National Aeronautics and Space Administration

Rocket Report

4 1 3 2 2017

Sounding Rockets Program Office

What's inside...

In Brief...

Preparations are underway for the final Peregrine static burn planned for the fall. Plans include the addition of an adapter section between the case and aft closure that will contain prototype insulation samples and instrumentation including ultrasonic sensor to measure real time erosion during motor burn. Post burn hardware inspections will enable direct measurement of insulation erosion rates.

The Design Review for the Astrophysics mission, 36.330 UG McEntaffer has been conducted. This mission will launch from Kwajalein in 2018, and for the first time water recovery of a telescope payload is planned.

12.086 Sabre Zombie was successfully launched from White Sands Missile Range, NM on June 14, 2017. The guided vehicle performed the tailored trajectory and flight maneuvers with high precision

In addition to educational programs outlined on pages 3–5, Office Chief Phil Eberspeaker conducted a workshop for Community College educators.

ASPIRE mission build up is underway. See page 6 for more on these flights.

Campaign planning is underway for Astrophysics launches from Australia in 2019.

36.309 US Hassler/SWRI - Rapid Acquisition Imaging Spectrograph Experiment (RAISE) launched May 5, 2017

RAISE was launched from White Sands Missile Range, NM on May 5, 2017. RAISE is a UV/EUV Imaging Spectrograph that uses only two reflections to provide stigmatic imaging over multiple wavelengths and spatial fields simultaneously. RAISE uses a single off-axis parabola telescope to scan an image of the Sun across a narrow entrance slit which feeds a toroidal variable line space (TVLS) grating spectrograph, and produces stigmatic spectra on two intensified Active Pixel Sensor (APS) cameras. Spectral images are then built up by rastering. RAISE has an extremely high speed scanning-slit imaging spectrograph designed to observe and analyze dynamics and heating of the solar chromosphere and corona on time scales as short as 100 ms, with TRACE-like spatial resolutions, and velocity sensitivity of 1-2 km/s. This was the third flight of RAISE.

RAISE payload during integration at White Sands.
Image Credit: Amir Caspi, Southwest Research Institute

The Principal Investigator is Dr. Donald Hassler/Southwest Research Institute, Boulder, Colorado.

More information: https://www.nasa.gov/feature/goddard/2017/nasa-funded-sounding-rocket-will-take-1500-images-of-sun-in-5-minutes

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36.317 GT - HESH SubTec-7 launched May 16, 2017

This was a technology demonstration mission with primary objectives being the test of the NSROC Forward OGIVE Recovery System (N-FORSe) and the Water Recovery Shutter Door. Both technologies were developed to enhance program capabilities. The secondary objective was to provide a flight opportunity for 23 SRPO/ NSROC development components and piggy-back technology development experiments from reimbursable customers.

NSROC Forward Ogive Recovery Section (NFORSe) is being developed as an in house solution to the Ogive Recovery System Assembly (ORSA) that is currently in use. The addition of a new suite of electronics packaging, the ability to accept various capacities of parachutes, and reduce the cost of manufacturing proves to be a welcomed addition to the inventory of flight hardware capabilities.

The new water recovery design include a modified shutter door with the prototype "water wedge" intended to protect the door mechanism and maintain sealed joint integrity. This recovery system will enable telescope payloads to be launched from sites with water impact areas such as Kwajalein and Wallops Island.

Additional experiments supported by NASA's Space Technology Mission Directorate's Game Changing Development program were also flown on this mission. These experiments included a carbon nanotube Composite Overwrap Pressure Vessel, a joint effort by NASA's Glenn Research Center in Cleveland, Ohio, Langley Research Center in Hampton, Virginia, and the Marshall Space Flight Center in Huntsville, Alabama; a CubeSat test of ultra-lightweight materials from Orbital ATK, Dulles, Virginia; and a Mars Packing Efficiency Payload from NASA Langley.

SubTec–7 being readied for flight.

SubTec–7 lifts off from Wallops Island.

36.323 UG - FRANCE Colorado High-resolution Echelle Stellar Spectrograph 3 (CHESS) launched June 26, 2017

CHESS studied translucent clouds in the interstellar medium (ISM). CHESS allows measurement of the composition, motion and temperature of this interstellar material in unprecedented detail, as well as, takes a snapshot of the raw materials available that were needed to develop planets such as carbon, nitrogen and oxygen. High-resolution absorption line spectroscopy when looking toward hot stars, such as ß Sco1 (beta Scorpii) the target for CHESS, provides a rich set of diagnostics with which to simultaneously measure the temperature, composition, and velocity fields of the solar neighborhood.

