NPOESS INSTRUMENTS: THE FUTURE OF METSAT OBSERVATIONS

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BACKGROUND

The past four decades have seen a tremendous growth in the use of weather satellites for both civilian and military applications. The maturation of visible-infrared imagery from geosynchronous and polar orbits has become familiar to vast television audiences and military planners as well as a wide array of geophysical, oceanographic, and atmospheric scientists.

The NOAA civilian polar orbiting satellites began in 1960 and evolved over time to become the POES (Polar-orbiting Operational Satellite) program. The military developed and operated their own distinct military operational satellites starting in 1965 under what became the Defense Meteorological Satellite Program (DMSP). During the Cold War, a dual system was required out of military necessity and differences between military and civilian user community needs.

Many government studies have been conducted to assess the value of converging the two systems into a single system. Most studies recommended retaining the separate systems. A 1993 tri-agency study by DoD, NOAA, and NASA recommended that a single converged system should replace the current separate systems. With the end of the Cold War, Congressional interest in saving money, and the increased cooperation between the nation's weather services, the concept of a converged system was included as an initiative in the Vice President's National Performance Review. A Presidential Decision Directive, signed in May of 1994, directed the convergence of the polar orbiting weather satellites systems into a single national system. An Integrated Program Office (IPO) within NOAA was established in October 1994 as a result of the signing of a tri-agency Memorandum of Agreement (MOA) in May 1994. The new converged system was identified as the National Polar-orbiting Operational Environmental Satellite System (NPOESS). The IPO was staffed with representatives of Department of Commerce, Department of Defense and NASA. Figure 1 is a notional system configuration.

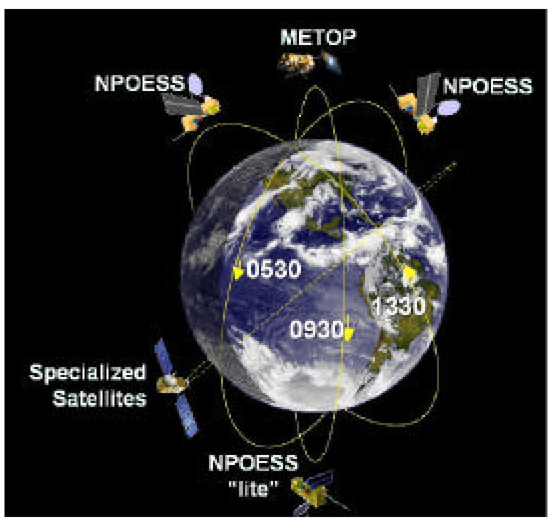

Figure 1. The NPOESS System Constellation

NPOESS is also charged to incorporate new technologies, especially from NASA, foster international cooperation, and, as the National Performance Review directed, save up to $ 1.3 B over operating separate systems. Current estimates indicate combined savings of greater than $ 1.8 B at this point.

NATIONAL IMPORTANCE

The goal of NPOESS is to dramatically improve the nation’s space-based, remote sensing capabilities for Environmental Monitoring. Both the civilian and military sectors depend upon polar-orbiting, remotely sensed weather data. Timely, accurate, and cost-effective public warnings and forecasts of severe weather events reduce the potential loss of human life, property, and agriculture, as well as advancing the national economy. NPOESS support of commercial and general aviation, agriculture, and maritime communities are aimed at increasing U.S. productivity. The NPOESS will allow DoD to shift the current tactical and strategic focus from “coping with and avoiding the weather” to “anticipating and exploiting” atmospheric and space environmental conditions. NPOESS has also “converged” the needs of the operational users with the needs of the science community in the case of the VIIRS (Visible Infrared Imaging Radiometer Suite). By addressing NASA scientific and climatic requirements as part of the VIIRS, important climatic data continuity is achieved while implementing NPOESS.

GETTING THERE

Over the next decade, NPOESS will evolve into the full operational capability as shown in Figure 2.

