

Ready for launch: CU Boulder instrument suite to assess space weather

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A new satellite mission carrying CU-Boulder space weather instruments is expected to help mitigate damage to satellites and communications systems caused by powerful solar storms. Credit: NASA

A multimillion dollar University of Colorado Boulder instrument

package expected to help scientists better understand potentially damaging space weather is now slated to launch aboard a National Oceanic and Atmospheric Administration satellite on Saturday, Nov. 19.

Designed and built by CU-Boulder's Laboratory for Atmospheric and Space Physics (LASP), the instrument suite known as the Extreme Ultraviolet and X-ray Irradiance Sensors (EXIS) is the first of four identical packages that will fly on four NOAA weather satellites in the coming decade. EXIS will measure energy output from the sun that can affect satellite operations, telecommunications, GPS navigation and power grids on Earth as part of NOAA's next-generation Geostationary Operational Environmental Satellites -R Series (GOES-R).

"We are ready for launch and are looking forward to a successful mission," said LASP Senior Research Scientist Frank Eparvier, principal investigator on the EXIS project. "These extremely sensitive instruments will help scientists better understand solar events and help to mitigate the effects of space weather on Earth."

NASA's contract with CU Boulder on behalf of NOAA to design, build, test, deliver and scientifically support the four instrument packages is for roughly \$105 million. The GOES-R satellite was built by Lockheed Martin Space Systems Co. in Littleton, Colorado and will be launched on an Atlas V rocket built by United Launch Alliance, headquartered in Centennial, Colorado.

EXIS consists of two LASP instruments, including XRS, an X-ray sensor that can determine the strength of solar flares and provide rapid alerts to scientists, said Eparvier. Large solar flares, equivalent to the explosion of millions of atomic bombs, can trigger "proton events" that send charged atomic particles flying off the sun and into Earth's atmosphere in just minutes. They can damage satellites, trigger radio blackouts and even threaten the health of astronauts by penetrating spacecraft shielding, he

said.

"The XRS gives the first alert that a solar flare is occurring, providing NOAA with details on its timing, magnitude and direction within seconds," said Eparvier.

The second EXIS instrument, EUVS, will monitor solar output in the [extreme ultraviolet](#) portion of the electromagnetic spectrum, which is completely absorbed by Earth's upper atmosphere, said Eparvier. When the extreme UV light wavelengths penetrate the upper atmosphere during active periods on the sun, they can break apart, ionize and change the properties of the atmosphere through which satellites fly and radio waves propagate.

Fluctuations in extreme UV wavelengths from the sun ionize the [upper atmosphere](#) and interfere with communications like cell phones and GPS signals, said Eparvier. In addition, such fluctuations can create satellite drag, causing spacecraft to slowly fall out of orbit and burn up months or years before such events are anticipated.

"Modern technology has made us vulnerable to extreme variations in [space weather](#) that can have significant effects on Earth communications," Eparvier said. "Extreme solar activity can cause problems for power companies all around the world, for example, in part because they all are interconnected."

NOAA's GOES satellites are a series of weather satellites that help scientists make timely and accurate weather forecasts. Two GOES satellites are now in geostationary orbit at a height of about 22,000 miles, with one focusing on the east part of the Americas overlapping with another focusing on the west. Satellites in geostationary orbits complete one revolution in the same amount of time it takes for the Earth to rotate once on its polar axis, allowing them to "stare" at a

portion of Earth, said Eparvier.

LASP also built key solar instruments for NASA's Van Allen Probes mission launched in 2012 to study Earth's radiation belts, and designed and built a \$32 million instrument package for NASA's Solar Dynamics Observatory that launched in 2010.

More than 100 LASP personnel ranging from scientists and engineers to technicians, programmers and students have worked on the EXIS program since 2006. CU Boulder's LASP will support EXIS on the four NOAA GOES satellite missions through spacecraft integration, testing, launch and commissioning, said Eparvier.

Each instrument package, roughly the size of a large microwave oven and weighing 66 pounds, is three times heavier than normal due to extra shielding that protects them from high-energy particle penetration. LASP's Mike Anfinson is the EXIS project manager.

Provided by University of Colorado at Boulder

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