CHESS-3 was used to demonstrate new technologies that continue the University of Colorado program of UV hardware demonstration to support efficient UV spectrographs on future large NASA astrophysical missions (e.g., the LUVOIR Surveyor). The instrument has been upgraded from the last flight and includes a new, higher-efficiency echelle that will allow for the first high resolution (R > 120,000) far-UV spectroscopic observation of ß Sco1.

This was the third flight of the CHESS payload that collected science data exceeding expectations

For more information on CHESS, see: https://www.nasa.gov/feature/goddard/2017/nasa-funded-chess-mission-will-check-out-the-space-between-stars

CHESS integration activities before flight.
Photo credit: Dr. Kevin France

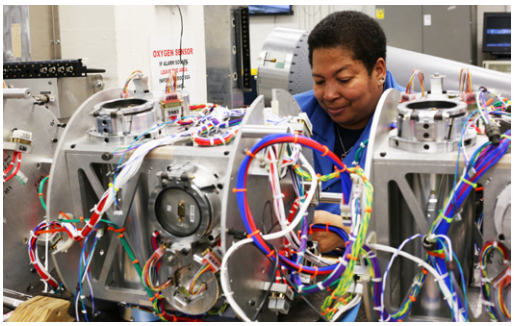
46.015 GT - Hall/NASA GSFC-WFF Ampule test flight launched June 29, 2017

The objective of this mission was to test a deployable ampoule system. The ampules, small “sub-payloads” carrying vapor tracer chemistry, are ejected from the main payload at various altitudes and times during the flight. Sophisticated control systems have been developed to allow autonomous operation of the ampules. The Ejectable Supervisory System (ESS) determines detonation times for the vapor tracers, collects and aggregates data from the ampules and provides the data to the Telemetry system. The ejectable portion includes the ampule with vapor tracer and initiator, Ampule Control Module (ACM), and an Off-the-Shelf rocket motor to propel the ampule. The ACM initiates the rocket motor, implements the release time from the ESS, and transmits data back to the ESS.

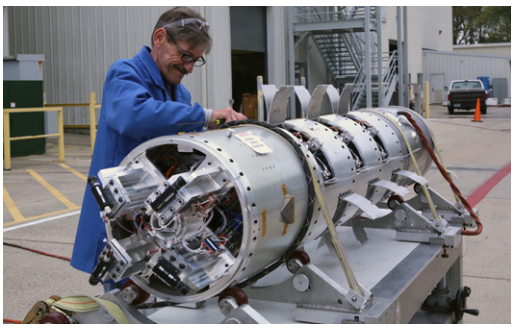
A total of ten ampules were deployed during this testflight. Two additional ampules were installed in the main payload but not deployed. The deploying ampules were designed to travel between 16 and 19 km from the main payload after ejection. Deployment altitudes were between 155 and 180 km. The spread of the deployables allows distributed measurements that are important for ionospheric and auroral research. Measurements of high altitude winds often utilize vapor tracer techniques and the deployable ampule system enables measurements in a larger volume.

Upcoming science missions that will use the new ampule system include two sounding rocket flights from Norway in the spring of 2018.

Spiraled tube launch bay for ejectables.



Ampules installed in launch bays.



Main payload section with deployment doors open.

Payload sequence testing.

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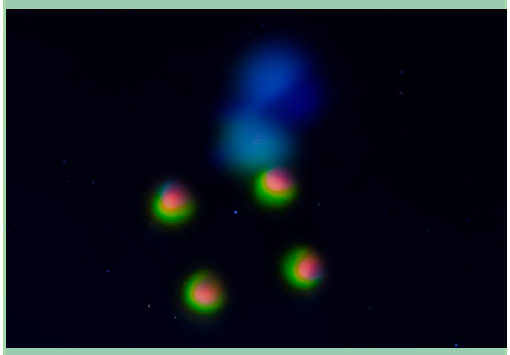
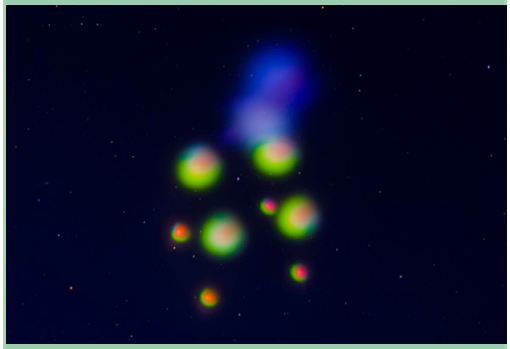
Lift–off from Wallops Island. Launch photo by Terry Zaperach/Wallops Imaging Lab.



