National Aeronautics and Space Administration

Sounding Rockets Program Office Quarterly Newsletter

Rocket Report

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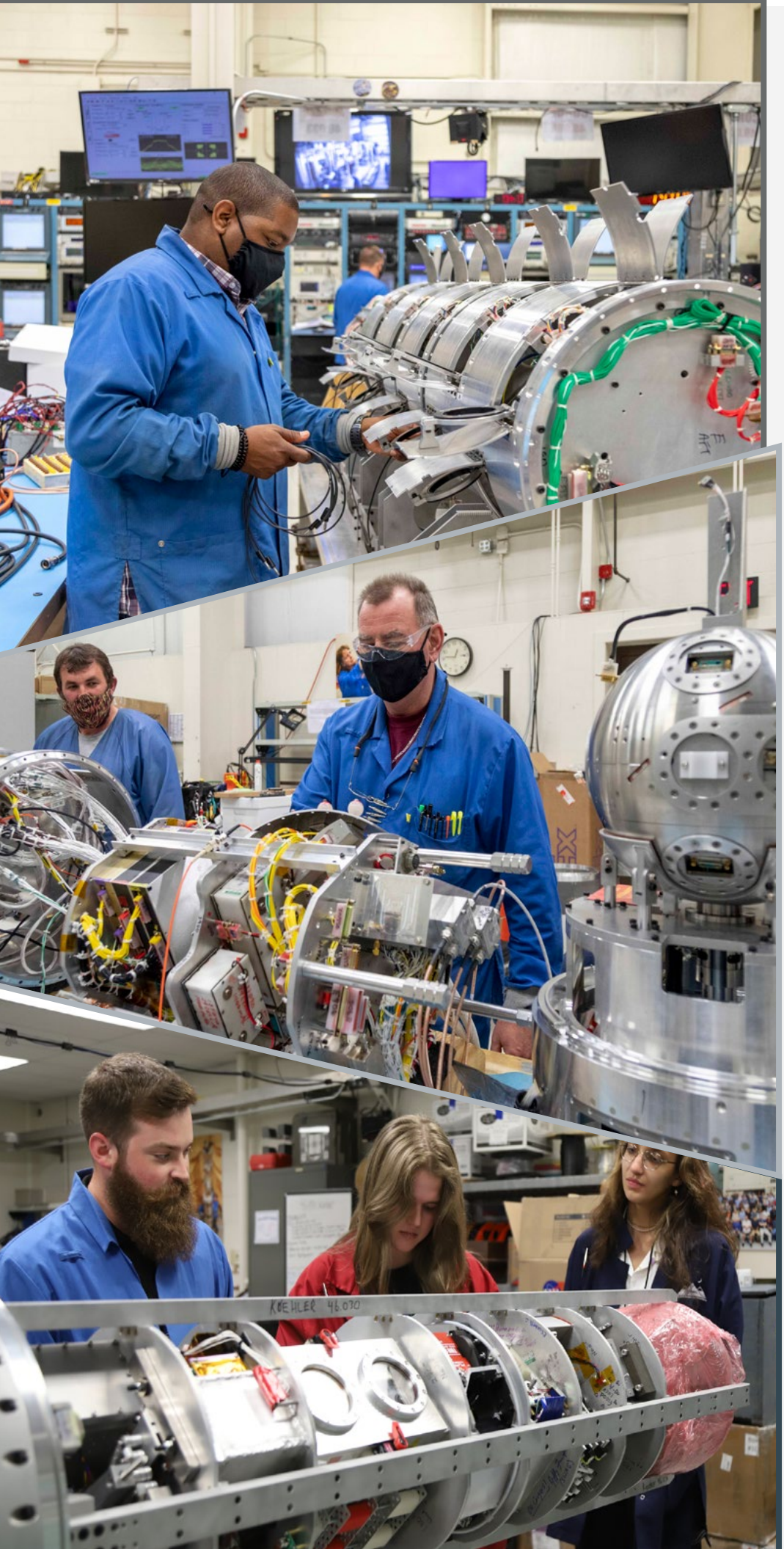
2021



