National Aeronautics and Space Administration

Rocket Report

2019

Sounding Rockets Program Office

What's inside...

In Brief...

The next phase of Grand Challenge Initiative – Cusp is underway. Three missions will launch in November 2019 as part of this effort: Cusp–Region Experiment 2 (C–REX 2), Cusp Heating Investigation (CHI), and the Norwegian mission, Investigation of Cusp Irregularities (ICI–5). Launch windows for all three open on November 25, 2019. CHI and ICI–5 will launch from Svalbard, Norway and C–REX 2 from Andoya Space Center, also in Norway.

Planning for next year's Australia campaign is progressing. Three astrophysics missions are currently scheduled to launch from a new launch range, Equatorial Launch Australia (ELA) in July 2020.

36.346 UG France - Suborbital Imaging Spectrograph for Transition region Irradiance from Nearby Exoplanet host stars successfully launched on August 11, 2019.

This was the first flight of the Suborbital Imaging Spectrograph for Transition region Irradiance from Nearby Exoplanet host stars (SISTINE), which aimed to study the ultraviolet radiation environment around low-mass stars and the effects of that UV on potential exoplanet atmospheres.

Image Credit: White Sands Missile Range

SISTINE payload team at White Sands, NM.

Characterization of exoplanet atmospheres, including the potential for habitability, requires an understanding of the interaction with the host star's ultraviolet (UV) radiation environment. Nearby solar-type stars and red dwarfs host the best opportunities to characterize potentially inhabited worlds, and many of these systems will be searched for biomarkers by NASA's future flagship missions.

SISTINE's imaging capability and spectral resolution allow the investigation of low-mass star UV environments and their effects on potential exoplanet atmospheres. SISTINE provides spectral coverage from 100 - 160nm, a range not covered, at moderate spectral resolution, by any current orbital asset; this range spans strong atomic

SISTINE continued

emission lines tracing various formation temperatures in the stellar atmosphere: 104 K (Ly α, 121 nm), 105 K (C IV, 155 nm), and 105.5 K (O VI, 103 nm).

For this mission, SISTINE aimed to characterize the instrument performance and demonstrate the advanced optical coatings and detectors for future NASA missions. This calibration mission was also designed to study how the outer envelopes of stars are dispersed back into the interstellar medium by observing the space target NGC 6828, a planetary nebula. While the new technology was demonstrated, the science collection was not successful.

SISTINE and parachute after impact in the desert.

SISTINE recovered.

36.340 DR Abbett successfully launched September 18, 2019.

This launch was conducted for the Department of Defense.

36.340 DR Abbett launch.

36.320 US Kankelborg - EUV Snapshot Imaging Spectrograph successfully launched September 30, 2019.

Every few seconds, a small (approximately Earth sized) explosion occurs somewhere on the solar disk. These transition region explosive events are an example of magnetic reconnection, the same mechanism that is responsible for the much larger release of energy in solar flares. The purpose of the EUV Snapshot Imaging Spectrograph (ESIS) mission is to observe these events in enough detail to characterize the triggering of and release of magnetic energy.

The new ESIS instrument mapped Doppler shifts and line widths, which correspond with bulk and turbulent velocities, in the transition region at a two second cadence in the 62.9 nm (O V) spectral line. ESIS was augmented by the existing Multi-Order Solar EUV Spectrograph (MOSES), which can be configured for either 46.5 nm (Ne VII) or 30.4 nm (He II).

46.022 UO Koehler - RockSat-X student mission successfully launched on August 12, 2019

RockSat-X was successfully launched from Wallops Island, VA on August 12, 2019. 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. 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 2019:

Community Colleges of Colorado
The Debris Orbital Tumbler and Thermal Sensor (DOTTS) project is a collaboration between three community colleges in Colorado: Arapahoe Community College, Community College of Aurora, and Red Rocks Community College. Their primary experiment was to develop a cost-effective method to alter the trajectory of space debris in suborbital flight.

College of the Canyons
The goal of the Mesospheric Autorotational Payload Lander Experiment (MAPLE) was to create a versatile reentry system that uses autorotation to reduce velocity while gathering kinematic and environmental data to determine the concept's efficiency and reliability.

University of Kentucky
The University of Kentucky improved upon an experiment flown in 2017 that tested data acquisition, communication, and thermal protection of a small reentry capsule. This year's experiment is one of the last stages of the development which aims to increase the technology readiness level (TRL) of the capsule to TRL 7.

University of Maryland
The Space Characterization and Assessment of Manipulator Performance (SCAMP) II project was a continuation of the experiment, first flown in 2018, and consisted of a functional robotic manipulator component in a microgravity environment to test contact stability on both hard and soft contacts.

University of Nebraska Lincoln
The University of Nebraska Lincoln's mission looked to further develop and streamline the mechanism for a deployable boom system started by NASA Langley Research Center. The boom is designed to be easily deployed and retracted for application in various space-based experiments.

