National Aeronautics and Space Administration

Rocket Report

4 1 3 2 2011

Sounding Rockets Program Office

What's Inside...

2 Features

3 Integration and Testing

4–5 Education

6 Picture Place

7 Schedules, Events & Miscellanea

In Brief...

Facilities upgrades to the Vehicle Assembly Building (VAB) at the White Sands Missile Range, NM are progressing well.

A Critical Design Review was held for the Inflatable Re–entry Vehicle Experiment (IRVE) III. IRVE III is currently scheduled to be launched April 2012.

The Sounding Rockets Program Office is hosting the first Eastern Shore Rocketry Challenge model rocket launch event. Approximately 200 students will launch their ESTES Alpha III rockets, as well as, several student designed models.

Development of a new launch vehicle, a two–stage, Terrier–Improved Malemute, is progressing and a second testflight is currently scheduled for August 2011.

The 36.278 Brodell payload has been recovered in Alaska and will be refurbished for the Terrier–Improved Malemute testflight.

Photo by Lee Wingfield \ Wallops Imaging Lab

36.278 on the rail at Poker.

36.278 Brodell – Black Brant test flight from Poker

The primary purpose was to conduct a test flight of a recently manufactured Black Brant motor that was cast with a new mixing process. Ground testing indicated that this new process should improve the regressive burn rates and erosion concerns. In addition, a new one piece carbon phenolic exit cone was tested as well as the first flight of the "smooth" contoured throat at the larger diameter. Vehicle performance was nominal collecting good flight data leading to the decision to cast future motors with this new process. Results indicate an improvement in pressure regression during flight.

41.096 Hall – SubTEC V launches from Wallops

The SubTEC V payload was launched on a Terrier–Improved Orion sounding rocket from Wallops Island, VA on June 10, 2011.The primary objective of this mission was to flight test SMART payload technologies designed and built by the Goddard Space Flight Center (GSFC) for the Opertationally Responsive Space (ORS) program. The secondary objectives were to provide a flight demonstration of the GSFC/Space Cube flight processor and to provide a test flight opportunity for NSROC components.

Continued on page 2.

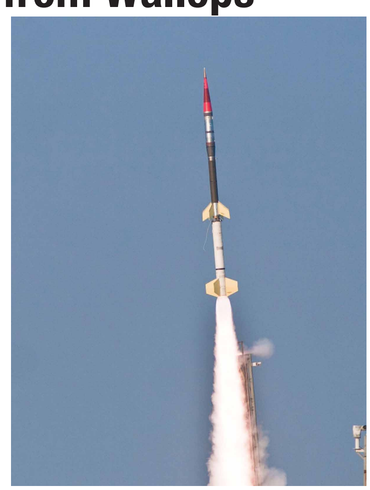


Photo by Cliff Murphy\NSROC

41.096 SubTEC V lift off from Wallops Island

Rocket Report

SubTEC IV continued

Adapted from Goddard Tech Trends/
Fall 2010
(http://gsfctechnology.gsfc.nasa.gov/)

The primary experiment was the Small Rocket/Spacecraft Technology (SMART) platform, created by Goddard technologist Jaime Esper and the Defense Department's Operationally Responsive Space (ORS) Office, which helped fund the platform's development. The platform promises to provide faster, less expensive access to space because of its modular, reconfigurable design that users can adapt to a variety of missions, Esper said.

Comparable in size to an old–fashioned hatbox, the SMART microsatellite can be integrated and readied for launch in as few as seven days for a cost of less than $1 million, Esper said. "We've developed a creative way to reduce mission life–cycle times, with the resulting savings in cost. This enables a new class of researchers who can't afford the high costs of getting into space."

Although Esper debuted SMART on a suborbital flight, he said his platform is intended for orbital missions, particularly as a freeflyer for planetary missions. To demonstrate that capability, Esper equipped SMART with three digital video cameras and other equipment serviced by SpaceCube. The microprocessor processed data–heavy video to test high–speed interfaces and monitor the deployment of SubTEC's recovery para–chute.

Another prototype experiment flown was an electrohydrodynamic based thermal control unit developed by Goddard thermal engineer Jeff Didion. "I recognized early that if you want to develop a new type of freeflyer that can travel in different orbits, you have to control the thermal environment," Esper said. Didion's technology uses electric fields to pump coolant through tiny ducts inside a thermal cold plate. The advantage is that the system requires no moving parts, just electrodes to apply the voltage to move the coolant. Didion now is attempting to further reduce the size of his technology and is investigating ways to take it to the chip level where the ducts would be no larger than 100 microns, or ten–thousands the width of a human hair.

SubTEC V team with payload on balancing table.

SubTEC V team with SMART.

While Esper's primary objective was to demonstrate SMART as a platform for scientific use, he and the Defense Depart–ment also want to showcase its capabilities as a platform for testing a space–based range tracking and safety system called the Autonomous Flight Safety System.

The secondary objective of this mission was to provide a flight demonstration for the Goddard–developed SpaceCube processor, which is equipped with Xilinx Virtex–5 field programmable gate arrays, including two commercially available power PC cores that overcome radiation upsets through software techniques. Twenty–five times faster than the current state–of–the–art microprocessor, SpaceCube captured simulated data and transmitted it to the ground using an omnidirectional S–band antenna encircling the SubTEC. Data that SpaceCube didn't transmit was processed and stored onboard at a rate of about one gigabit per second — another capability scientists said they need to carry out their research.

