National Aeronautics and Space Administration

Sounding Rockets Program Office
Quarterly Newsletter

# Rocket Report

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2024

## INSIDE



Cover photo:
36.384 UG OAxFORTIS payload team.
Credit: WSMR photo

NASA Photos/Berit Bland.

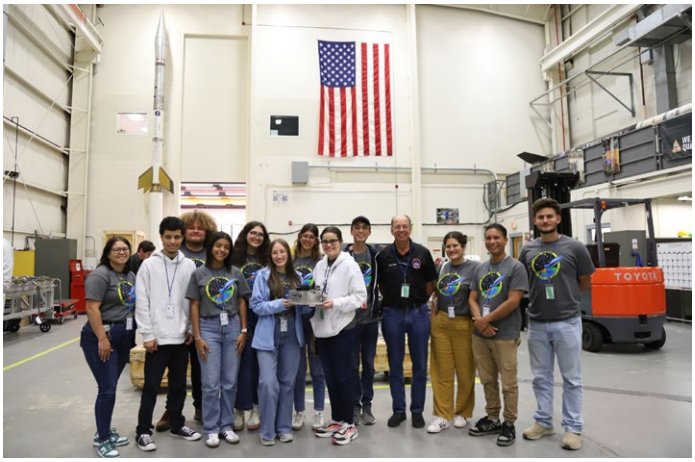
36.385 NS MaGIXS launch.
Credit: WSMR Photo/Chirs Bohn

# Program News

The third quarter included launches from White Sands Missile Range (WSMR), NM and Wallops Island, VA. Three science missions, two Solar Physics and one Astrophysics, were launched from WSMR and one Student mission from Wallops Island.

A total of 17 sounding rocket missions have been flown during Fiscal Year 2024, which ends on September 30. The success rate for the year was 94%.

The current manifest for FY 2025 includes 18 launches from five different launch sites. Remote campaigns are planned for Andøya Space, Norway, Poker Flat Research Range, AK and Kwajalein, Marshall Islands. Launches are also scheduled for WSMR and Wallops Island.



University of Puerto Rico RockSat–X team with their experiment postflight. Credit: NASA Photo/Berit Bland

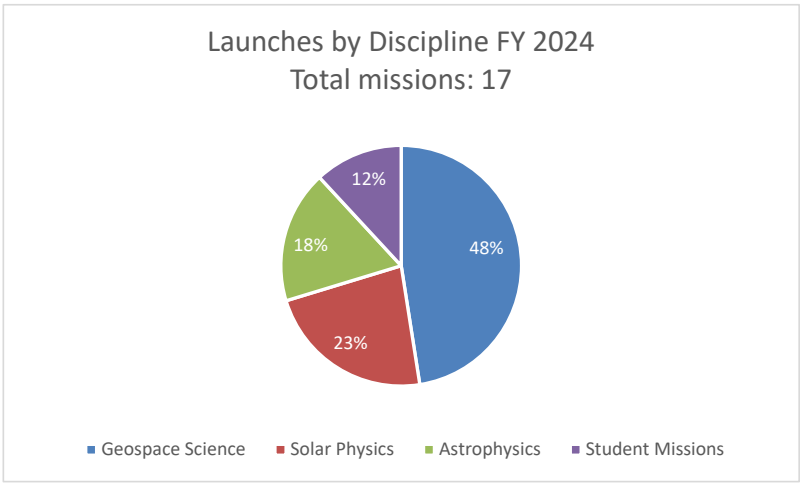



Chart shows missions by Discipline for FY 2024.

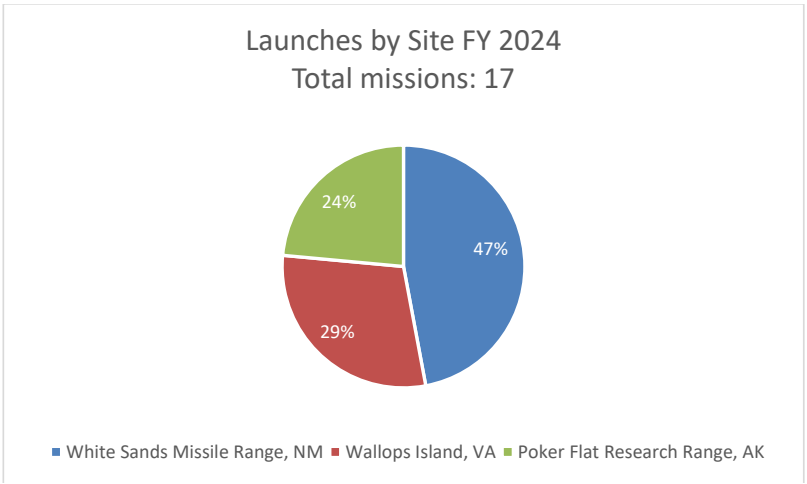



Chart shows missions by Site for FY 2024.

