National Aeronautics and Space Administration

Rocket Report

2018

Sounding Rockets Program Office

What's inside...

In Brief...

The launcher team is preparing to leave for Svalbard in mid–August for the MML instal–lation.

Sounding Rocket Working Group meeting was held at Greenbelt on July 10, 2018.

The international effort to study the Earth's cusp region, Grand Challenge Initiative – Cusp, includes seven NASA missions with ten rockets. Integration of the first set of Grand Challenge Initiative missions, with launch windows in December 2018 and January 2019, is currently underway at Wallops.

Campaign planning for Australia 2020 is underway, with a kick–off meeting scheduled at Wallops in August.

Launch window opens for the third ASPIRE payload on July 31, 2018. See more on page 7.

RockSat–X students arrive in August for final integration and launch of their payload. Cur–rently scheduled for an August 14th launch.

36.330 UH McEntaffer/Penn State Univ - Water Recovery X-ray Rocket (WRX-R) launched April 4, 2018

WRX-R was the first of two missions to launch from Roi Namur, Kwajalein Atoll, Marshall Islands, during the spring 2018 campaign. The WRX-R mission targeted the Vela Supernova Remnant (SNR) and measured soft X-rays emanating from this region. The Vela SNR was created when a star, >10 times the mass of the Sun, collapsed and then exploded as a Supernova, the final stage of stellar evolution. Supernova explosions are one of the most energetic events in the Universe, and play a role in recycling material within galaxies. They are responsible for the creation and distribu-tion of elements such as, oxygen, silicon, neon, iron, nickel, and magne-sium among others, into the interstellar medium, thereby providing source material for the next generation of stars, planets, and even organic chemistry. The explosions are rarely seen in action, but evidence is left behind as Supernova Remnants. Ejected material from the explo-sion travels at high speeds and the shockwave sweeps up interstellar material along the way, continuing to heat it to temperatures as high as 10 million Kelvin. Hotter temperatures lead to the emission of higher energy electromagnetic radiation, such as X-rays, from the SNR.

WRX–R before launch in Kwajalein.

The mission was successfully launched and met the scientific objectives. The pay-load, equipped with the new water wedge shutter door, was recovered.

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36.333 UG - France/University of Colorado - High-resolution Echelle Stellar Spectrograph (CHESS) launched April 16, 2018

The CHESS-4 mission studied the interstellar medium (ISM), the matter between stars, and specifically translucent clouds of gas which provide fundamental building blocks for star and planet formation. These clouds have very low densities and the only way to study them is to measure absorption spectra of light from stars passing through the cloud.

CHESS launch from Kwajalein.

The CHESS spectrograph measures energies in the Far-Ultraviolet part of the spectrum, 1000 - 1600 Ångstrom. This covers wavelengths of, for example, Oxygen^{5+}, H2, several levels of ionized Carbon, Fe II and Mg II (once ionized Iron and Magnesium). The gas in the cloud absorbs some of the wavelengths of light from the star, leading to dark bands in the spectrum. For example, molecular hydrogen (H2) has a system of absorption lines near 1100 Å (110 nm). H2 traces cool molecular material (100 Kelvin), and makes up 99.99% of the total molecular gas in the Galaxy. If H2 is present in the cloud that the starlight passes through, the spectrograph will show less energy at wavelengths near 1100 Å.

CHESS was pointed at the star Gamma Ara, in the constellation Ara. Gamma Ara displays an unusually powerful stellar wind; CHESS studied the interaction of this stellar wind with the surrounding ISM and the excitation of atoms and molecules in the interface region. This allowed the CHESS team to study the catalysts of Galactic chemistry and the raw materials for future generations of stars and planets, as well as, quantify the temperature and motions of the clouds along the line of sight.
The mission was successful and science objectives were met.

Pictures from Kwaj by Wallops Imaging Lab

36.342 NS - Winebarger/NASA MSFC - Hi-C 2.1 launched May 29, 2018 from White Sands Missile Range, NM.

The High-resolution Coronal Imager (Hi-C) is designed to place significant new limits on theories of coronal heating and dynamics by measuring the structures at size scales relevant to reconnection physics. Hi-C was flown successfully in 2012, and a second flight was conducted in 2016, but due to an instrument shutter failure no data was received.

Hi–C launches from White Sands Missile Range, NM.

Compared to the 2012 flight, Hi-C 2.1 used new detectors, with lower read noise. As a tradeoff for markedly improved read noise, the reflight had a smaller field of view (~260 arcsec) due to a reduced detector size (4k x 4k to 2k x 2k). The bandpass filter for the observations was also changed from FeXII 193 Å to FeIX 172 Å. Hinode observations, with plasma diagnostics from the EUV Imaging Spectrometer (EIS), and high-resolution magnetic field data from the 0.5m optical telescope (SOT), as well as, contextual coronal images from X-ray Telescope (XRT) on Hinode, were used in conjunction with the Hi-C 2.1 flight. These data provided comparisons between the low-temperature coronal data from Hi-C 2.1, particularly at active foot point regions, with the surface and the outer atmosphere. Combined with Interface Region Imaging Spectrograph (IRIS) data, this will give a broad picture of the nature of smallscale reconnection and dynamics or magnetoacoustic oscillations.