University of Puerto Rico
The University of Puerto Rico's mission was to collect micrometeorites in the Meteor Trail at altitudes of 50-68 miles (80-110 km) in order to gather organic molecules for complete Nucleic Acids sequencing of DNA and RNA. The payload used polyimide aerogels stored in a sealable container to collect samples of micrometeorites and organic molecules.

West Virginia Collaboration
The West Virginia Space Flight Design Challenge is a collaboration between colleges in West Virginia, New York, and NASA IV&V. Each school had its own experiment which were integrated together with an additional system that provides power and telemetry. The Hobart and William Smith Colleges were attempting to measure the temperature and vibration of their payload throughout the rocket's flight. West Virginia State University flew radiation, optical, and particle detectors to provide hands-on experience with designing and building space related experiments and prepare for potential future CubeSat missions by comparing component designs. West Virginia University flew an antenna that is capable of changing shape during flight. West Virginia Wesleyan College flew a Geiger counter to measure the cosmic ray incident on Earth to compare with previous NASA studies. Finally, Blue Ridge Community and Technical College aimed to record an accurate vibration of the rocket to provide vibrational data to future RockSat teams.

For more information visit:

RockSat-X

Launch photo: Allison Stancil–Ervin

The Wallops Rocket Academy for Teachers and Students (WRATS) workshop was held August 12 - 16. 2019. The workshop is hosted by the Sounding Rockets Program Office and NSROC with support from the Wallops Education Office. 2019 was the 9th year of the workshop with 19 teachers selected from over 60 applicants. All participating educators teach STEM topics at the Middle and High School Levels.

The WRATS week in 2019 started with an early morning viewing of the RockSat-X launch, and set the stage for the coming weeks activities.

WRATS offers a unique, in-depth, learning experience where teachers get hands-on practice building model rockets. Topics such as aerodynamics, propulsion, recovery system design and trajectory simulations are covered in presentations and then put into practice with rocket and payload construction activities.

WRATS starts with overviews of the sounding rockets program and model rocketry, followed by construction of an E-powered model rocket. Tours of sounding rocket Testing and Evaluation facilities and machine shop are also included. By the end of the first day all teachers have a flyable model rocket.

On the second day teachers build an electronic payload to measure acceleration, temperature and pressure during flight. The payload is based on the Arduino microprocessor and inexpensive sensors. Recovery system design and construction are also completed.

Once all the construction activities are completed the models are launched and recovered at Wallops Flight Facility. Flight data is then plotted and analyzed.

WRATS teacher team.

Fin alignment.

Parachute construction.

Team post launch.

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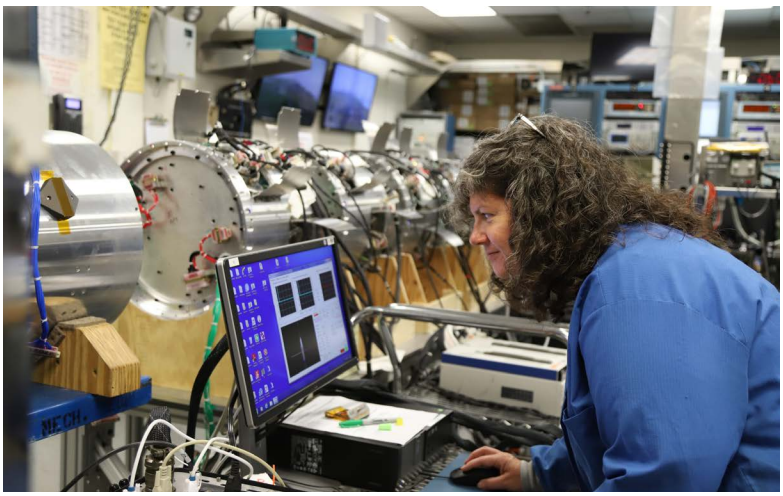
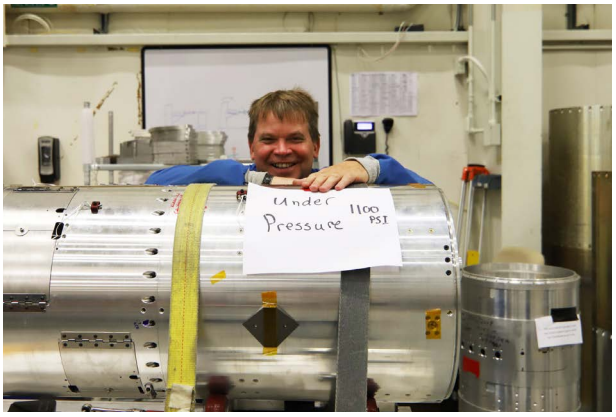
Picture Place

Kobe with the Assistant EE.



Valerie working on C–REX 2.

Kyle and John with RockSat–X.