INSIDE

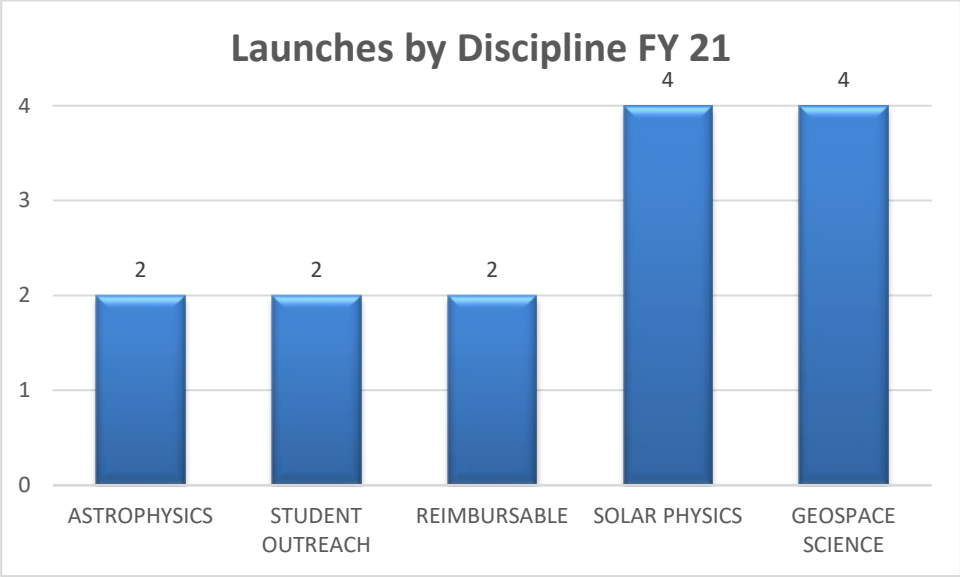
Cover photo:
46.030 UO Koehler student team from Colorado Space Grant preparing for the RockSat–X launch on Wallops Island, on August 19, 2021.

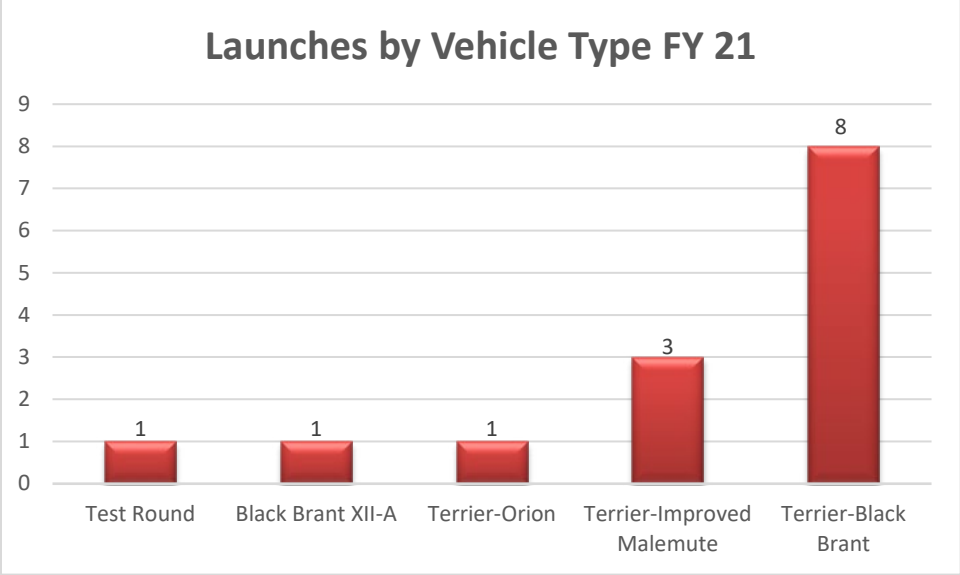
46.033 AR Leathe payload during integration at Wallops Flight Fa–cility.


