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# Rocket report

4 1  
3 2 2017

Sounding Rockets Program Office

## 36.326 NR Clark/NASA JPL Advanced Supersonic Parachute Inflation Research and Experiments (ASPIRE) - Launched October 4, 2017

The first, of four, ASPIRE missions was launched from Wallops Island, VA on October 4, 2017. The purpose of the ASPIRE series of missions is to demonstrate the high velocity deployment of parachute systems towards the ultimate goal of developing a system that can be utilized to land payloads onto the surface of Mars.



36.326 NR ASPIRE launches from Wallops Island, VA.



# Rocket Report

## ASPIRE Integration and testing photos



36.311 UG Green/University of Colorado - Dual-channel Extreme Ultraviolet Continuum Spectrograph (DEUCE) - Launched October 30, 2017

The DEUCE mission was launched from White Sands Missile Range, NM on October 30, 2017. DEUCE was designed to directly measure the amount of the Lyman continuum (LyC) radiation that is being produced by early B stars in our own galaxy, the Milky Way.

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 at  $z = 6-11$ .

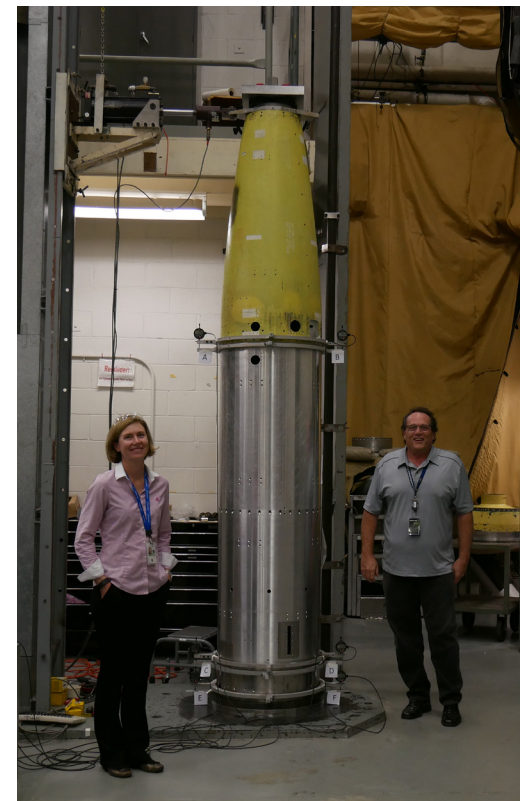
This DEUCE flight aimed to observe the only two non-white-dwarf stars in our own galaxy known to have a sufficiently low neutral hydrogen column density to measure their ionizing radiation directly: Beta Canis Major ( $\beta\text{CMa}$ ) and Epsilon Canis Major ( $\epsilon\text{CMa}$ ).

Due to a malfunctioning Attitude Control System component, data on the target object was not collected.

12.085 DR Chrisley/U.S. Army Space and Missile Defense Command - Sabre/Zombie - Launched November 16, 2017

This Sabre mission was the second operational flight to support defense systems testing. This Sabre vehicle was the four meter configuration. The goal of the Zombie program is to develop a set of low cost, threat representative short range guided targets for missile defense testing.

The vehicles consist of a M-124 motor with tactical guidance actuators with control system provided by Orbital/ATK Launch Vehicle Division (LVD) in Chandler, Arizona.



Sabre/ZOMBIE bend testing.

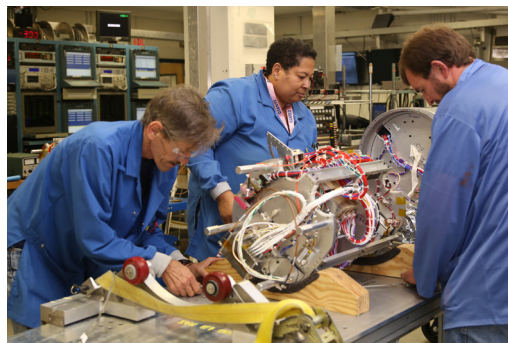
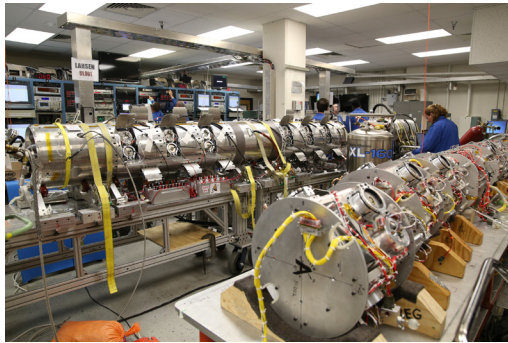
# Integration and Testing