SubTEC–10, a Technology Demonstration mission is scheduled for late FY 2025, and will provide an opportunity for internal and external participants to test new and evolving technologies in a relevant environment.

Two payloads will be launched from Kwajalein, Marshall Islands, for Dr. Barjatya/Embry–Riddle Aeronautical University. The launch window for the mission, Sporadic E Electrodynamics (SEED), is scheduled to open in June 2025.

Poker Flat Research Range, AK, will see two separate campaigns in FY 2025. The first in January and the second in March. A total of 6 payloads will be launched.

## 36.385 NS Winebarger/NASA MSFC - Marshall Grazing Incidence X-ray Spectrometer (MaGIXS) - July 16, 2024

MaGIXS–2 was flown from White Sands Missile Range, NM on July 16, 2024. This was a new instrument with heritage from past experiments.

The scientific goal is to determine the frequency of heating in active region cores by making four critical observations in the soft X–ray wavelength range:

- Derive the relative amount of high temperature plasma in different solar structures
- Measure the elemental abundances in different solar structures
- Compare the temporal variability at high temperatures in different solar structures
- Identify the likelihood of Maxwellian or non–Maxwellian distributions

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. 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.

For this, the second flight, MaGIXS–2, the instrument was reconfigured to a more simplified optical layout that reuses the Wolter–I telescope and blazed varied–line space reflective grating. The field stop at the telescope focal plane and the finite conjugate spectrometer mirror pair have been removed – the telescope now directly feeds the grating. Additionally, an identical but new 2k x 1k CCD camera was built for this flight. The MaGIXS–2 data product will again be overlapping spectroheliograms of at least one solar active region, but with improved resolution, a larger field of view and increased effective area.

MaGIXS team at WSMR.
Credit: WSMR/Ryan Harty

## 46.042 WO Koehler/NASA WFF- RockSat-X - Launched August 13, 2024

RockSat–X was launched from Wallops Island, VA on August 13, 2024. RockSat–X carried student developed experiments and is the third, and most advanced, student flight opportunity. RockSat–X experiments are fully exposed to the space environment above the atmosphere. Power and telemetry were provided to each experiment deck. Additionally, this payload included an Attitude Control System (ACS) for alignment of the payload. These amenities allow experimenters to spend more time on experiment design and less on power and data storage systems.

The following experiments were flown on RockSat–X in 2024:

University of Alabama Huntsville

University of Alberta

Clemson University

College of the Canyons

Community Colleges of Colorado

Northwest Nazarene University

University of Puerto Rico

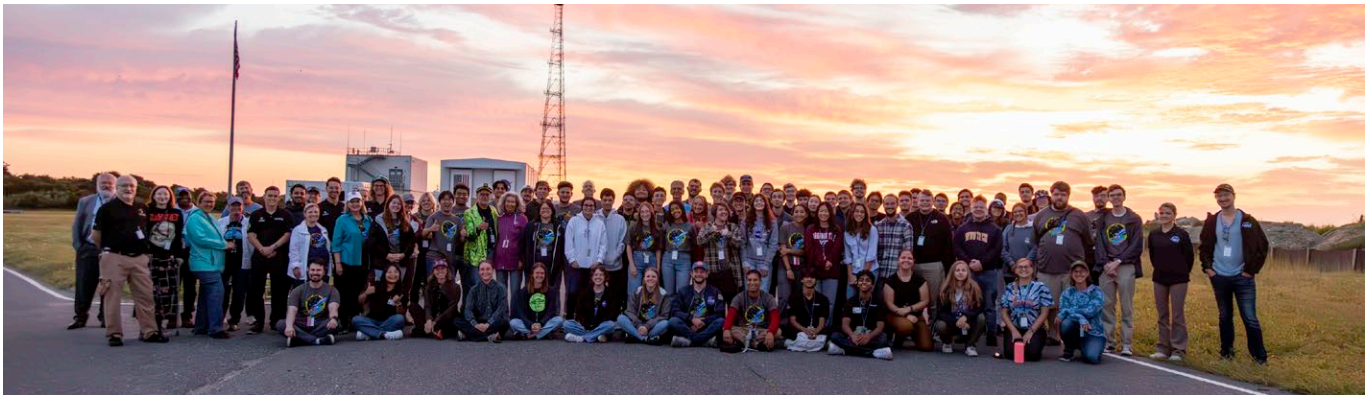
Virginia Tech

West Virginia Space Collaboration

Learn more about Student Flight Projects at:
https://www.nasa.gov/nasa–rocksat–program/