STATIC / DYNAMIC
BALANCER
GISHOLT

Program Overview

Fiscal Year 21 ended on September 30, 2021. Fourteen launches, covering five disciplines were conducted during the fiscal year. Two launch sites, Wallops Island, VA and White Sands Missile Range, NM were used, with seven missions launched from each.





36.357 & 36.358 GE Pfaff/NASA GSFC - Dynamo 2- launched July 11 and 7, 2021

The Dynamo–2 flights were successfully launched on two–stage Terrier–Black Brant sounding rockets on July 7 (36.358) and July 11 (36.357), 2021 from the Wallops Island, VA.

The mission, Dynamos, Winds, and Electric Fields in the Daytime Lower Ionosphere–2 or Dynamo–2, explored the ion–neutral coupling, winds, and electrodynamics that govern the global atmospheric dynamo that flows at the base of the daytime ionosphere. Two Terrier–Black Brant vehicles carried identical payloads. One payload was launched during quiet conditions, and the other during disturbed conditions.

The atmospheric dynamo is a pattern of electrical current swirling in continent–sized circuits in the ionosphere Driven by the Sun, it migrates across the planet, centered wherever the Sun is directly overhead. The Earth's ionosphere is a layer of the atmosphere where the Sun's intense radiation separates electrons from their atoms, allowing electricity to flow.

The first Dynamo mission, flown in 2013, discovered very high winds in the dynamo region of the ionosphere. This discovery has since been backed up by NASA's Ionospheric Connection Explorer (ICON) satellite. ICON has also observed much faster winds than expected by theory, and the Dynamo–2 rockets were launched to verify the data received from ICON.

The Dynamo–2 rocket launches were timed with ICON orbital passes to combine data from the satellite and sounding rocket flights. ICON's wind measurements are lower resolution than the Dynamo rockets', but it covers a much broader swath of space, and allows repeated observations on each orbit.

Dynamo–2 integration at Wallops Flight Facility.

36.357 GE launches from Wallops Island, on July 11, 2021.

36.319 NS Winebarger/NASA MSFC - Marshall Grazing Incidence X-ray Spectrometer (MaGIXS) - launched July 30, 2021

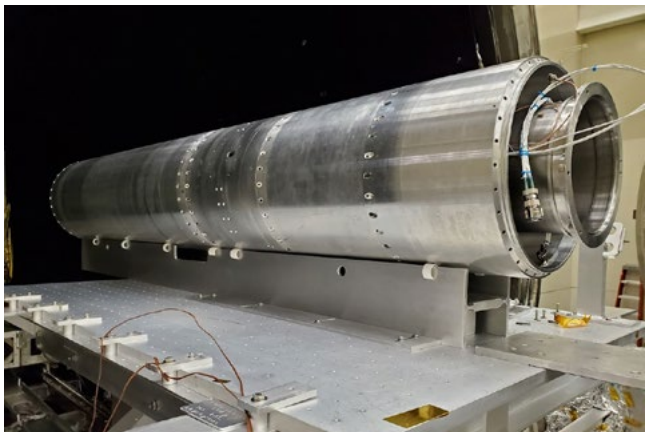
The MaGIXS mission was successfully launched on a NASA sounding rocket on July 30, 2021 from the White Sands Missile Range in New Mexico.

MaGIXS, an X–ray solar imager was designed to gather new insight regarding how and why the Sun's corona grows so much hotter than the actual surface of Earth's parent star.

The payload included a high–powered camera, telescope, and X–ray spectrometer containing a matched pair of grazing incidence parabolic mirrors – to study "soft" X–rays at a wavelength, 6 – 24 Å, that hasn't been previously observed in such detail.

Past soft X–ray spectrometer missions have only observed the Sun's corona over a fairly large field of view, or with limited energy diagnostic capabilities. MaGIXS, by comparison, is the first imager to measure specific temperature distributions at different parts of an active solar region. That precision data help scientists resolve the debate concerning how – and how often – the corona is superheated.

