NRL sensor to measure natural airglow in the upper atmosphere

The second of five Special Sensor Ultraviolet Limb Imager (SSULI) remote sensing instruments, developed by the Naval Research Laboratory, was launched on November 4, 2006 on board the DMSP F-17 satellite. SSULI is the first operational instrument of its kind and provides a new technique for remote sensing of the ionosphere and thermosphere from space. SSULI's measurements will provide scientific data supporting military and civil systems and will assist in predicting atmospheric drag effects on satellites and reentry vehicles.

A Boeing Delta 4 vehicle launched the Air Force's Defense Meteorological Satellite Program (DMSP) F-17 satellite and the SSULI sensor into low earth orbit from Vandenberg Air Force Base, California. SSULI will be powered on and start initial sensor checkout 30 days after launch.

"Characterization of the Earth's upper atmosphere and ionosphere is a critical goal for Department of Defense (DoD) and civilian users," said Andrew Nicholas, the SSULI Principal Investigator at NRL. He discussed the significance of the planned SSULI observations, saying, "The upper atmosphere affects many systems from global to tactical scales. These systems include GPS positioning, HF radio communications, satellite drag and orbit determination, and over-the-horizon radar. Both the neutral atmosphere and the ionosphere are driven by solar and geomagnetic forcing that occur on many timescales ranging from short (minute, hours) to medium (days to months) to long (years). Real-time global observations that yield altitude profiles of the ionosphere and neutral atmosphere, over an extended period of time (DMSP through the year 2016) will fill a critical need."

SSULI measures vertical profiles of the natural airglow radiation from atoms, molecules, and ions in the upper atmosphere and ionosphere from low earth orbit aboard the DMSP satellite. It builds on the successes of the NRL High Resolution Airglow/Aurora Spectroscopy (HIRAAS) experiment recently flown aboard the Space Test Program (STP) Advanced Research and Global Observations Satellite (ARGOS). SSULI makes measurements from the extreme ultraviolet (EUV) to the far ultraviolet (FUV) over the wavelength range of 80 nm to 170 nm with 2.4 nm resolution. SSULI also measures the electron density and neutral density profiles of the emitting atmospheric constituents. SSULI uses a spectrograph with a mirror capable of scanning below the satellite horizon from 10 degrees to 27 degrees every 90 seconds. These observations represent a vertical slice of the Earth's atmosphere from 750 km to 50 km in depth. Use of these data enables the development of new techniques for global ionospheric remote sensing and new models of global electron density variation.

Commenting on the practical application of the instrument, Mr. Ken Weldy, the Program Manager at NRL said, "Since natural atmospheric phenomena can disrupt day-to-day operations in the military use of space, we look forward to providing SSULI operational products to feed into the Global Assimilation of Ionospheric Measurements (GAIM) model. This will provide an important piece of the characterization of the Earth's upper atmosphere and ionosphere."

An extensive data processing suite was developed to support on-orbit observations and flight operations. It includes data reduction software using unique science algorithms developed at NRL, comprehensive data validation techniques, and graphical interfaces for the user community. After launch, the SSULI sensor, software, and derived atmospheric specification will under go an extensive validation. After validation, SSULI products will be distributed by the Air Force Weather Agency to support operational DoD systems.

Source: Naval Research Laboratory