De–integration of RockSat–X experiments.
Credit: NASA Photo/Berit Bland

Experiments returned to students after flight.
Credit: NASA Photo/Berit Bland



RockSat–X teams on Wallops Island, VA.
Credit: NASA Photo/Berit Bland

# Missions Launched:

## 36.384 UG McCandliss/Johns Hopkins University - Off-Axis Far-Ultraviolet Off-Rowland Telescope for Imaging and Spectroscopy (OAxFORTIS)- Launched August 26, 2024

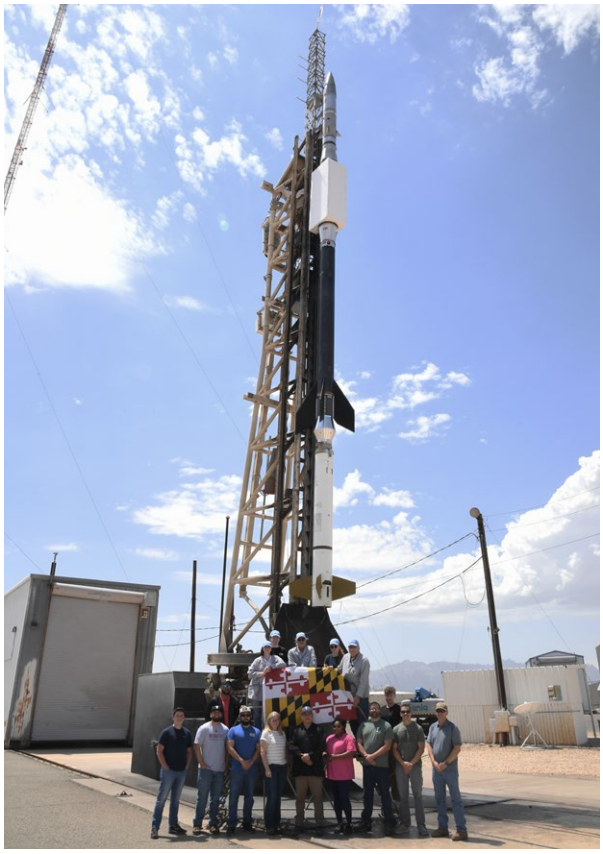
OAxFORTIS was successfully launched from White Sands Missile Range on August 25, 2024.

FORTIS is an innovative multi–object far–UV spectro/telescope featuring a number of new technologies developed with the support of the NASA Astrophysics Research and Analysis (APRA) and James Webb Space Telescope (JWST) programs. Off–Axis FORTIS (OAxFORTIS) is a new version of the largely matured FORTIS instrument evolved into an Off–Axis telescope configuration. This new design eliminates the problem with scattered geo–coronal Ly$\alpha$ that has prevented the FORTIS from making detector background limited observations.

This, the first flight of OAxFORTIS and the fifth of FORTIS, acquired far–UV spectra of the globular cluster Messier 10 (M10). M10 is located in the equatorial constellation of Ophiuchus. The hot Horizontal Branch (HB) of globular clusters is populated by far–UV luminous stars at the end stage of evolution. HB stars lie along a roughly horizontal line in the Hertzsprung–Russell diagram. By the time stars reach the zero–age–horizontal–branch (ZAHB), nucleosynthetic energy generation has for the most part ceased. The temperature, mass, radius, and chemical abundance of the thin radiative atmospheres of stars on the ZAHB offer clues as to their progenitor mass and initial chemical abundance.

The goal was to identify the progenitor populations of the ZAHB in three globular clusters, starting with M10 (this flight) with similar ages and [Fe/H] abundances – as determined from near–UV and visible photometry – but exhibiting significant differences in the distribution of ZAHB temperatures. The objective was to determine the spread of temperature, mass, radius, and abundances of stars on the ZAHB sequence in a region extending from the rc out to ~ rt/2 and provide critical constraints to evolutionary models of stars in globular clusters.