Shedding new light on coronal heating mechanisms could help researchers better understand and even predict potential solar flares and coronal mass ejections, both of which occur most often in connection with regional spikes in coronal heating. 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.



MaGIXS experiment during testing at the X–ray & Cryogenic Facility at NASA's Marshall Space Flight Center in Huntsville, Alabama.

MaGIXS ready to launch at White Sands Missile Range, NM. Credit: Visual Infor–mation Branch/WSMR.

46.030 UO Koehler/Colorado Space Grant Consortium - RockSat-X- launched August 19, 2021

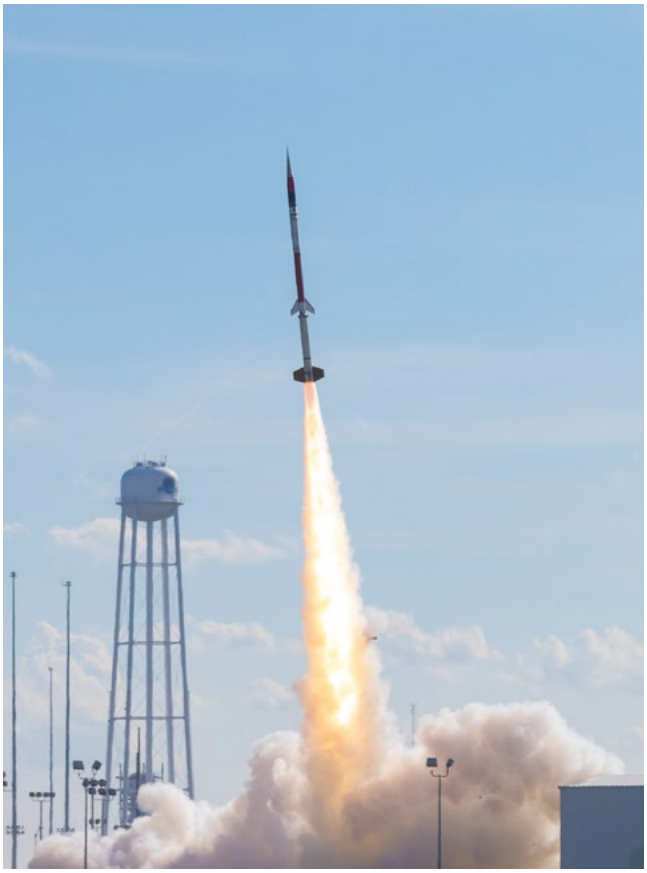
This was the the tenth flight of a RockSat–X payload with participation from eight community college and university teams. The projects on this flight were a mix of technology and science experiments, including the development of a 360–degree camera for use on sounding rockets; space debris removal concepts; a solar array deployment system for CubeSats; and collection of particles in space for research on the origins of life.

The experiments were flown through the RockSat–X program in conjunction with the Colorado Space Grant Consortium. RockSat–X is part of a three–tier program that introduces secondary institution students to building experiments for space flight. RockOn, the first level of student flight opportunities, is a workshop program where students build, integrate, and test an experiment from a kit. RockSat–C, the next level, provides an opportunity for students to create their own experiment, but with limited payload services. RockOn and RockSat–C fly on the same rocket. RockSat–X is the most advanced sounding rocket program for students. RockSat–X provides access to the space environment, and includes power, telemetry and attitude control.

Participating institutions in the 2021 RockSat–X flight were the Arapahoe Community College in Littleton, Colorado; Red Rocks Community College in Lakewood, Colorado; College of the Canyons in Santa Clarita, California; the University of Puerto Rico, San Juan; Virginia Tech, Blacksburg; University of Colorado, Boulder; Northwest Nazarene University in Nampa, Idaho; Kauai Community College in Lhue, Hawaii; and Colorado School of Mines, Golden.

Additional participants from West Virginia include West Virginia University, Morgantown; Blue Ridge Community and Technical College, Martinsburg; West Virginia State University, Institute; and West Virginia Wesleyan College, Buckhannon.

RockSat–X team at Wallops Island after the launch.



