National Polar-orbiting Operational Environmental Satellite System Interface Data Processing Segment

NPOESS, the National Polar-orbiting Operational Environmental Satellite System, represents the next generation U.S. polar-orbiting, Low-Earth-Orbit (LEO) satellite constellation and end-to-end system for environmental remote sensing. The tri-agency Integrated Program Office (IPO), consisting of members from the Department of Commerce (DOC)/National Oceanic and Atmospheric Administration (NOAA), the Department of Defense (DoD) and the National Aeronautics and Space Administration (NASA), will begin launching NPOESS spacecraft into two orbital planes to provide significantly improved operational capabilities and benefits to satisfy critical civil and national security requirements for space-based, remotely sensed environmental data. With the development of NPOESS, we are evolving operational "weather" satellites into integrated environmental observing systems by expanding our capabilities to observe, assess, and predict the total Earth system - atmosphere, ocean, land, and the space environment. The higher resolution data from NPOESS will enable more accurate short-term weather forecasts and severe storm warnings. As one cornerstone of an Integrated Global Observing System, NPOESS will also provide sustained, space-based measurements to ensure continuity of data for monitoring, understanding, and predicting climate change and its impacts on seasonal and longer time scales. NPOESS, comprised of the spacecraft, instruments and sensors on the spacecraft, the command, control and communications infrastructure, data processing software and hardware, and launch support capabilities, has its first launch scheduled in 2014. The NPOESS program also includes the NPOESS Preparatory Project (NPP), a risk reduction and data continuity mission managed jointly by the NPOESS Integrated Program Office (IPO) and NASA. It provides an opportunity for NPOESS to demonstrate and validate new sensors, algorithms, and operational processing capabilities, and to test many components of the system prior to the first NPOESS flight. NPP also provides continuity between the current Earth Observing System (EOS) and NPOESS for select remotely sensed data that support global climate studies and research.

The NPOESS Ground System will provide data to the DoD and DOC weather Centrals (the Air Force Weather Agency (AFWA), the Fleet Numerical Meteorology and Oceanography Center (FNMOC), the Naval Oceanographic Office (NAVOCEANO) and the National Environmental

Satellite, Data, and Information Service (NESDIS)) in unprecedented latency. All data products will also be made available to the general user community through NOAA's Comprehensive Large Array-data Stewardship System (CLASS). Additionally, NASA's Science Data Segment will independently assess the quality of the science and environmental data records from the NPP mission for their ability to support climate research.

The keys to the system's low data latency and high data availability are the robust IDPS hardware and software, and the SafetyNet™ system. SafetyNet™ consists of 15 globally distributed Stored Mission Data (SMD) receptors linked to the Centrals via commercial fiber communications, enabling latency improvements by reducing data storage time on the spacecraft. This means over 75% of NPOESS data products will be available at the nation's weather Centrals within 15 minutes from time of observation, with the remainder being delivered in less than 30 minutes.

Each IDP Segment installation consists of the hardware and software necessary to receive and process raw satellite data into Environmental Data Records (EDRs). An architecture with an IDP at each of the four Centrals, each capable of generating all the products, was derived after studying the communications cost to transmit the products from a centralized location. Estimates of an 8- to 10-fold increase in volume from the raw data stream to the products made the concept of distributing products unfeasible. The current design employs an I-P-O model. Input (I) performs the retrieval of all needed input data for a process. Processing (P) executes the scientific processing to create EDRs and IPs from the input data. Output (O) sends products and metadata to the DMS for storage, formatting & delivery. This construct allows the decoupling of algorithms from I/O, facilitating the modifications to products. The use of modular software isolates impacts of changes to the basic architecture and provides for rapid, low impact recovery from hardware and software failures. Additionally, granule based processing allows the generation of high quality products within latency timelines.

Bibliography

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