Multiple spectra were observed from hot stars in the globular cluster, which were acquired autonomously using our Zero Order Monitor Interface (ZOMI) to the GSFC provided NextGen MicroShutter Array (NGMSA).



36.384 UG OAxFORTIS payload tem.
Credit: WSMR photo

## 36.366 US Kankelborg/Montana State University - Full-sun Ultraviolet SpecTrograph (FURST) - Launched September 3, 2024

FURST was flown from White Sands Missile Range, NM on September 3, 2024. The goal of this mission was to study and better understand spectra of the "Sun as a Star". FURST was designed to obtain the first high resolution (R > 20, 000), radiometrically calibrated FUV spectra of the Sun as a star, from 121–185 nm. FURST spectra will have applications to solar and stellar physics, climate science, and the interaction of solar UV radiation with comets, moons, and planets.

The immediate science goal is to understand better the processes of chromospheric and coronal heating. The solar spectrum obtained will enable a better understanding of the interaction of solar UV radiation with solar system bodies, the nature of magnetic energy dissipation as a Sun–like star evolves, and the dependence of magnetic activity on stellar mass and metallicity.

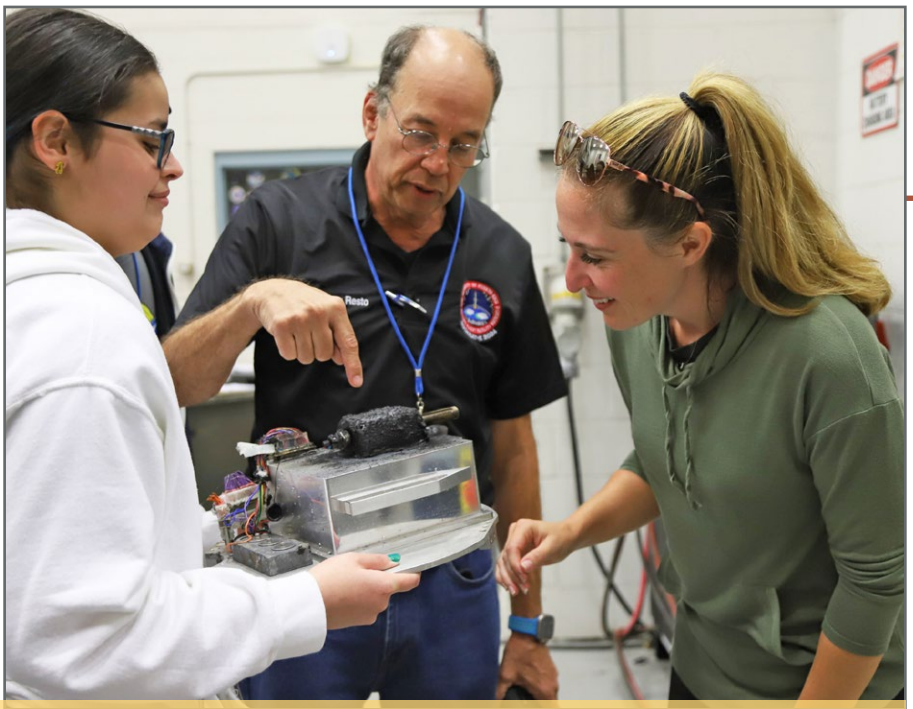
FURST science is cross disciplinary and includes:

Sun as a star:
Comparison of solar and stellar spectra
Heating of solar and stellar atmospheres
Waves and reconnection
Solar cycle variation

Atmospheric, solar system, and heliospheric science:
Earth, planets, moons, comets
Resonant absorption in atmospheres

Post–flight assessment confirms that images taken during flight are not scientifically usable due to saturation by stray light. An investigation into possible sources of the stray light is ongoing and a proposal for a re–flight will be submitted.