RockSat–X launches from Wallops Island.

36.353 US Woods/University of Colorado- Extreme Ultraviolet Variability Experiment (EVE) - launched September 9, 2021

The EVE mission was successfully launched on a NASA sounding rocket on September 9, 2021 from the White Sands Missile Range in New Mexico.

The primary objective for this mission was to provide an underflight calibration for the EUV Variability Experiment (EVE) aboard the NASA Solar Dynamics Observatory (SDO) satellite.

The EVE program provides solar EUV irradiance data for NASA's Living With the Star (LWS) program, including near real–time data products for use in operational atmospheric models that specify the space environment and to assist in forecasting space weather operations.

This was the 10th underflight calibration for the EUV Variability Experiment (EVE) aboard the NASA Solar Dynamics Observatory (SDO) satellite. This mission also provided underflight calibrations for solar EUV imagers aboard several other spacecraft.

NASA 36.353 was reflight of NASA 36.336 but with some changes:

- The Compact SOLSTICE (CSOL) solar FUV–MUV spectrograph and the GOES–R prototype XRS solar X–ray photometers were removed.

- Three Solar Photometer Array (SPA) units to provide special calibrations for Hydrogen Lyman–alpha (121.6 nm), X–ray bands (0.1–2 nm), and EUV bands (10–35 nm) were added.

Recovery Operations. Credit: Visual Information Branch/WSMR.

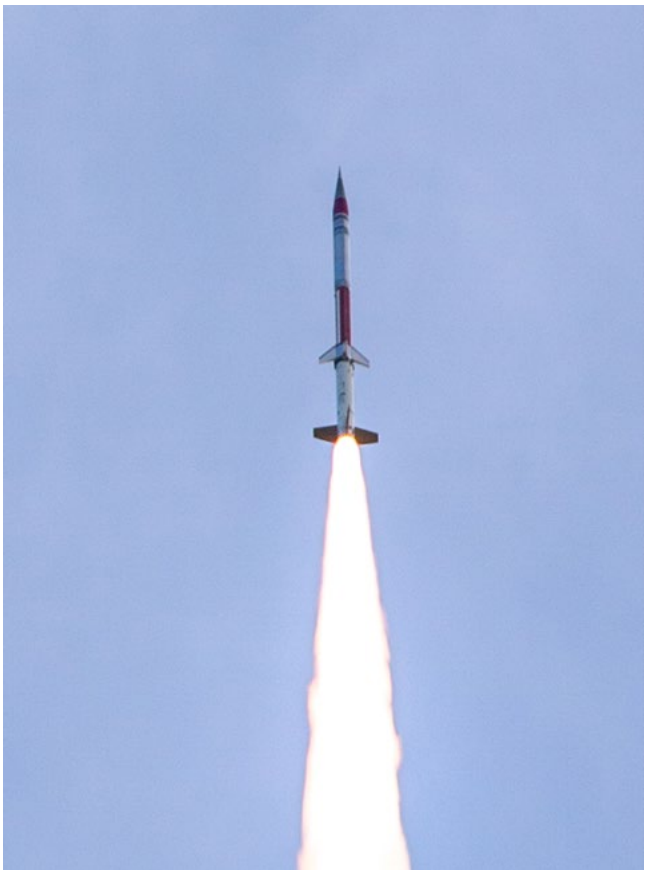
EVE payload during testing at White Sands Missile Range, NM.

EVE launch. Credit: Visual Information Branch/WSMR.