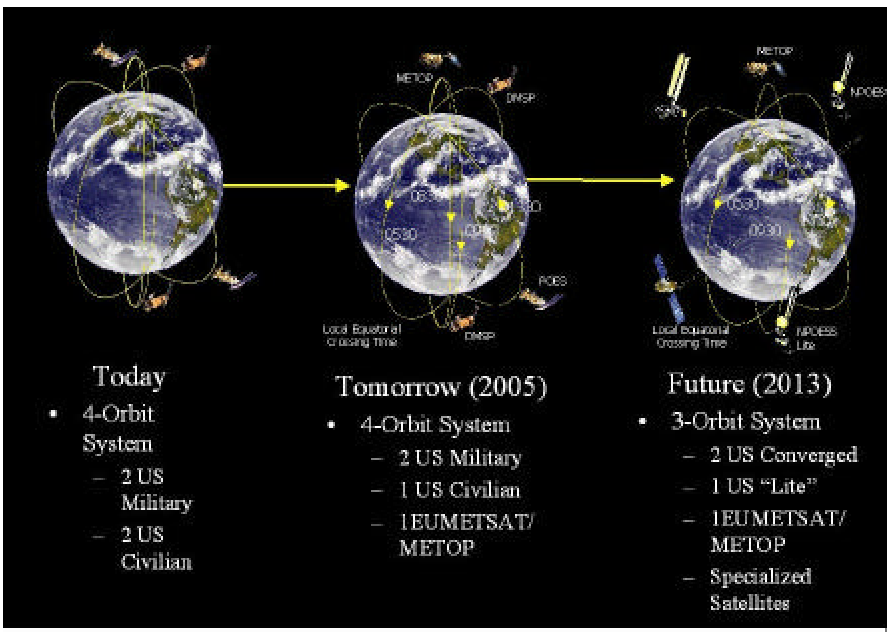

Figure 2. A Possible Evolution of the NPOESS Constellation

The IPO is currently managing two major types of competitive contractual programs: instrument development and Total System Program Responsibility. This means Figure 2 is more notional until a TSPR contractor is selected in 2002.

Currently, the U.S. operates two polar-orbiting systems with two Defense Meteorological Satellite Program (DMSP) spacecraft and two Department of Commerce Polar-orbiting Operational Environment Satellite (POES) platforms. By 2005, METOP will become operational to supplement the scheduled U.S. remaining satellites. In addition, a risk reduction effort, the NPOESS Preparatory Program (NPP), which is a joint NPOESS-NASA effort, will join the multinational operational satellites to provide data continuity for the NASA EOS program and risk reduction to the NPOESS program. NPP will be carrying three major NPOESS instruments: the VIIRS, the CrIS (Cross-track Infrared Sounder) and the NASA ATMS (Advanced Technology Microwave Sounder). NPP will help the IPO to assess the operability of the instruments as well as the C3 network and EDR (Environment Data Record Performance). Figure 3 is the planned NPOESS transition in more detail.

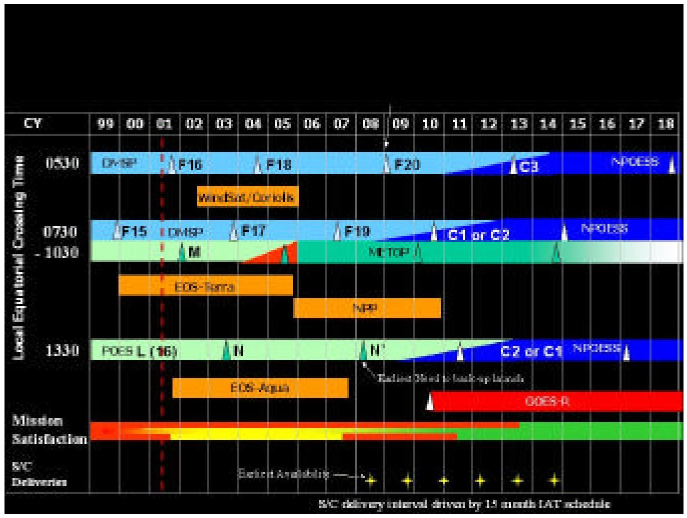

Figure 3 – The NPOESS Schedule

The Integrated program Office (IPO) is responsible for the operational deployment and operation of the NPOESS as early as 2008. The NPOESS will remain operational for at least ten years and provide global data for meteorological, oceanographic, and solar-geophysical users by disseminating the data to worldwide users. These data will be delivered in the form of Environmental Data Records (EDRs) in compliance with the Integrated Operational Requirements Document (IORD),which incorporates the DOC and DoD operational mission requirements. Figure 4 relates the IORD EDRs to the NPOESS-developed instruments.