36.336 UE - Woods/University of Colorado - Extreme ultraviolet Variability Experiment (EVE) launched June 18, 2018 from White Sands Missile Range, NM.

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 seventh 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 SDO, SOHO, GOES, Proba2, Hinode, and SEM irradiance instruments aboard SORCE XPS, TIMED SEE, and SOHO. A new instrument, Compact SOLSTICE (CSOL) solar FUV-MUV spectrograph, was added for final calibration of NASA SORCE before it is decommissioned in June 2019.

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46.021 UO Koehler/RockOn launched June 21, 2018 from Wallops Island, VA.

The 11th RockOn student mission was flown from Wallops Island, VA on June 21, 2018. Over 200 students and educators from around the country attended the launch. The payload was successfully recovered and the experiments returned to the students. For more on this mission see the following page, Rocket Week at Wallops.

RockOn launches from Wallops Island, VA.

Rocket Week at Wallops

For the 11th year in a row the RockOn! student mission was flown successfully from Wallops Island, VA. The launch occured on Thursday, June 21nd at 05:30 EDT with over 200 excited students watching their experiments head for space.

Three types of experiments were included in the 2018 RockOn! flight: RockOn Workshop experiments, RockSat-C experiments and Cubes-in-Space.

RockOn workshop experiments are constructed the week before launch at Wallops Flight Facility. Students arrived on Friday, June 15th and started experiment construction on Saturday. All experiments were ready for integration into the payload by Monday afternoon.

Teams of three, with both students and faculty members, work together to build, program and test a workshop experiment. The experiments include a microprocessor for data collection and a suite of sensors such as thermistors, pressure transducers, accelerometers, and geiger counters. Additionally a camera is located on one of the experiment boards. The workshop experience prepares students to participate in more advanced flight opportunities, such as RockSat-C and RockSat-X. 28 experiments were part of the RockOn workshop portion of the payload.

RockOn! workshop experiment construction.

RockSat–C experiment returned after flight.

RockSat-C experiments are more advanced and designed and constructed by the students. This year 10 Colleges and Universities participated in RockSat-C.

Cubes-in-Space is a program for students age 11 to 18. One inch cubes with student designed experiments are flown in the nosecone of the rocket. Students and teachers submit a proposal for an experiment to the Cubes-in-Space program. The proposals are reviewed and 80 teams are selected for flight on the rocket

Cubes–in–Space returned after flight.

Links for more information on:

RockOn!

RockSat-C

Cubes-in-Space

RockOn, RockSat–C and RockSat–X students.

The Wallops Rocket Week includes the Wallops Rocket Academy for Teachers and Students (WRATS) workshop. The workshop is hosted by the Sounding Rockets Program Office and NSROC with support from the Wallops Education Office. 2018 was the 8th year of the workshop with 20 teachers selected from over 60 applicants. All participating educators teach STEM topics at the Middle and High School Levels.

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 a visit with the RockOn workshop students 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.

On Thursday the WRATS participants watched the launch of RockOn! on Wallops Island, one of the highlights of the week.

WRATS teacher team.

WRATS rocket lift–off.


Measuring Center of Gravity of the WRATS rocket.

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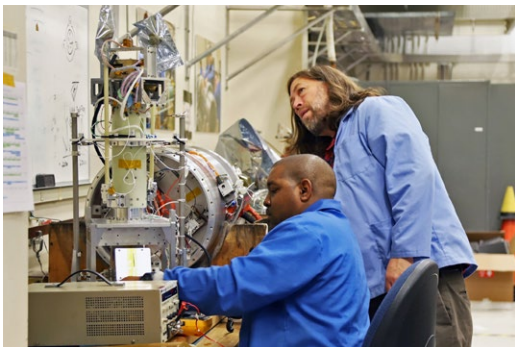
Rob, Mark and Frank stowing instruments after deploy–ment testing.

Integration and Testing

35.039 & 35.040 GE Rowland – VISualizing Ion Outflow via Neutral atom imaging during a Substorm (VISIONS) 2

VISIONS-2 is designed to investigate the outflow of oxygen ions from Earth's upper atmosphere and into the magnetosphere. Specifically, VISIONS-2 attempts to answer the question "What is the nature and extent of low altitude ion outflow (>10 eV) from the cusp?" VISIONS-2 will make the first measurements that can separate spatial from temporal variations in low-altitude cusp ion outflows and determine their relation to sources of free energy in the cusp during a period of enhanced energy input. The results will lead to a better understanding the physics that influence Earth's magnetosphere. VISIONS-2 is part of the Grand Challenge CUSP initiative with participation from Norway, Japan and the United States. VISIONS-2 is currently scheduled for launch in December 2018 from Svalbard, Norway.



Frank and PI Doug Rowland.