46.033 AR Leathe/Sandia - High Operational Tempo (HOTShot) - launched September 11, 2021

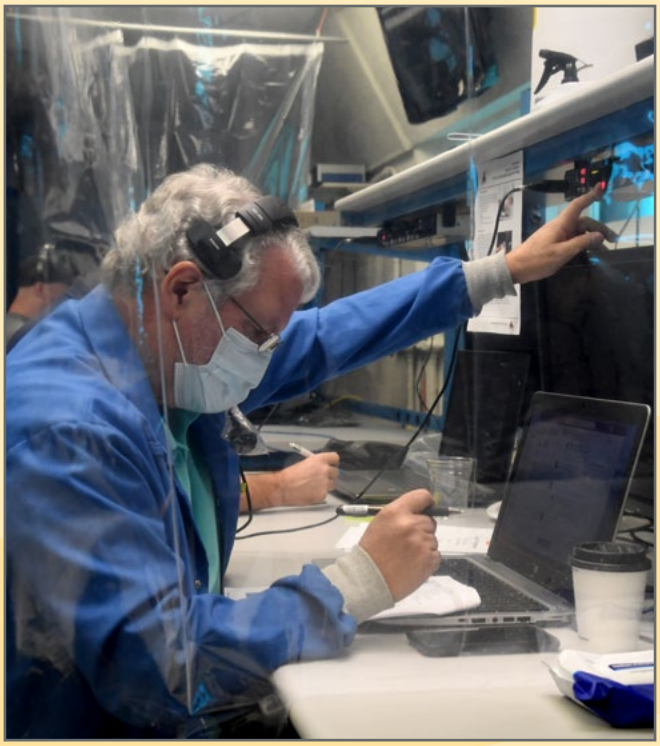
The HOTShot payload was successfully launched on a NASA sounding rocket on September 11, 2021 from Wallops Island, VA.

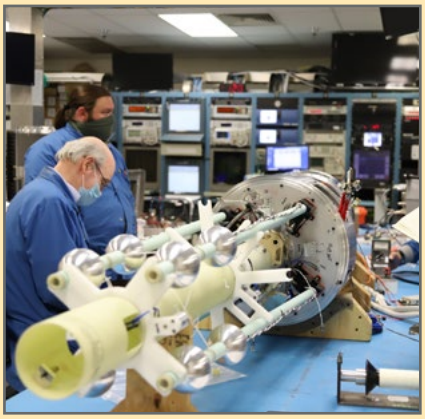
This flight was part of the HOTShot program, which collects scientific data that benefits aerospace research and informs future weapon designs for the U.S. nuclear enterprise. Its non–nuclear scientific experiments evaluate prototypes and help develop high–fidelity computer models and mechanical flight simulators.

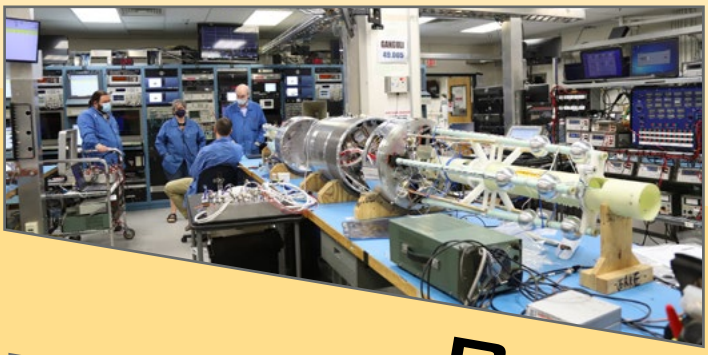


HOTShot launches from Wallops Island. Credit: NASA/Terry Zaperach

HOTShot payload on the vibration table at Wallops.







PICTURE PLACE

Integration and Testing

Sequence testing of C–REX 2

49.004 UE Conde/University of Alaska - Cusp-Region Experiment 2 (C-REX)

Integration and testing was completed for the C–REX 2 pay–load. C–REX 2 is scheduled to launch from Andoya Space in Norway in December 2021.

The purpose of the C–REX–2 experiment is to identify mechanisms responsible for sustaining a region of neutral mass density at 400km altitude that appears to be a perma–nent feature of the Earth's cusp–region thermosphere. The mission will study the neutral winds by deploying 16 can–isters of mixed Barium (Ba) and Strontium (Sr) tracers and 4 canisters of Tri–Methyl–Aluminum (TMA) west of Svalbard, at altitudes between 350 and 150km Additional instruments are included to characterize the electrodynamic environment.

This is the second flight of C–REX.