Walt under pressure.

Team luncheon for Brian Hall who is leaving Sounding Rockets for Balloons.


Conde
McCandliss
Nuth
Larsen
STOP
HYSTER

Integration & Testing

36.352 UG McCandliss – Far–ultraviolet Off Rowland–circle Telescope for Imaging and Spectroscopy (FORTIS)

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. These innovations include, triaxial diffraction gratings, large format micro channel plate detectors, Goddard Space Flight Center (GSFC) micro shutter arrays (PI- Moseley) and an autonomous targeting system, Johns Hopkins University (JHU). This mission will provide Far-UV spectra of blue stragglers in globular cluster M33 with the FORTIS instrument. This, the 4th flight of FORTIS, is scheduled for October 2019.

52.006 UE Conde – Cusp–Region Experiment 2 (C–REX 2)

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 permanent feature of the Earth's cusp-region thermosphere. The mission will study the neutral winds by deploying 16 canisters of barium and strontium tracers and 4 canisters of TMA west of Svalbard, at altitudes between 350 and 150km. Additional instruments are included to characterize the electrodynamic environment. The C-REX 2 mission is scheduled to launch from Andoya Space Center, Norway in November/December 2019.

36.349 UE Larsen – Cusp Heating Investigation (CHI)

The purpose of the mission is to measure neutral upwelling and high-resolution electric fields over an extended region in the Cusp. The measurement technique uses eight non-ejecting barium/strontium canister releases distributed across the vehicle trajectory above 180 km altitude. CHI will allow both plasma drift measurements, obtained from barium clouds that ionize in sunlight, and neutral wind measurements from strontium clouds that remain neutral. Estimates of Joule heating, including the small-scale contributions, are achieved using a combination of the in-situ rocket measurements and groundbased radar data. The CHI mission is scheduled to launch from Svalbard, Norway in November/December 2019.

36.343 G Nuth – Determining Unknown yet Significant Traits (DUST)

The purpose of the Determining Unknown yet Significant Traits (DUST) experiment is to measure important variables in the end-to-end process of grain formation in circumstellar outflows around AGB stars and model the physical and chemical properties of the dust. The scientific goal is to determine the most important physical properties controlling dust production and measure the infrared spectrum of the analog dust grains during formation and agglomeration in the laboratory and in microgravity. The DUST instrument includes four double wavelength interferometers and two in-situ IR spectrometers.

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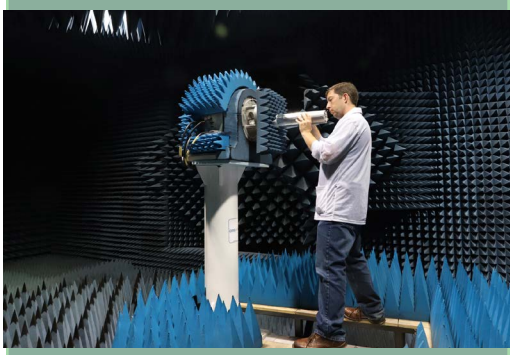
46.020 GT Hesh – SubTEC 8

SubTEC 8 carries several technologies under development by the SRPO. The main objective is to test distributed measurements with deployed sub-payloads. These newly developed sub-payloads include transmitters and will send data to the main payload telemetry system for downlink to the ground.



Sub–payload in the Antenna Pattern Measurement Facility.

Sub–payload testing in the EMI chamber.

Ground station setup for the sub–payload testing.

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Want to contribute?

Working on something interesting, or have an idea for a story? Please let us know, we'd love to put it in print!

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Launch Schedule October – December 2019

MISSION	DISCIPLINE	EXPERIMENTER	ORGANIZATION	PROJECT	RANGE	DATE
36.343 G	LAB ASTRO	NUTH	NASA GSFC	DUST	WS	10/07/19
46.020 GT	TEST & SUPPORT	HESH	NASA GSFC-WFF	SUB-TEC 8	WI	10/22/19
36.352 UG	UV/OPTICAL ASTROPHYSICS	MCCANDLISS	JOHNS HOPKINS	FORTIS	WS	10/27/19
36.322 GS	SOLAR & HELIOSPHERIC	DAW	NASA/GSFC	EUNIS	WS	11/12/19
52.006 UE	GEOSPACE SCIENCE	CONDE	UNIV OF ALASKA	C-REX-2	NOR	11/25/19
36.349 UE	GEOSPACE SCIENCE	LARSEN	CLEMSON UNIV	CHI	SVAL	11/25/19
46.029 UE	GEOSPACE SCIENCE	MOEN	UNIV OF OSLO	ICI-5	SVAL	11/25/19

NOR - Andoya Space Center
SVAL - Svalbard, Norway
WS - White Sands
WI -Wallops Island

Great Job!

Scott, Kyle, and Treye are commended for a job well done! The three have worked diligently to organize the metal stor–age area.