Satellite Systems - Meteorological Systems

Providing the systems with which to conduct military weather observations from space is presently the mission of the Defense Meteorological Satellite Program (DMSP), which maintains a constellation of at least two operational weather satellites in polar orbits about 450 miles above the earth. DMSP satellites now carry primary sensors that provide images of cloud cover over the earth's surface during both day and night, and they also carry other sensors that provide additional types of data on weather and on the space environment.

The first DMSP satellites were developed by a program office physically located with Space Systems Division but reporting to the National Reconnaissance Office (NRO), which needed analyses of cloud cover over Eurasia to plan its photographic reconnaissance. The program office awarded a development contract for weather satellites employing television cameras to RCA in 1961. DMSP Block I began with five launch attempts on Scout launch vehicles during 1962 and 1963, all but one of which failed. Later Block I launches on Thor Agena and Thor Burner I vehicles were more successful. Two launches in 1964 using Thor Agena vehicles placed two Block I satellites in orbit during each launch and provided enough weather imagery for strategic purposes for the first time. Six launch attempts during 1965 and 1966 employed a new Thor upper stage known as Burner I for DMSP payloads, including two more Block I, three Block II, and one Block III.

Besides providing weather information for strategic purposes, early DMSP satellites also provided the earliest tactical uses of space-based weather information. A Block I satellite launched on 18 March 1965 secretly provided weather data for North and South Vietnam to a ground station at Tan Son Nhut Air Base in Saigon. This was the world's first use of satellite imagery to support tactical military operations. The Block II satellites were also modified for direct readout of meteorological data so that they could be used for planning tactical air operations in Southeast Asia while continuing to provide weather information for strategic reconnaissance. The single Block III satellite, launched in 1965, was equipped only for tactical uses in Southeast Asia.

Wider military uses for weather data led to an important change in the program's reporting structure when, on 1 July 1965, it became a program office under Space Systems Division. Development of more capable and more complex satellites also came to fruition with DMSP Block 4 satellites, seven of which were launched during 1966-1969. Television resolution improved from 3 to 4 nautical miles with Blocks I and II to 0.8 to 3 nautical miles with Block 4, along with many other improvements in the sophistication of secondary sensors. Block 5A satellites introduced the Operational Line Scan (OLS) sensor, which provided images of clouds in both visual and infrared spectra. Television resolution improved to 0.3 nautical miles in daylight. Three Block 5A, five 5B, and three 5C satellites were launched during 1970-1976 on Thor Burner II launch vehicles. Larger and much more sophisticated Block 5D-1 satellites were also developed during the 1970s, but only five were built. This proved to be a mistake in 1980, when the fifth 5D-1 satellite was lost in a launch failure, and the operational 5D-1 satellites in orbit ceased to function prematurely. From August 1980 to December 1982, when the first Block 5D-2 satellite was successfully launched, meteorological data was supplied to DOD entirely by civilian satellites. That mistake was not repeated with Block 5D-2 satellites, nine of which were launched during 1982-1997 on Atlas E and Titan II launch vehicles.

In 1989, Space Systems Division began the procurement of five Block 5D-3 satellites from General Electric (later acquired by Lockheed Martin). The 5D-3 satellites featured advanced spacecraft buses as well as significant enhancements in their suite of sensors, power and communications subsystems, and expected lifetimes. Launches of the fully developed 5D-3 satellites began with F-16 in 2003, using the last Titan II vehicle. Satellite F-17 was launched on a Delta IV vehicle in 2006 and F-18 on an Atlas V in 2009. By early 2014, two more Block 5D-3 satellites were waiting to replenish the constellation.

U.S. civilian weather satellites were operated by the National Oceanic and Atmospheric Administration (NOAA). Proposals to merge the civilian and military meteorological systems had been made from time to time since the early 1970s. On 5 May 1994, President Clinton issued a presidential decision directive ordering the convergence and eventual merger of the two programs into a new national space-based system for environmental monitoring. SMC was responsible for carrying out the major systems acquisitions, including satellites and launch vehicles. However, NOAA was to have overall responsibility for operating the new system, which was soon named the National Polar-orbiting Operational Environmental Satellite System (NPOESS). A Tri-Agency Integrated Program Office (IPO) made up of representatives from NOAA, NASA, and DOD would be responsible for carrying out major systems acquisitions, including satellites and launch vehicles. However, NOAA would have overall responsibility for operating the new system, which was soon named the National Polar-orbiting Operational Environmental Satellite System (NPOESS). A major step in convergence occurred in 1998, when the new Satellite Operations Control Center (SOCC) for NPOESS took over control authority of the existing DMSP system.

The merger of the two programs proved to be an unsuccessful experiment. After a phase of competitive development, SMC issued a contract to TRW (acquired by Northrop Grumman) in 2002 to further develop, deploy, and operate NPOESS under the direction of the NPOESS Integrated Program Office (IPO). Unfortunately, the development program suffered a long period of cost increases and schedule delays. Despite restructuring by DoD in 2006, the problems continued. A presidential task force formed to examine the problem in 2009 concluded that the IPO's management structure was fundamentally flawed, and it recommended dividing NPOESS into civilian and military programs once again. NOAA began the development of a follow-on system known as the Joint Polar Satellite System (JPSS), and DoD established the Defense Weather Satellite System (DWSS) in 2010 as the follow-on program for DMSP and the DoD replacement for NPOESS.

Nevertheless, Congress cancelled funding for DWSS for 2012, and the Air Force formally terminated design work on the new system in April 2012. Despite the cancellation, Congress provided funding to begin work on a new development program for a space-based military weather system in its appropriations for 2014. Fortunately, the long projected on-orbit lifetimes of Block 5D-3 satellites along with the two satellites not yet launched allowed a cautious approach to a new DoD weather system. One possibility under consideration was a concept known as disaggregation, which would involve placing various weather sensors on different satellites.