National Aeronautics and Space Administration

# Rocket Report

2017

Sounding Rockets Program Office

## What's inside...



## In Brief...

Planning is underway to launch Astrophysics missions from Australia in 2019. – Equatorial Launch Australia and Woomera Test Range are both under consideration for possible launch sites.

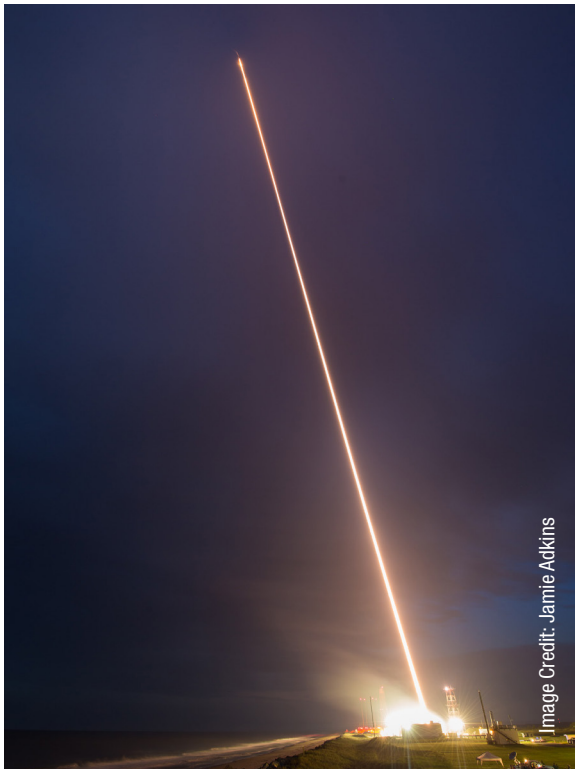
Annual Review was held with State Department. to discuss internaltional campaigns.

The Nihka motor was successfully testfired in August.

Kwajalein rocket team returned home after a very busy campaign.

The launch schedule for FY 2018 is very busy and includes several campaigns in remote loca–tions. Starting with four launches from Poker Flat in January 2018, two launches from Andoya Space Center March 2018, and two launches from Kwajalein in April 2018.

## 46.017 UO Koehler/Colorado Space Grant Consortium RockSat-X successfully launched on August 13, 2017




RockSat–X launches from Wallops Island, VA.

RockSat-X was successfully launched from Wallops Island, VA on August 13, 2017. RockSat-X carried student developed experi-ments. The 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 Con-trol 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.

# RockSat–X cont.

The following experiments were flown on RockSat-X in 2017:

**University Of Hawai'i Community College System**

Primary Experiments

- Sublimation Rocket (heritage component) (WinCC)
- On-board deck mounted imagery cameras (HonCC)

Secondary Experiments

- 9-axis motion tracking system (HonCC)
- Microwave range data of sublimation rocket
- Hammerhead cameras: wireless look-back cameras on sublimation rocket

**University of Kentucky**

The mission objectives of this experiment were to test and demonstrate the release mechanism, communication, and the thermal protection system design of the re-entry capsule so that it can be applied in future research. Additionally, data on the thermal protection system will be used to help ongoing scientific investigations of entry conditions.

**Capitol Technology University (M)**

This mission aimed to demonstrate the functionality of the 1U Hermes Cube and to record video during flight using a VR camera. Additional mission objectives included testing the functionality of the Iridium 9603 SBD modem and other components that are slated to fly on the CACTUS mission, and to fly components from Ragnorak industries and the University of Maryland at College Park

**Oregon State University**

This mission was designed to demonstrate that an autonomous robotic arm can locate predetermined targets around the payload under microgravity conditions. The technical actions performed by this demonstration will illustrate a proof of concept for creating assemblies, autonomous repairs, and performing experiments in space.

**Virginia Tech**

Virginia Tech expanded on their prior RockSat-X experiments to demonstrate the compatibility of a software defined radio (SDR) unit on different communication frequencies. This year's experiment improves communication dependency by implementing an omni-directional patch antenna that requires minimal pointing. Additionally, the capability of SDR in receiving ADS-B and AIS signals, used in tracking the location, speed, and course of planes and boats was demonstrated.

