# Hitching a ride on SLS to study solar particles

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A miniature research spacecraft, the CubeSat to study Solar Particles (CuSP), is one of the lucky projects that will hitch a ride on the historic first flight of NASA's Space Launch System (SLS) in 2018. The microsatellite will observe interplanetary magnetic fields and energetic particles in the solar wind.

Exploration Mission 1 (EM-1) is the maiden flight of SLS that will send the unmanned Orion spacecraft on a trip around the moon. Besides fulfilling its main mission, the EM-1 also offers an opportunity for secondary payloads to be delivered into space. NASA decided to select CuSP and 12 other CubeSat projects for a piggyback ride on SLS within the second stage of the rocket from which they will be deployed.

"We are delighted to have secured a ride on NASA's next-generation launch system," Mihir Desai, the principal investigator for CuSP at the Southwest Research Institute (SwRI) in San Antonio, Texas, told Astrowatch.net.

CuSP, being developed by SwRI, is a shoebox-sized, six-unit CubeSat nanosatellite. CuSP will orbit the sun in interplanetary space, measuring incoming radiation that can create a wide variety of effects at Earth. The satellite is currently in the design phase.

"We are in the design phase, we have built one of the instruments and are testing it in the lab. We expect to deliver the spacecraft in June 2017," Desai said.

CuSP will carry three scientific instruments. The SwRi-built Suprathermal Ion Sensor (SIS), will measure angular and energy distributions of around three to 70 keV/e protons from the sun and interplanetary space. The Miniaturized Electron and Proton Telescope (MeRIT)—is designed by NASA's Goddard Space Flight Center to measure energy and composition of protons and heavy ions such as iron in the two to 50 MeV/nucleon energy range. The Vector Helium Magnetometer (VHM), built by NASA's Jet Propulsion Laboratory, will study the strength and direction of the interplanetary magnetic field.

In layman's terms, SIS and MeRIT will measure solar particles that are accelerated near the sun and in interplanetary space by solar flares and coronal mass ejections (CMEs). When CMEs reach Earth, they can interact with Earth's magnetic field, creating geomagnetic storms.

"The SIS instrument measures the properties of suprathermal ions. These ions escape ahead of strong interplanetary shocks that accompany CMEs. These ejections cause major disturbances in the near-Earth space environment," Desai explained.

It's worth observing that when it comes to space weather forecasting, current systems are able to provide up to about one hour of advance warning. The suprathermal ions that SIS will detect can provide up to approximately 24-hour warning of the upcoming CME shock waves.

"Thus, the CuSP mission is a pathfinder for multi-point space weather beacons, which are critically needed to provide inputs to space weather forecasting and prediction models," Desai noted.

The MeRIT instrument could provide crucial information for future deep space missions, as it measures solar particles that increase the radiation hazards for astronauts and space-based technology like communication satellites.

Initially, the satellite was designed to fly in low-Earth orbit to study solar particles near Earth's poles. However, when NASA announced plans to fly CubeSats on the SLS test, the team realized they had an opportunity to conduct interplanetary space weather research.

The CuSP mission could be the first step toward a network of space science stations. Due to the relatively low cost of CubeSats, as well as their small mass and standardized design, they could be used in the future to create a network of space weather monitoring satellites.

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