Deployments.



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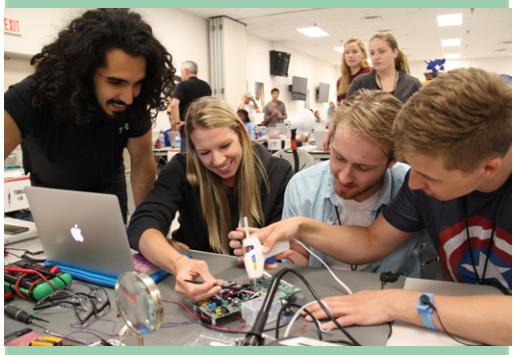
Rocket Week at Wallops

For the tenth year in a row the RockOn! student mission was flown successfully from Wallops Island, VA. The launch occured on Thursday, June 22nd at 05:30 EDT with over 200 excited students watching their experiments head for space.

Three types of experiments were included in the 2017 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 16th 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 sensor 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. 71 students and faculty attended the RockOn! workshop in 2017 and built 24 experiments.



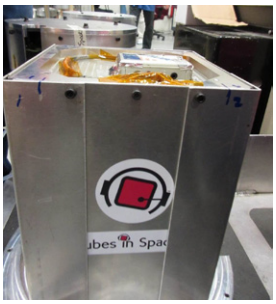
RockOn! workshop experiment construction.

RockSat–C experiment integration.

RockSat–C team after flight.

RockSat-C experiments are more advanced and designed and constructed by the students. This year nine Colleges and Universities participated in RockSat-C with 65 students attending the launch on Wallops Island.

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.



RockOn! launches from Wallops Island.

Students watching the launch.

Links for more information on:

RockOn!

RockSat-C

Cubes-in-Space

The Wallops Rocket Week includes the Wallops Rocketry 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. 2017 was the 6th year of the workshop with 18 teachers selected from over 60 applicants. All participating educators teach STEM topics at the High School Level.

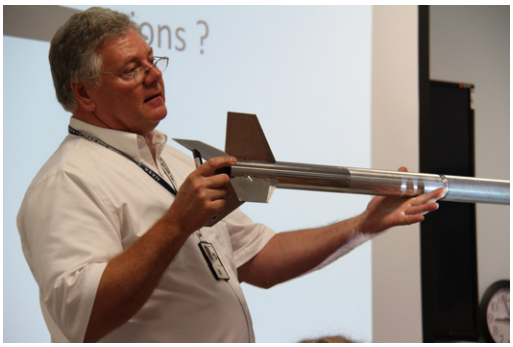
WRATS offers a unique, in-depth, learning experience where teachers not only get hands-on practice building rockets but are exposed to rocket physics through interactive lectures conducted by Office Chief Phil Eberspeaker. Topics such as aerodynamics, propulsion, recovery system design and trajectory simulations are covered in detailed 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 micro-processor 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.


Interactive presentations and demonstrations.


Payload construction.


Model rocket construction.


Rocket testing.


Parachute construction.


Rocket Launch.

Other Educational Activities

Mrs. Hall's art class at Philip C. Showell Elementary School had a unique opportunity to get their creativity flowing. Charlie Cathell from NSROC provided the students with an old nosecone to paint. Below are the fantastic results of the students' efforts.








Mrs. Osmon, Physics teacher at Arcadia High School in Accomack County conducted an after school rocket club program. SRPO provided support with model rocket construction and launching. The students were challenged with packaging a raw egg as their payload and were limited to using a streamer recovery system.





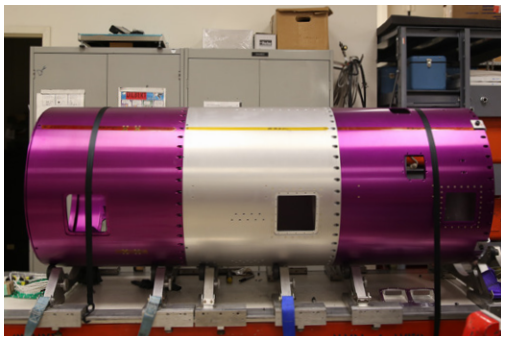

Integration and Testing

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 September 2017. The other two launches are scheduled for November 2017 and January 2018, respectively.

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.

Frank and Travis checking the TM system.