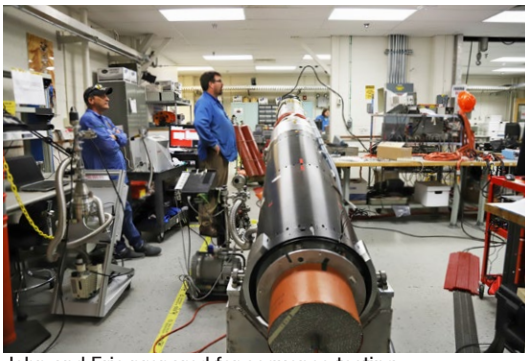
Payload team members during integration.

Freddie with Micro–X on the vibration table.

36.245 UH Figueroa – Micro–X

Micro-X combines a high-energy-resolution X-ray microcalorimeter with an imaging mirror to obtain the first imaging X-ray microcalorimeter spectra from an astronomical source. As a photon is absorbed in a microcalorimeter and its energy converted to heat, the resulting temperature rise can be measured by the resistance change of a Transition Edge Sensor (TES). This is the first flight of Micro-X and will investigate the plasma conditions (such as temperature, electron density and ionization) and the velocity structure of the Cassiopeia A Supernova remnant (SNR).

Science team at work.



John and Eric prepared for sequence testing.

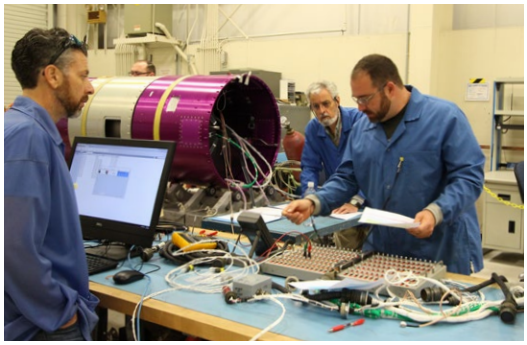
Integration and Testing

36.328 NR Clark – Advanced Supersonic Parachute Inflation Research and Experiments

Integration and testing of the third ASPIRE payload was completed. The launch is currently scheduled for July 31, 2018.

The ASPIRE project investigates the supersonic deployment, inflation, and aerodynamics of Disk-Gap-Band (DGB) parachutes in the wake of a slender body. A total of four sounding rocket launches are planned to test the parachute system for NASA's Mars 2020 project. Sounding rockets deliver the parachute to the targeted deployment conditions representative of those on Mars.

Nicole and Wale starting ASPIRE integration.



ASPIRE payload team members during integration.

Nate and Michelle balancing ASPIRE.

46.021 UO Koehler – RockSat–X

RockSat-X, the most advanced of the student missions, is currently scheduled for launch on August 14, 2018. The student teams were at Wallops during Rocket Week for testing and evaluation activities. Student groups from College of the Canyons, Community Colleges of Colorado, University of Maryland, Capitol Technology University, Virginia Tech, Temple University, University of Colorado, West Virginia Space Collaboration, and University of Puerto Rico are flying experiments in this year's RockSat-X payload.

RockSat–X on the vibration table.

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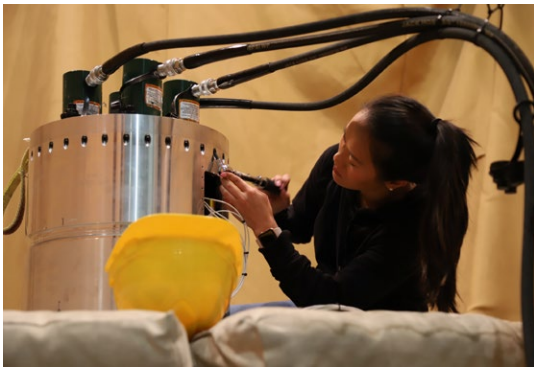
Picture Place

Jorge with VISIONS–2.

Commuting in Kwajalein.

BFFs Mike and Joe.



T&E intern, Michelle, hard at work.

Dr. Zurbuchen/AA NASA Science visits F–10.

Ahmed during VISIONS–2 integration.

Bernita with friends

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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 July – October 2018

MISSION	DISCIPLINE	EXPERIMENTER	ORGANIZATION	PROJECT	RANGE	DATE
36.245 UH	HIGH ENERGY ASTROPHYSICS	FIGUEROA	NORTHWESTERN	MICRO-X	WS	07/22/18
36.328 NR	TEST & SUPPORT	CLARK	NASA/JPL	ASPIRE	WI	07/31/18
46.021 UO	STUDENT OUTREACH	KOEHLER	UNIVERSITY OF COLORADO	ROCKSAT-X	WI	08/14/18
36.325 US	SOLAR & HELIOSPHERIC	GLESENER	UNIVERSITY OF MINNESOTA	FOXSI	WS	08/21/18

WS - White Sands
WI -Wallops Island
NOR - Norway
FB - Fairbanks

Woods science team 1988 and 2018.

Left to right: Greg Ucker, Rick Kohnert, Dr. Woods, unknown

Left to right: Greg Ucker, Rick Kohnert, Dr. Woods, Michael Klapetzky