**West Virginia Space Collaboration**

The West Viginia Space Collaboration

RockSat–X students with payload on the balancing table.

included five Universities, each with their own experiment inside the shared canister. The experiments included: Capturing near-infrared (NIR) and long-wave infrared (LWIR) images of earth and outer space and record video of the payload (actuators/LEDs/etc) throughout entire flight.

Eject an atmospheric probe to study the ejection dynamics in microgravity and heat of re-entry.

Test autonomous pointing determination and target acquisition system for astronomical instruments.

Collect data on flight dynamics and magnetic field strength in addition to determining the tensile yield stress on ABS plastic specimens in space.

Detect high-energy particles, observe space effects on DNA.

**University of Colorado Boulder**

The primary objective for this experiment was to successfully deploy a ROCCOR slit boom at an altitude of 150-170 km and characterize its deployment and viability as a space-weather antenna. Additional objectives include measuring solar radiation and geomagnetic activity in the D and E region ionosphere. Variables studied included:

- Ion Plasma disturbances (solar flare)
- EM Field disturbances and RF
- Long Range Upper Atmos Lightning
- Magnetosphere strength & variation

**University of Puerto Rico**

The experiment collected micrometeorites in the Meteor Trail at an altitude of 150km. The experiment used a biosphere contamination mitigation system consisting of an oxygen RF plasma decontamination and a UVC-LED photon emitter to find organic molecules. Amino Acid sequencing during flight was done using a MinION Oxford product. This experiment validated using a 4K video recording camera during flight.

## 36.321 & 29.042 UE Hysell - Waves and Instabilities from a Neutral Dynamo (WINDY) launched September 9, 2017.


WINDY launch.

Two rockets were part of the Waves and Instabilities from a Neutral Dynamo (WINDY) mission. The Black Brant IX sounding rocket was successfully launched at 7:34 a.m. EDT (11:34 p.m. Kwajalein local time) on September 9 and was followed five minutes later by a Terrier-Improved Malemute rocket. The first rocket flew to approximately 254-miles altitude and released its tri-methyl aluminum (TMA) and lithium, forming vapor trails to allow scientists to measure the winds and energetic particles that are in motion in the upper atmosphere.

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The second rocket, carrying instruments to measure densities and electric and magnetic fields in the ionospheric disturbance, did not obtain useful data.

WINDY was designed to study a phenomenon referred to as equatorial spread F (ESF). ESF disturbances occur in the F region of the ionosphere post sunset at latitudes near the equator. ESF disturbances interfere with radio communication, navigation, and imaging systems and pose a hazard to technology and a society that depends on it.

The ionosphere is defined as the layer of the Earth's atmosphere that is ionized by solar and cosmic radiation. Ionization occurs when incoming energetic radiation strips electrons from atoms and molecules, creating temporarily charged particles. The nighttime ionosphere has two layers, E and F. Disturbances in the F layer, the layer studied by WINDY, degrade radio and radar signals at low magnetic latitudes. Predicting when these disturbances will occur would improve the reliability of space-borne and ground-based communication systems. WINDY was designed to answer questions about the origin, i.e. the events preceding a disturbance, of ESF by measuring the influence of horizontal thermospheric winds on the formation of ESF, as well as, taking measurements of ionospheric densities and electric and magnetic fields.

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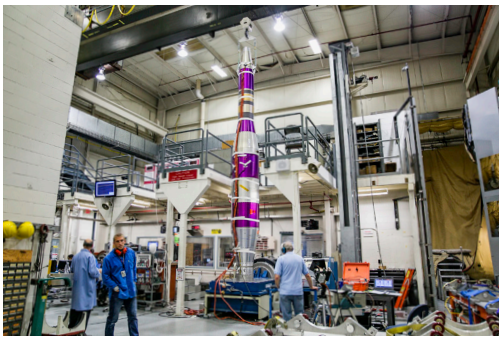
# Integration and Testing

**36.326, 327, and 328 NR Clark – Advanced Supersonic Parachute Inflation Research and Experiments**

Build-up of the ASPIRE payloads has started. The first launch, 36.326, is currently scheduled for October 3, 2017. The other two launches are scheduled for December 2017 and February 2018, respectively. An additional mission is on schedule for April 2018.