NPOESS INSTRUMENTS

The Requests for Proposal (RFPs) were released in April 1997 for the NPOESS sensor development effort. The IPO awarded nine sensor development efforts in July 1997. Because of the technical complexity and risk involved with these five particular payload suites below, two competitive contracts per sensor (except for GPSOS) were awarded to begin sensor development and risk mitigation. These sensors include: VIIRS - Raytheon; CMIS - Conical Microwave Imager/Sounder - Ball Aerospace and Boeing; CrIS - ITT; OMPS - Ozone Mapper/Profiler Suite - Ball Aerospace; GPSOS - Global Positioning System Occultation Sensor - Saab -Ericsson. Posters on VIIRS, OMPS, and CrIS will also be presented at this conference. All NPOESS instruments will provide capabilities well in excess of current operational sensors. The sensors and instruments on NPOESS will operate the breadth of the electromagnetic spectrum from 100 MHz to the UV for earth observations and into the X-ray region for the space environment.

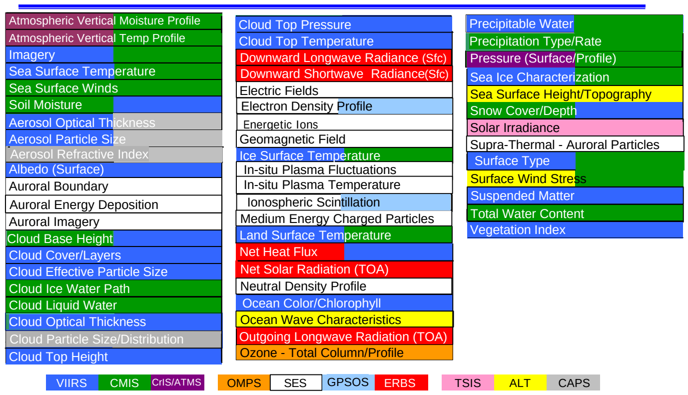

Figure 4 – EDR Allocation by NPOESS Sensor

NPOESS BENEFITS AND PROMISE

NPOESS will be providing an astonishing amount of environmental and climatic data from many advanced sensors beginning in the next few years. VIIRS alone will be capable of providing up to nearly 900 Gigabits of data per day. With the tight accuracy, precision, and uncertainty constraints of the EDRs, NPOESS will contribute to more accurate forecasts, which are critical to the protection of life, safety, and property. The military sector will also be well served with NPOESS data to central forecast centers and remotely located field terminals. Since weather permeates all aspects of military operations, NPOESS data will contribute to excellent situational awareness for unit commanders at many echelons. Situational awareness is critical to combat planning, air superiority and, ultimately, winning the war.

Figure 5 shows how far remote sensing has come from the early 1960's to the end of the 20th century. NPOESS will lead the way into the 21st century for remote sensing.

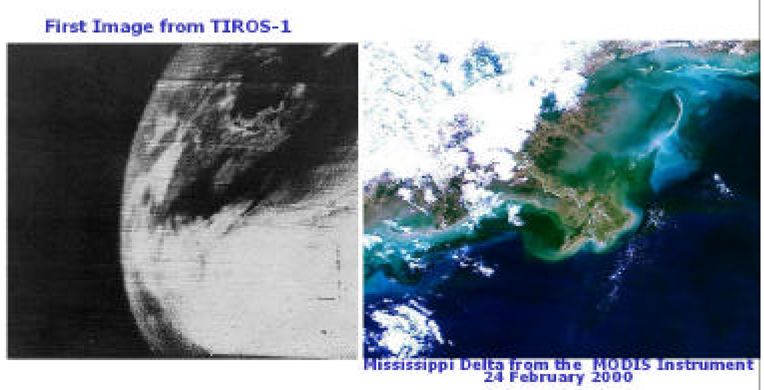

Figure 5. Imagery: Yesterday and Today.