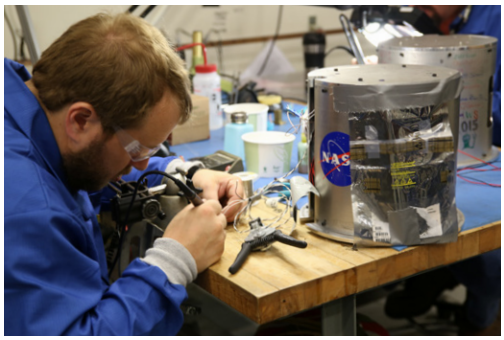


Purple anodized skin for ASPIRE.

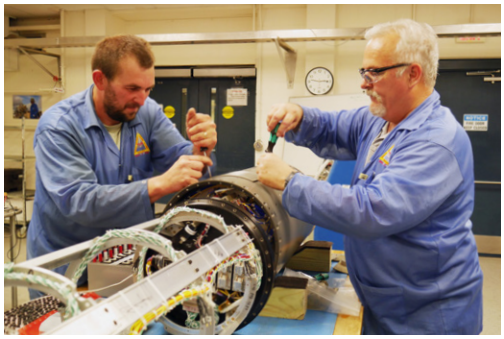
Venus wiring one of the ASPIRE payloads.

41.121 UO Koehler – RockOn!

RockOn! is a quick turn around mission where the testing activities are completed a few weeks prior to the students' arrival at Wallops. The students participating in the workshop portion of the mission build their experiments at Wallops. The more advanced, RockSat-C experiments, are complete on arrival. The RockSat-C experiments are vibrated to check for potential issues during flight. After vibration testing the experiments are returned to the students for corrective action if necessary before flight.



Bill soldering connectors.



Irvin and Gary assembling payload structure.

Randy preparing RockOn! for balancing.

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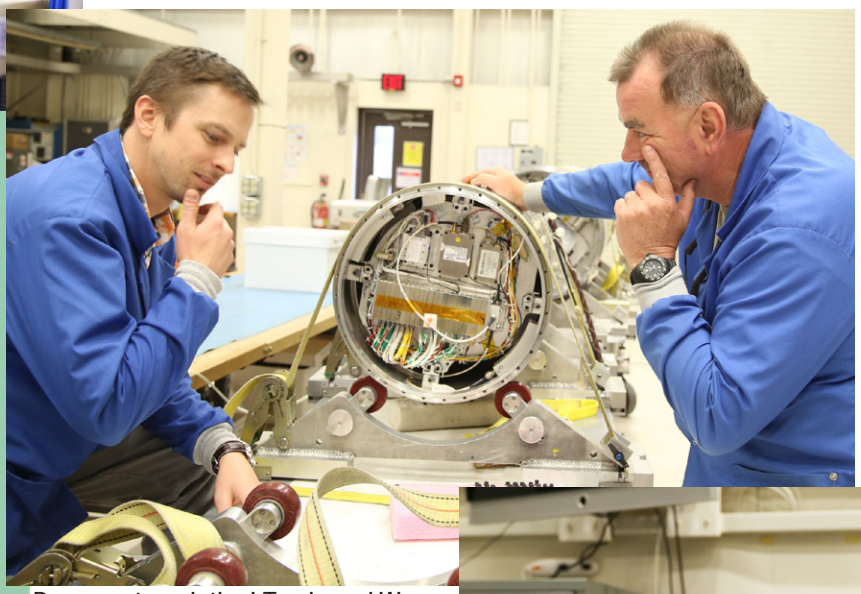
Picture Place

Randy with RockSat–C students in the spin/balance control room.

Zeb and Robert mixing cement for the new machine.



Deep contemplation! Travis and Wayne.

Bernita and Chris waiting for deployment testing.

Koby, Charlie and Megan reviewing schematics.

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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 2017

MISSION	DISCIPLINE	EXPERIMENTER	ORGANIZATION	PROJECT	RANGE	DATE	TIME
46.017 UO	STUDENT OUTREACH	KOEHLER	UNIV. OF COLORADO	RockSat-X	WI	08/12/17	DAY
29.042 UE	GEOSPACE SCIENCES	HYSELL	CORNELL UNIVERSITY	WINDY	KWAJ	08/29/17	NIGHT
36.321 UE	GEOSPACE SCIENCES	HYSELL	CORNELL UNIVERSITY	WINDY	KWAJ	08/29/17	NIGHT
36.311 UG	UV/OPTICAL ASTROPHYSICS	GREEN	UNIV. OF COLORADO	DEUCE	WS	10/30/17	NIGHT

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

WRATS participants before launching their rockets.