The ASPIRE project investigates the supersonic deployment, inflation, and aerodynamics of Disk-Gap-Band (DGB) parachutes in the wake of a slender body. The parachutes will be full-scale versions of the DGBs used by the Mars Science Laboratory in 2012 and planned for NASA's Mars 2020 project and will be delivered to targeted deployment conditions representative of flight at Mars by sounding rockets launched from Wallops Island, VA.

ASPIRE Team ready to go!

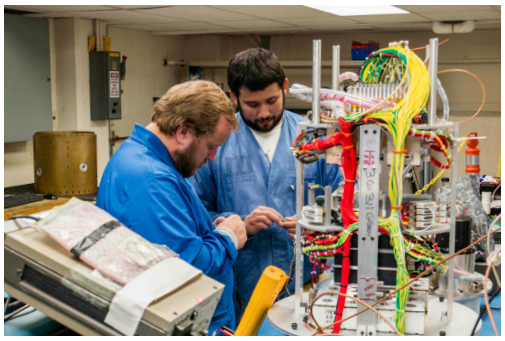


ASPIRE on the vibration table.

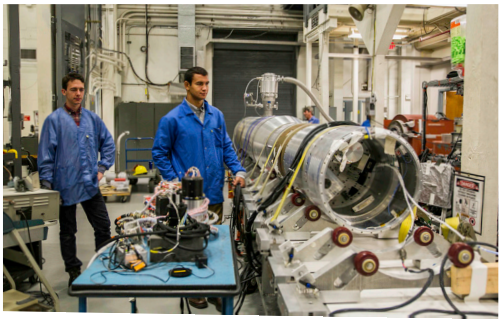
JPL team reviews data.

**36.311 UG Green – Dual–channel Extreme Ultraviolet Continuum Spectrograph**

One of the major questions for modern astrophysics is how and when galaxies first formed and how did their formation "feedback" into their circumgalactic environments to modify early galaxy formation during the Epoch of Reionization. DEUCE will observe the only two non-white-dwarf stars in our own galaxy known to have a sufficiently low neutral hydrogen column density to measure their ionizing radiation directly: Beta Canis Major (ßCMa) and Epsilon Canis Major (εCMa). This flight will observe ßCMa and εCMa will be observed during a future flight.



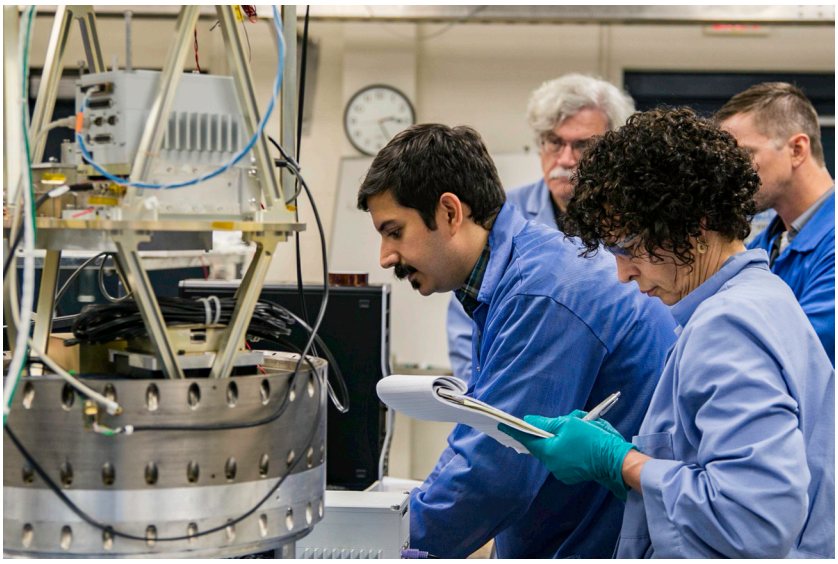
Bill and Cliff DEUCE build–up.