## 51.001 & 51.002 UE Larsen – Auroral Zone Upwelling Rocket Experiment (AZURE)

Two Black Brant XI-A (Talos-Terrier-Black Brant) rockets will be launched from Andoya Space Center in Norway carrying the AZURE payloads. The purpose of the AZURE mission is to determine the relative contribution of the barometric (compression and expansion) and dynamic (divergence and convergence) vertical velocity components in the lower E region across the altitude range of maximum Joule heating. In addition, AZURE will attempt to:

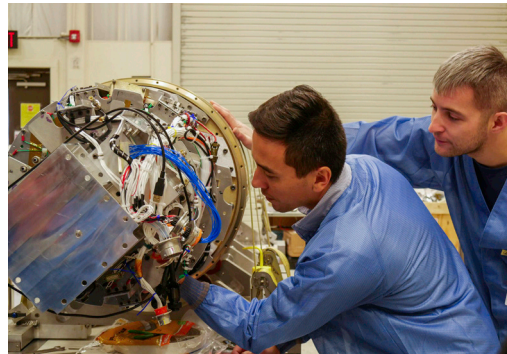
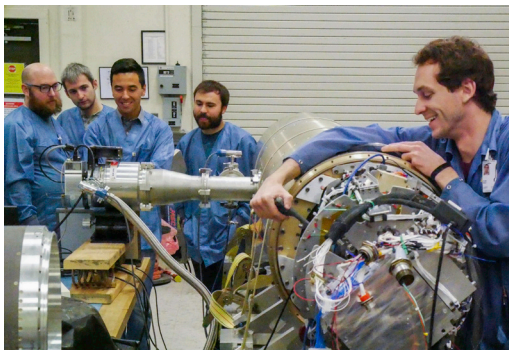
- Obtain the first high-resolution measurements of the mesoscale (10 to 100 km) horizontal neutral flow structure, including the altitude profile of the flow divergence and vorticity, in the active region near magnetic midnight over a broad range of altitudes.
- Obtain the first extended vertical wind profiles covering the full range of altitudes across the E region (AZURE-A) and in both the E and F region (AZURE-B) in disturbed conditions.
- Compare in-situ composition measurements with the measured vertical wind profile and with the predictions of already-published numerical modeling results

The two rockets will be launched into disturbed conditions to measure the neutral flow parameters, the in-situ density and temperature profiles, and the composition profiles in order to address the vertical circulation problems outlined above. Each rocket carries 24 rocket propelled ampules with vapor tracers to enable visualization and ground based observations of the neutral flow.



## 36.330 UH McEntaffer – Water Recovery X-ray – Rocket (WRX-R)

The Water Recovery X-ray - Rocket (WRX-R) is a X-ray spectroscopy payload scheduled to be launched from Kwajalein, Marshall Islands in April 2018. WRX-R is capable of providing moderate spectral resolution,  $R(\approx \lambda/\Delta\lambda) \approx 30$  and will be used to study the Vela Supernova Remnant. The mission will attempt to measure the key lines that indicate the temperature and ionization state of the plasma in the Supernova Remnant. Characterization and comparison of the soft X-ray emission will lead to a more complete understanding of the evolution of supernova remnants and their interaction with the surrounding interstellar medium, as well as, shedding light on matter and energy feedback in the galaxy in general.