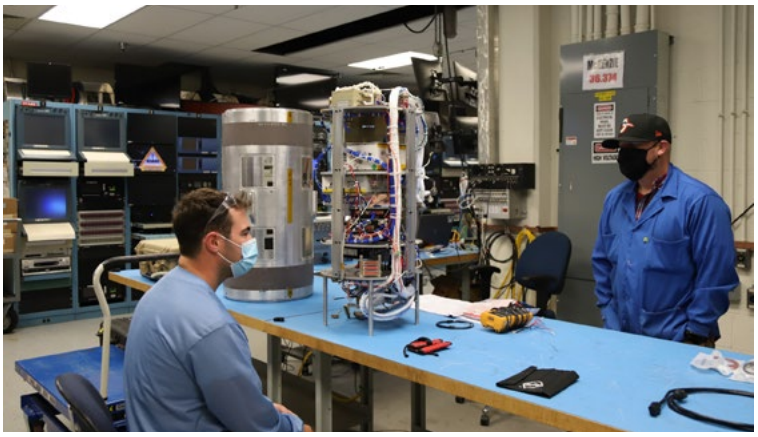
36.374 NS McKenzie/NASA MSFC - Chromo-spheric Lyman-Alpha Spectro Polarimeter 2.1 (CLASP)

The aim of CLASP–2.1 is the mapping of circular polarization of the Mg II h & k lines from a solar active region caused by scattering and magnetic effects. The wavelength range of CLASP–2.1 is 279.9 nm +/– 0.45 nm.

CLASP–2.1 is a re–fly of CLASP–2 (36.332 NS McKenzie) with a very minor change to the camera power supply.

CLASP–2 observed 3 targets on the Sun (Sun center, then 2 other targets), for 13s, 157s and 142s respectively.

CLASP–2.1 will observe the Sun center, then "scan" across an active region on the Sun, by shifting pointing every ~19 seconds



CLASP 2.1 pre–integration checkouts.

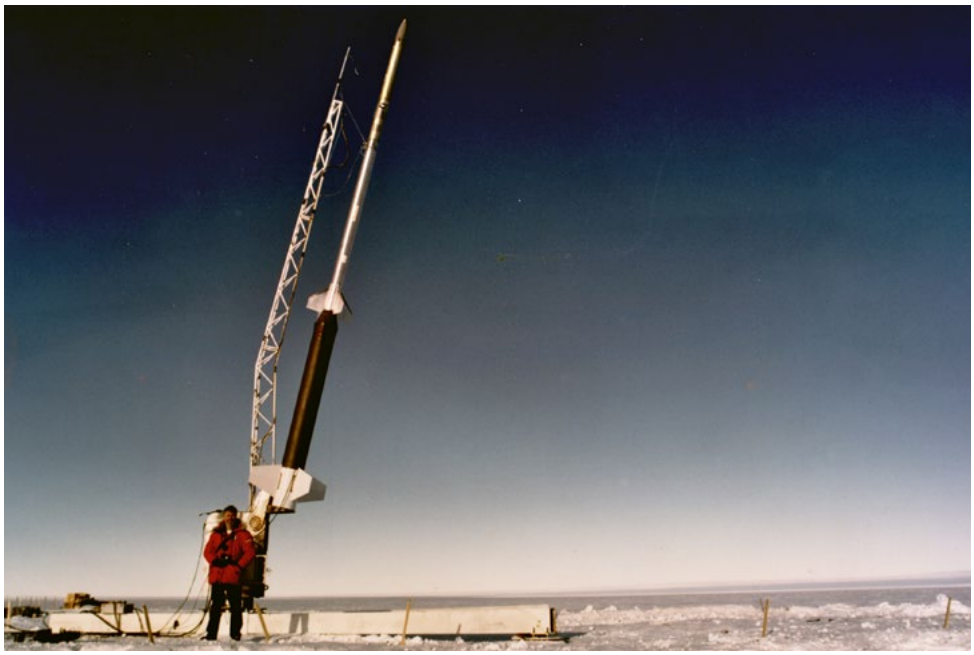
From the Archives: Launches from Siple Station 1980-1981

Scientific requirements drive launch site selection for Sounding Rockets, and in 1980 – 1981 that meant launching from Siple Station, Antarctica.