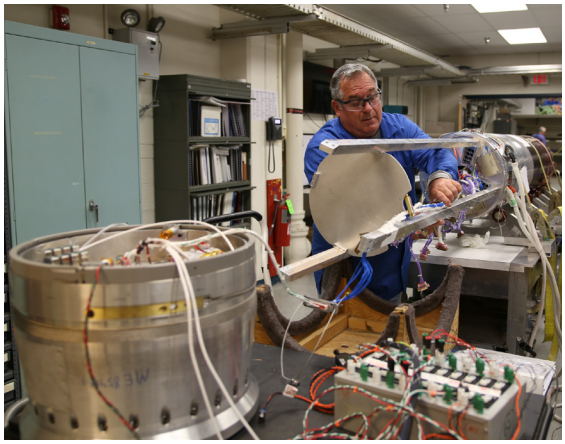
Ready for vibration testing.

DEUCE payload ready for bend testing.

# Picture Place



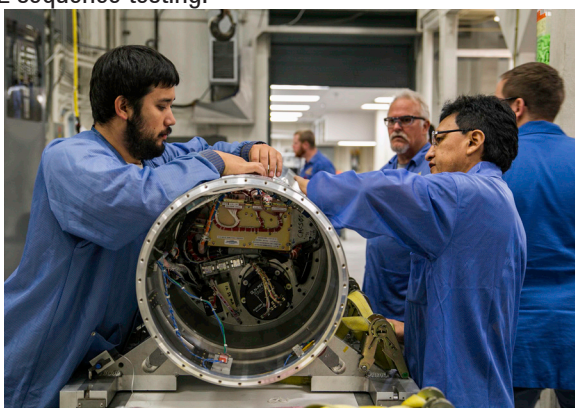
Johns Hopkins science team with ACCESS instrument.



RockSat–X integration.

N–FORSe vibration testing.

Preparing for ASPIRE sequence testing.



DEUCE in T&E.

ACS team

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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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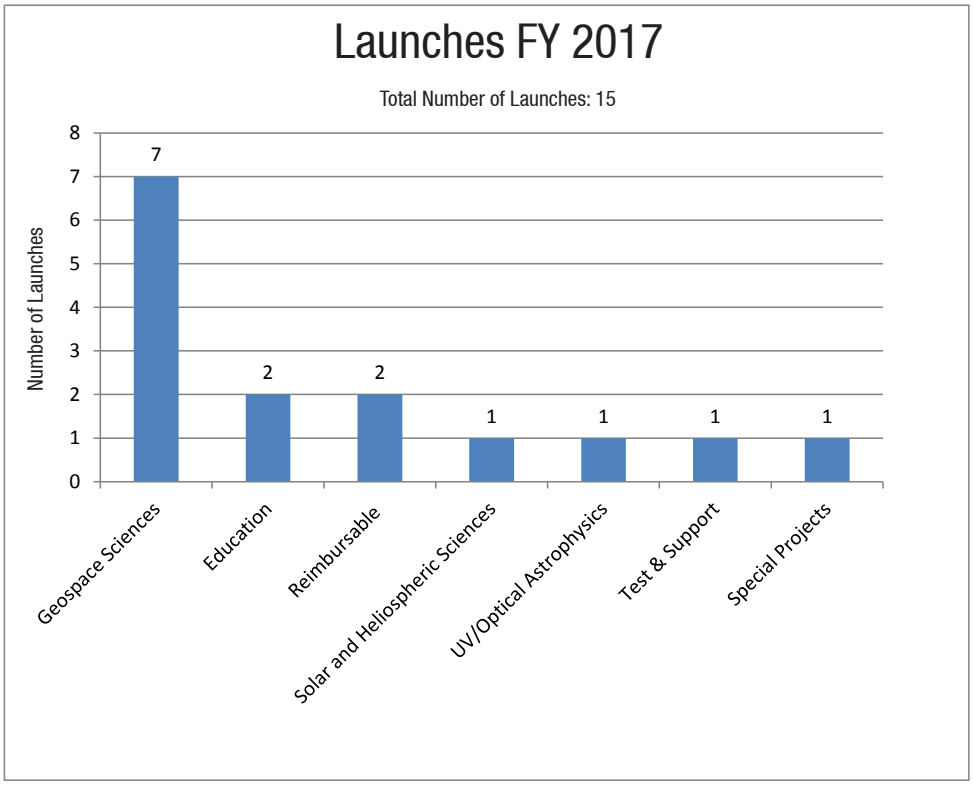


## Kwaj Rocket Team

Image Credit: Matt Griffin