight that must be reassessed at CDR.

Agreement has been reached regarding user field terminal testing with NPOESS satellites both in the factory and on-orbit. Lack of synchronization between the NPOESS program and the Services' field terminal acquisition programs, however, could put this test concept at risk. Unavailability of user field terminals could impact two key test events. The first is a combined Developmental Test/Operational Test event that would verify interoperability by connecting at least one of each type of field terminal directly to the satellite in the factory. The second test event is MOT&E, the primary system-wide operational test. DOT&E is working with the users to ensure that the IPO's proposals address all user requirements and that an integrated acquisition and test strategy is developed to evaluate end-to-end interoperability.

Algorithm performance has been identified as a leading risk to EDR quality. The IPO and their contractors have identified a risk mitigation strategy that includes Technical Interchange Meetings, code testing using the Integrated Weather Products Testbed, phased algorithm verifications, and other techniques. This is an adequate strategy, and DOT&E will continue to work with the IPO to track progress on this important issue. EDR quality is also affected by sensor performance and data quality control. Sensor performance is at risk for three key sensors that represent major advances over legacy sensors, and each faces a tight development schedule and technical challenges. Quality control of the data processing string in the IDPS should be planned to ensure that erroneous data is properly filtered and that operators are alerted whenever error conditions arise.

NPP is the primary risk reduction flight for NPOESS. It will carry three key NPOESS sensors and generate 93 percent of the NPOESS data volume. The first NPOESS satellite need date is in FY08, but the largest schedule driver is the NPP mission, with a planned launch in May 2006. This results in schedule risk for the delivery of the three sensors and the IDPS in time for the launch of NPP. This could potentially result in either a delay of the NPP launch, flying NPP without the full

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complement of sensors, or flying NPP without fully capable sensors or data processing capabilities. Any of these scenarios would adversely impact NPOESS by reducing the degree of risk mitigation offered by NPP.

T&E and risk reduction activities in FY02 included an update of the Test and Evaluation Master Plan, an Operational Assessment (OA) in support of KDP-C, further definition of roles and responsibilities for a Combined Test Force and for field terminal development, and ground demonstrations conducted by the two PDRR contractors.

## **TEST & EVALUATION ASSESSMENT**

OA1 was conducted by AFOTEC in support of KDP-C. This OA occurred at an early stage in the program's development when there was no hardware and software to test, and the prime contractor and final system design had not yet been determined. As a result, the OA was primarily a paper study, supplemented by M&S. AFOTEC determined that NPOESS is making satisfactory progress, with qualifications, toward operational effectiveness. AFOTEC also determined that the program is making satisfactory progress towards supporting MOT&E. Suitability was not observed because no hardware was available to test.

NPOESS is an extremely complex system, composed of different elements, which are supplied by a multitude of vendors. The successful operation of the system depends critically on rigorous system engineering. It is particularly important that the efforts of different contractors and of different groups belonging to the same contractor are coordinated and consistent.