Siple Station is located on Ellsworth Land, West Antarctica. Construction of Siple I began in 1969, but the station was later crushed by ice. Siple II was built on top of the first station around 1979.

Three Nike–Tomahawk rockets (18.203, 204, 205, PI Matthews/University of Maryland) and four Arcas rockets (15.189, 190, 191, 192, PI Sheldon/University of Houston) were launched from Siple II between December 12, 1980 and January 11, 1981. In addition to the rockets, 12 instrumented balloons were flown during the campaign.

The 1980–1981 campaign was an international effort, and in addition to US researchers, groups from England and Norway also participated.



Nike-Tomahawk on a launcher at Siple Station.
Credit: Steve Jurvetson, https://www.flickr.com/photos/jurvetson/4791767571/in/photostream/

The rocket and balloon launches were coordinated with VLF transmitter operations, and were directed toward observing and improving understanding of wave–particle interactions in the magnetosphere. Ground–based instrumentation, including magnetometer, riometer, micropulsation station, and VLF emission direction–finding equipment provided additional data.

The rocket launches were made during periods of magnetospheric wave activity triggered by the Siple transmitter. Interesting natural activity was also present on some of the flights. By agreement in the field among the participating scientists, the last Nike–Tomahawk rocket was reserved for a "pure" condition of transmitter triggering, which was actually attained a few days before termination of the campaign.*

Ref.
SOUNDING ROCKETS I N ANTARCTICA
George C. Alford/Thiokol Corporation
Gary W. Cooper and Norman E. Peterson, Jr.
Special Payloads Division
Goddard Space Flight Center

*Matthews, D.L.
Siple Station magnetospheric physics campaign

Australia Campaign Setup

Sounding Rockets will return to Australia in 2022 to launch three Astrophysics missions.

Three Terrier–Black Brant vehicles will be launched during the window. The missions include the Suborbital Imaging Spectrograph for Transition region Irradiance from Nearby Exoplanet host stars (SISTINE), PI Dr. France/ University of Colorado, Dual–channel Extreme Ultraviolet Continuum Spectrograph (DEUCE–ELA), PI Dr. Fleming/University of Colorado, and X–ray Quantum Calorimeter (XQC), PI Dr. McCammon/University of Wisconsin.

The setup of the launch range started in September 2021. Personnel travelling to Australia quarantined for 14 days before travelling to Nhulunbuy, the nearest town to the launch site.

The NASA Campaign Manager, Scott Bissett, shared these photos from the setup trip.

Quarantine exercise hour (Mens sana in corpore sano!)

Launch site entrance.

Equipment setup progress.

MISSION	DISCIPLINE	EXPERIMENTER	ORGANIZATION	PROJECT	RANGE	DATE
36.373 UG	UV/OPTICAL ASTROPHYSICS	FRANCE	UNIV OF COLORADO	SISTINE 2	WS	11/08/21
49.004 UE	GEOSPACE SCIENCES	CONDE	UNIV OF ALASKA FAIRBANKS	C–REX 2	NOR	12/01/21
36.363 UH	HIGH ENERGY ASTROPHYSICS	GALEAZZI	UNIV OF MIAMI	DXL 3	WI	12/06/21

WS – White Sands Missile Range, NM
NOR – Andoya Space, Norway
WI – Wallops Island, VA

Writing Assignment for Students

This quarter's activity is a writing assigment!

Imagine you are a rocket scientist. What kind of mission would you fly? Would you carry an experiment, or would you fly to space yourself? If you are an astronaut, and could travel anywhere in the Universe, where would that be, and why? If you're not flying to space, but sending an experiment, what kind of experiment would it be, and why?

Write a short story and send it to us. We'll publish the best ones in this newsletter.

Email entries to: Berit.H.Bland@nasa.gov