FURST payload team at WSMR.
Credit: WSMR Photo/Chirs Bohn



# Picture Place



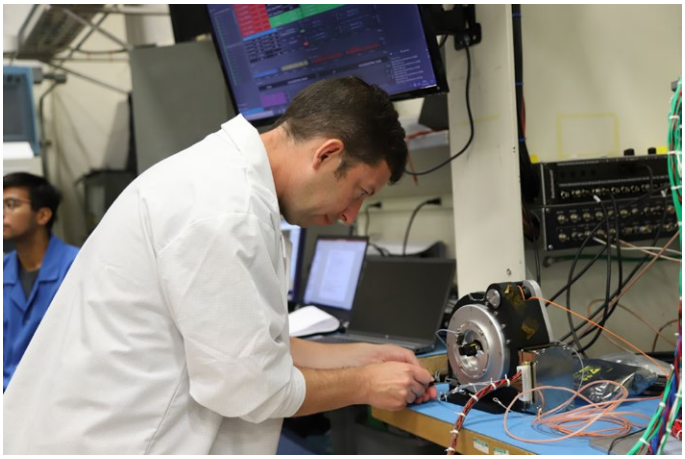
# Integration and Testing

### 36.382 UE Gilchrist/University of Michigan - Beam-Spacecraft Plasma Interaction and Charging Experiment (B-SPICE)

B–SPICE will use a variety of science instruments to study spacecraft neutral–ization via ion emission while firing a high current electron beam. This will be very similar to a mission called Charge 2 that was launched in 1985.

B–SPICE is a tethered rocket experiment dedicated to study the physics of spacecraft charging induced by an electron beam and its mitigation by a plasma contactor and the newly identified ion emission regime. The experiment studies ion current production, plasma plume expansion, and expellant utilization in relation to mitigation effectiveness to understand how the system may scale for magnetospheric experiments.

The B–SPICE launch is scheduled for November 22, 2024 from WSMR, NM.

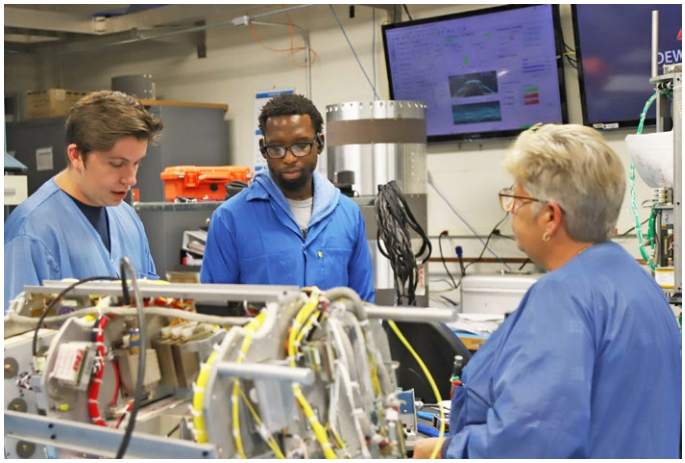


B–SPICE build–up and integration at Wallops.
Credit: NASA Photo/Berit Bland

### 36.380 & 36.381 GE Michell/NASA GSFC - Ground Imaging to Rocket investigation of Auroral Fast Features (GIRAFF)

The goal of GIRAFF is to study the processes responsible for creating the fastest optical variations observable within the aurora. This investigation focuses on two specific mechanisms of energy coupling, namely Electromag–netic Ion Cyclotron (EMIC) wave–particle interactions at low altitude (3000 km) and chorus wave modulation in the equatorial magnetosphere that can have significant impacts on the total energy flux of electrons precipitating from the magnetosphere to the ionosphere/thermosphere. To better understand the mechanisms of these interactions, this investigation targets two different, yet somewhat similar auroral phenomena, namely flickering and fast pulsating aurora, where these wave–particle interactions are manifested as modulations of the auroral luminosity, which typically occur at relatively high frequencies between a few Hz and 15 Hz or more. GIRAFF will accomplish the science goal by launching the two identical rockets through two different types of aurora using a suite of science instruments with previous sounding rocket heritage.

The GIRAFF mission is scheduled for launch from Poker Flat Research Range, AK and the launch window opens January 21, 2025.



GIRAFF build–up and integration at Wallops.
Credit: NASA Photo/Berit Bland

### 46.034, 46.035 & 52.010 UE Conde/University of Alaska - Auroral Waves Excited by Substorm Onset Magnectic Events (AWESOME)

This project will study the density, wind, and composition perturbations that occur in Earth's high latitude thermosphere in response to impulsive local forcing during auroral substorms. It is motivated by the premise that gen–eration of acoustic–gravity waves plays a far greater role in the substorm response than is generally recognized or implemented in current models.

