NASA sounding rocket launches, studies heating of sun's active regions

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NASA’s MaGIXS-2 sounding rocket mission successfully launched from White Sands Missile Range in New Mexico on July 16. Credit: United States Navy

Investigators at NASA's Marshall Space Flight Center in Huntsville, Alabama, will use observations from a recently-launched sounding rocket mission to provide a clearer image of how and why the sun's corona grows so much hotter than the visible surface of Earth's parent star. The MaGIXS-2 mission—short for the second flight of the Marshall Grazing Incidence X-ray Spectrometer—launched from White Sands Missile Range in New Mexico on Tuesday, July 16.

The mission's goal is to determine the heating mechanisms in active regions on the sun by making critical observations using X-ray spectroscopy.

The sun's surface temperature is around 10,000 degrees Fahrenheit—but the corona routinely measures more than 1.8 million degrees, with active regions measuring up to 5 million degrees.

Amy Winebarger, Marshall heliophysicist and principal investigator for the MaGIXS missions, said studying the X-rays from the sun sheds light on what's happening in the solar atmosphere—which, in turn, directly impacts Earth and the entire solar system.

X-ray spectroscopy provides unique capabilities for answering fundamental questions in solar physics and for potentially predicting the onset of energetic eruptions on the sun like solar flares or coronal mass ejections. These violent outbursts can interfere with communications satellites and electronic systems, even causing physical drag on satellites

as Earth's atmosphere expands to absorb the added solar energy.

"Learning more about these solar events and being able to predict them are the kind of things we need to do to better live in this solar system with our sun," Winebarger said.

The NASA team retrieved the payload immediately after the flight and has begun processing datasets.

The MaGIXS-2 sounding rocket team stand on the launchpad in White Sands, New Mexico prior to launch on July 16, 2024. Credit: United States Navy

"We have these active regions on the sun, and these areas are very hot,

much hotter than even the rest of the corona," said Patrick Champey, deputy principal investigator at Marshall for the mission. "There's been a big question—how are these regions heated? We previously determined it could relate to how often energy is released. The X-rays are particularly sensitive to this frequency number, and so we built an instrument to look at the X-ray spectra and disentangle the data."

Following a successful July 2021 launch of the first MaGIXS mission, Marshall and its partners refined instrumentation for MaGIXS-2 to provide a broader view for observing the sun's X-rays. Marshall engineers developed and fabricated the telescope and spectrometer mirrors, and the camera. The integrated instrument was exhaustively tested in Marshall's state-of-the-art X-ray & Cryogenic Facility. For MaGIXS-2, the team refined the same mirrors used on the first flight, with a much larger aperture and completed the testing at Marshall's Stray Light Test Facility.

A Marshall project from inception, technology developments for MaGIXS include the low-noise CCD camera, high-resolution X-ray optics, calibration methods, and more.

Winebarger and Champey said many of the team members started their NASA careers with the project, learning to take on lead roles and benefitting from mentorship.

"I think that's probably the most critical thing, aside from the technology, for being successful," Winebarger said. "It's very rare that you get from concept to flight in a few years. A young engineer can go all the way to flight, come to White Sands to watch it launch, and retrieve it."

NASA routinely uses sounding rockets for brief, focused science missions. They're often smaller, more affordable, and faster to design

and build than large-scale satellite missions, Winebarger said. Sounding rockets carry scientific instruments into space along a parabolic trajectory. Their overall time in space is brief, typically five minutes, and at lower vehicle speeds for a well-placed scientific experiment.

The MaGIXS mission was developed at Marshall in partnership with the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. The Sounding Rockets Program Office, located at NASA Goddard Space Flight Center's Wallops Flight Facility, provides suborbital launch vehicles, payload development, and field operations support to NASA and other government agencies.

Provided by NASA

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