LESSONS LEARNED AND HERITAGE APPLICATION FOR DEVELOPMENT OF THE MICROWAVE IMAGER/SOUNDER (MIS)

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ABSTRACT

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) Integrated Program Office (IPO) and the Naval Research Laboratory (NRL) are currently developing the Microwave Imager/Sounder (MIS) radiometer. MIS will collect global imagery and sounding data. Using algorithms developed in conjunction with the flight hardware and software, data will be processed to produce microwave imagery and other specialized meteorological and oceanographic products. MIS contributions to NPOESS include: All-weather capability (heavy clouds or light rain), soil moisture, sea surface winds, atmospheric vertical temperature, atmospheric vertical moisture, all-weather sea surface temperature, and cloud characterization (liquid; integrated water). These products will be processed and disseminated to data users by the Departments of Defense and Commerce in the form of Raw Data Records (RDR), Temperature Data Records (TDR), Sensor Data Records (SDR), and Environmental Data Records (EDR). MIS is scheduled to launch on the NPOESS C2 spacecraft in 2016 and is planned for the C3 and C4 subsequent launches.

The MIS sensor data products are critical to weather forecasting in support of effective operations planning. The importance of MIS-related measurements to meteorology and weather forecasting is already demonstrated by the role of measurements from several MIS-legacy sensors. As such, heritage design and experience will be used to the greatest extent practical to ensure legacy microwave weather and climate data continuity is maintained, while reducing developmental and programmatic risk to the MIS program. MIS heritage is defined as the Defense Meteorological Satellite Program (DMSP) and the Polar-orbiting Environmental Satellites (POES).

Lessons learned and heritage experience for MIS implementation originates from: 1) the Conical-scanning Microwave Imager/Sounder (CMIS), the NPOESS predecessor to MIS; 2) WindSat, the risk reduction instrument for CMIS; and 3) other MIS-legacy sensor algorithms.

The CMIS sensor program was terminated in mid-2006 due to difficulty experienced in exercising control over requirements and their interpretation, leading to both a high-cost development and high-risk program. The fundamental premise of its successor MIS is to reduce development and program risk through maximized use of heritage design and experience. Because CMIS had completed preliminary design and was nearing critical design phase before its termination, many programmatic and technical lessons learned are being applied to ensure a successful MIS development and deployment.

WindSat, developed and built by NRL, was launched in January 2003 and continues to provide critical ocean surface wind vector measurements for the U.S. Navy. WindSat also measures other environmental parameters such as sea surface temperature, precipitable water, integrated cloud liquid water, and rain rate. In addition to utilizing the WindSat heritage design capabilities, other WindSat risk reduction activities for MIS are algorithm development, implementation of technical lessons learned; and utilization of WindSat data to develop MIS sensor calibration, data exploitation and integration applications.

Similar to the sensor hardware development, the MIS algorithms will be developed using a low-risk approach based on experience with legacy systems: Sounding from the DMSP Special Sensor Microwave Imager (SSM/I) and Imager/Sounder (SSMIS); soil moisture and sea surface temperature from the Earth Observing System (EOS) Advanced Microwave Scanning Radiometer (AMSR-E); and sea surface wind direction from WindSat.

This paper will discuss the heritage and lessons learned application in the development of MIS, with concentration on CMIS, WindSat, and other MIS-legacy sensors.