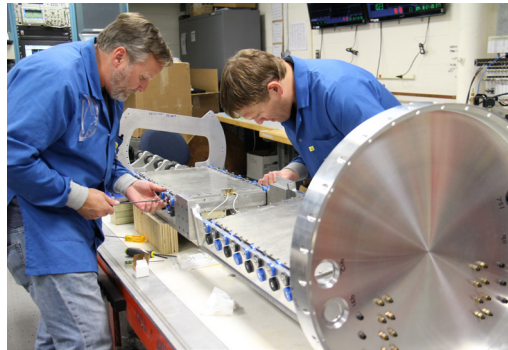


## Integration and Testing cont.

### 36.329 UG Galeazzi – Diffuse X-ray emission from the Local galaxy (DXL)

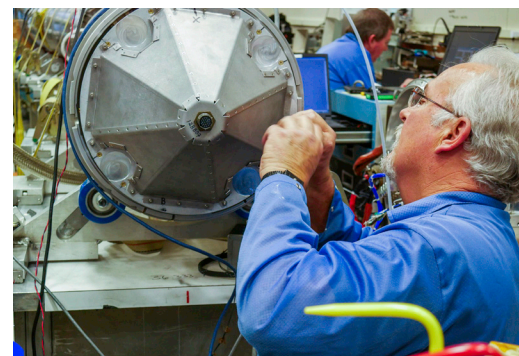
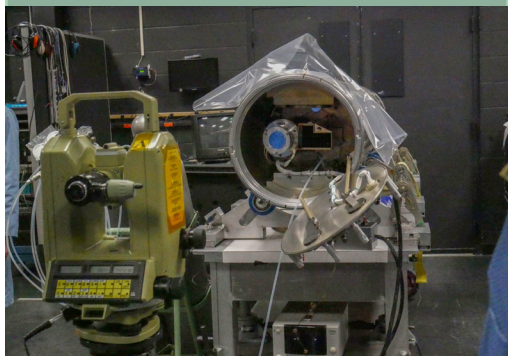
The DXL mission was designed as a multi-year campaign with a total of three sounding rocket flights. The first flight, evaluating the scientific potential of the mission, was launched from White Sands Missile Range (WSMR), NM in December 2012, the second mission, also from WSMR, was launched in December 2015. The third launch is scheduled for January 2018 from Poker Flat Research Range in Alaska. The purpose of the two latter flights is to better understand the nature and characteristics of Local Hot Bubble (LHB) and Solar Wind Charge eXchange (SWCX). Flight 2 investigated X-rays created through SWCX interactions with helium. Flight three will focus on geocoronal SWCX and X-rays created through interactions with hydrogen.

In SWCX, highly ionized ions, such as  $O^{8+}$  or fully ionized Oxygen, in the solar wind collide with neutral atoms, such as hydrogen, picking up an electron in an excited state. The electron then decays producing Ultraviolet (UV) and X-ray emission. These X-rays will be measure by DXL's main instruments, X-ray proportional counters.



### 36.333 UG France – Colorado High-resolution Echelle Stellar Spectrograph (CHESS)

CHESS is designed to study the interstellar medium (ISM) in the ultraviolet part of the spectrum, 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 will be pointed at the star Gamma Ara, in the southern constellation Ara. With this fourth flight of the Colorado High-resolution Echelle Stellar Spectrograph (CHESS-4) sounding rocket payload, sightlines at the lower-edge of the translucent cloud regime can be sampled. This mission aims to study translucent clouds by analyzing the ultraviolet absorption spectra of the two most abundant molecules ( $H_2$  and  $CO$ ) that reside within them. CHESS is scheduled to launch from Kwajalein, Marshall Islands in April 2018.



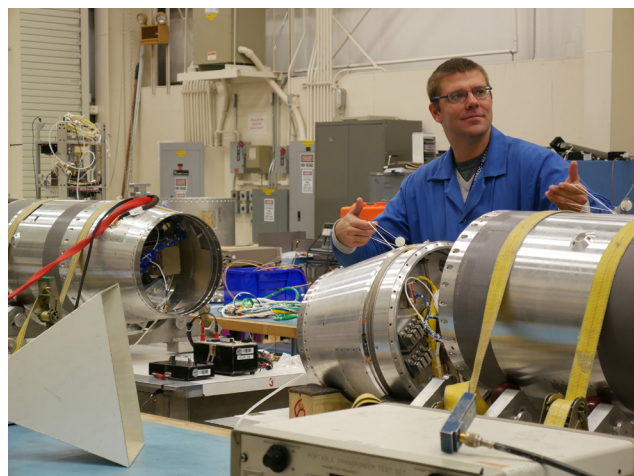
## 41.119, 41.120 & 41.122 CE Azeem – SuperSoaker

Three Terrier-Orion sounding rockets will be launched from Poker Flat Research Range in Alaska in January 2018, as part of the Transport, Chemistry, and Energetics of Water in the Mesosphere and Lower Thermosphere and Implications for Polar Mesospheric Cloud Occurrence mission, also referred to as the Super Soaker mission.

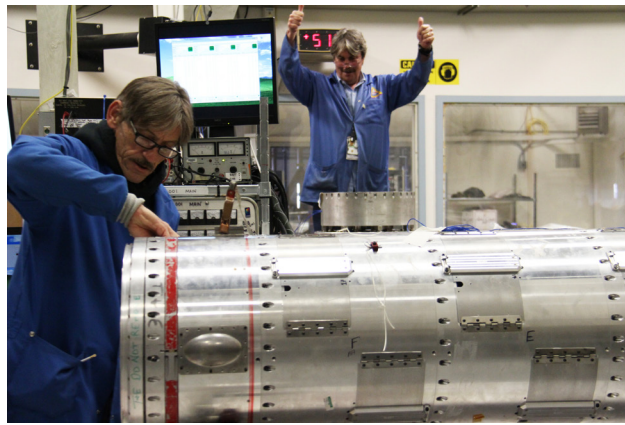
Polar Mesospheric Clouds (PMC), also called Noctilucent Clouds (NLC) are thin ice clouds that form at altitudes of near 85 km at high latitudes in the summer. For these clouds to form, three constituents are needed: cold temperatures, water vapor, and particles for condensation. The sounding rocket mission will study the dynamics of the Mesosphere and Lower Thermosphere (MLT) regions and specifically how release of water in this region impacts local temperature and PMC formation.