The AWESOME mission is scheduled for launch from Poker Flat Research Range, AK and the launch window opens March 24, 2025.

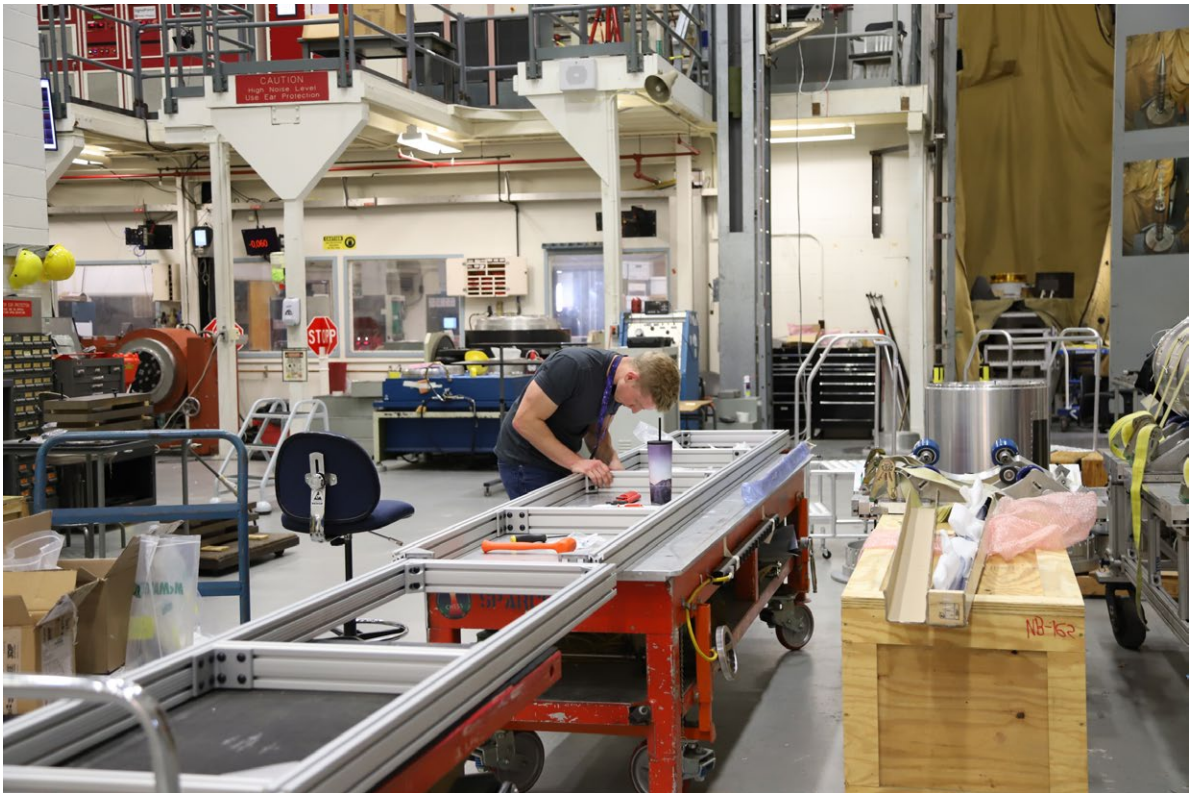
AWESOME ejectable sub–payloads testing at Wallops.
Credit: NASA Photo/Berit Bland

## SCHEDULE FOR NEXT QUARTER

| MISSION | DISCIPLINE | EXPERIMENTER | ORGANIZATION | PROJECT | RANGE | DATE |
|---|---|---|---|---|---|---|
| 36.362 UE | GEOPACE SCIENCE | LEHMACHER | CLEMSON UNIV | VORTEX | NOR | 10/27/24 |
| 41.128 UE | GEOPACE SCIENCE | LEHMACHER | CLEMSON UNIV | VORTEX | NOR | 10/27/24 |
| 36.391 DS | SOLAR & HELIOSPHERIC | TUN | NRL | HERSCHEL 3 | WS | 10/28/24 |
| 36.382 UE | GEOSPACE SCIENCES | GILCHRIST | UNIV OF MICHIGAN | B–SPICE | WS | 11/22/24 |

NOR – Andøya Space, Norway
WS – White Sands Missile Range, NM

## MISCELLANEA




Construction of a new horizontal deployment fixture in the Testing and Evaluation Lab.
Credit: NASA Photo/Berit Bland