The first two Super Soaker rockets, launched 30-minutes apart, will release vapor trails and measure the background winds. The trails will be tracked optically to measure any changes to the winds and allow observation of how the atmosphere responds dynamically to the injection of water. The third rocket, launched 30-seconds after the second, will disperse a large payload of water in the MLT. Additionally the evolution of temperature and any ice particles in the MLT before, during and after the water release will be studied using a lidar. An Advanced Mesospheric Temperature Mapper (AMTM) instrument will be deployed to image the upper mesosphere (~87 km) before, during and after the water release to provide quantitative information on any dynamics/wave activity and changes in mesospheric temperature. The sky will be continuously imaged throughout the experiment at a variety of visible and IR wavelengths to quantify the formation and evolution of any mesospheric clouds formed as a result of the water release. The launch date, January 2018, avoids the summertime PMC season and ensures clear mesospheric air before the release.

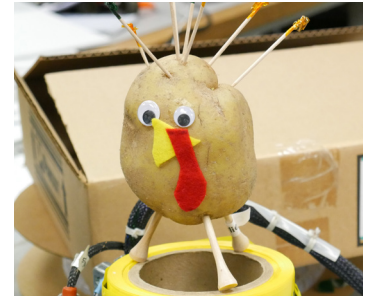
# Rocket Report



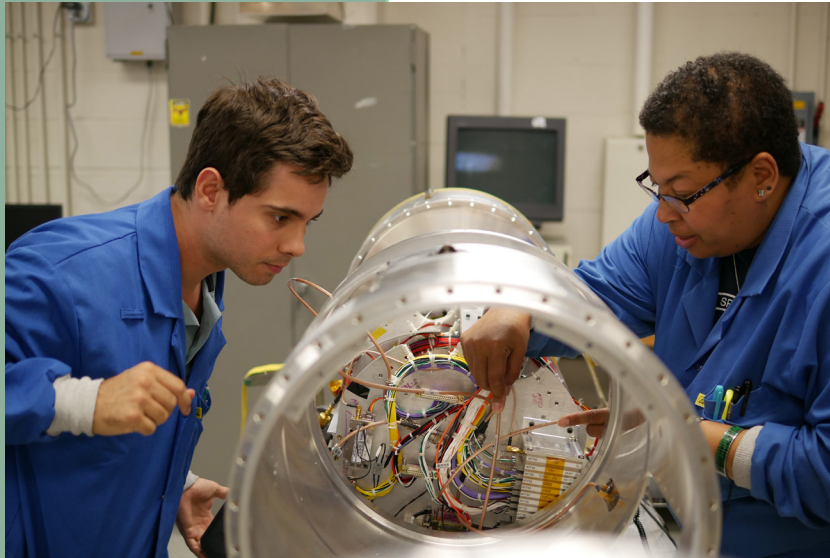
## Picture Place



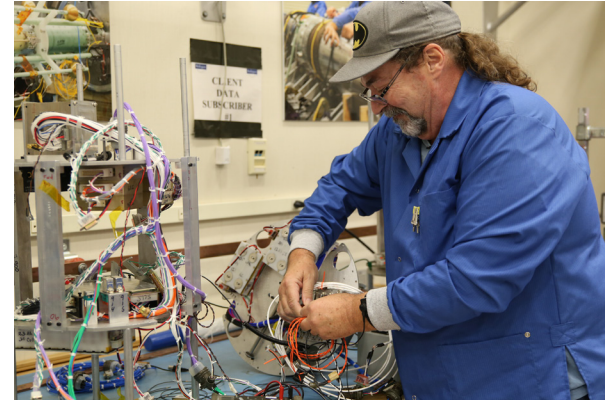
We're GO! Tommy and Clay preparing to vibrate.



Potato turkey courtesy of 5-year old Charlie Southward.



Santiago and Bernita working on Larsen 51.001.



Brian with one of the Azeem payloads.



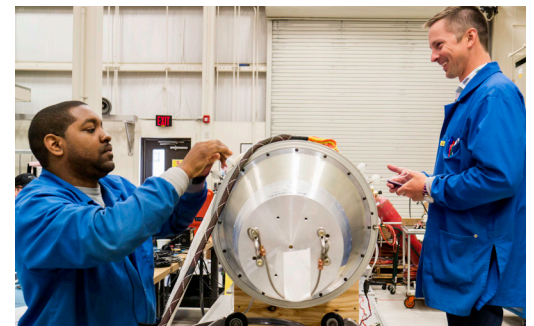
Nathan and Scott at AGU.



Irvin machining.



Azeem payload on the vibration table.



Frank and Travis working on the Clark payload.

*Office Chief Phil Eberspecker and Assistant Chief Tripp Ransone retire.*