Integration and Testing

21.140, 21.141, 41.090 & 41.091 Pfaff – Daytime Dynamo Experiment

The Daytime Dynamo Rocket Investigation is a series of rocket payload pairs to investigate the Neutral–Ion Coupling and Shear Wind Effects in the Daytime Lower Ionosphere. This investigation will explore, for the first time, the ionneutral coupling, wind shears, and electrodynamics of the mid latitude lower ionosphere during the daytime. In particular, it will determine the cause of intense daytime irregularities that are consistently observed in the mid–latitude, ionosphere during the summer. The investigation will examine, as a function of altitude, the relationship of the electric fields, currents, neutral winds, plasma density, ion mass, and neutral density in order to reveal fundamental processes regarding the momentum transfer between the ionized and neutral gases and their associated electro–dynamics (e.g. the daytime dynamo). The data will be used to deter–mine the relative roles of DC electric fields, plasma density gradients, and wind shears adds to the source of the intense irregularities.

The Daytime Dynamo mission will launch a total of four rockets. Two rocket/payload pairs include one each of a highly instrumented payload with multiple sensors on booms and appendages. The second payload of each pair includes a lithium pyrophoric ejection along with a falling sphere incorporating GPS for tracking purposes. The two pairs of rockets are intended to be launched within the minimum realistic time span (approximately 15 seconds).

Above: Dr. Pfaff, Principal Investigator inspecting an instrumented payload. Top right: Paul Rockwell and Charlie Cathell with one of the falling spheres. Right: Frank Waters working on one of the instrumented payloads.

Education

Wallops Rocket Acadmy for Teachers and Students (WRATS)

WRATS
Wallops Rocket Academy for Teachers and Students

The first WRATS High School teacher workshop was held in the new education lab in building F–7 at Wallops Flight Facility. Twenty–three educators, representing twelve states, attended the workshop and spent June 20 – 24 learning about sounding rockets, model rockets, electronics, rocket physics and aerodynamics. The participants also visited with the college level workshop RockOn! occuring the same week, and attended the RockOn! Terrier–Orion launch on June 23rd.

The first day of the workshop started with a range entry briefing, a general overview of the sounding rockets program, and a presentation on rocket propulsion. The afternoon focused on electronics with the participants building their own electronic payloads for model rockets. The payloads recorded pressure, temperature and acceleration data.

Days two and three involved rocket physics, trajectories, and flight performance. Moments of inertia were measured using inertia bars and the educators conducted wind tunnel testing of a model rocket. Hands–on activities for these two days included building model rockets, integrating the payload and conducting launch operations. The rockets were successfully launched on the Wallops airfield.

Viewing the RockOn! launch on Thursday involved an early morning wake–up time. The launch window opened at 6:00 a.m. and the rocket was launched at 06:18 ET. For most WRATS attendees, this was their first sounding rocket launch and their excite–ment was noticable. De–integration of the RockOn! payload occured in the afternoon and the WRATS team saw the payload skins removed and the experiments returned to the students. Additionally, parachute construction and drops, using the crane in F–7, were conducted on Thursday.

The last day of workshop, Friday, June 24th, teachers wrote evaluations of the program and also listened to presentations about NASA Explorer Schools and the AESP programs. Six participants stayed for the afternoon computer programming session.

Education

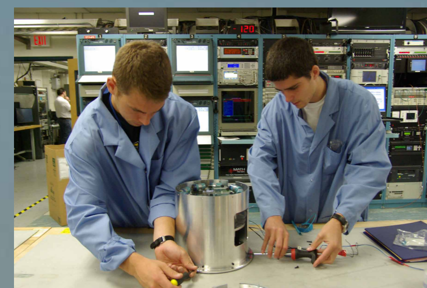
RockOn! and RockSat–C launched on June 23, 2011.

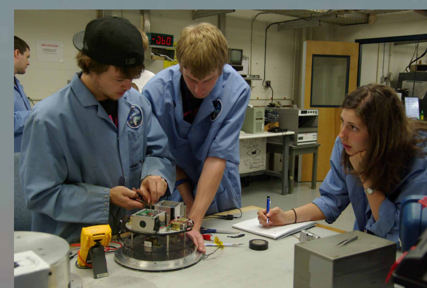
For the 4th consecutive year, the RockOn! mission launched successfully from Wallops Island. About 70 college students and educators had spent a week at Rocket – U Wallops completing and integrating their experiments to fly on this sub–orbital mission.

The RockOn! workshop is arranged by the Colorado and Virginia Space Consortia and provides flight opportunities for Colleges and Universities. The mission was comprised of 10 RockOn! workshop experiments and 8 RockSat–C experiments. RockSat–C experiments are completely designed by the student teams while the RockOn! work–shop experiments are built from kits created by the Colo–rado Space Grant. Attending the workshop is the first step toward more elaborate future experiments.

Working in teams of three or four, each RockOn! team receives an experiment kit consisting of an AVR micropro–cessor, various sensors, mounting hardware and program–ming software. Chris Koehler, Director of the Colorado Space Grant Consortium, is the instructor for the RockOn! workshop. He is assisted by several students from the University of Colorado. By mid–week all RockOn! teams had completed their experiment construction, programming and integration. Their experiments were installed in the payload structure and transported to Wallops Island for mating with the rocket motors.

The launch window opened at 6 a.m. on June 23rd and the countdown started a few hours before that. The launch of the 2011 payload occurred at approximately 06:18 a.m. The viewers aided in the countdown as the clock neared 0. At T –0 the Terrier booster ignited and some very happy experimenters cheared it on as it lifted their instruments toward space. A short burning booster, the Terrier burns out after about five seconds, and the Orion sustainer takes over after a short coast phase. At an altitude of about 110 km the payload separates from the Orion and coasts to reach an apogee of 119 km. On the downleg a parachute is deployed to soften the impact of the payload. The payload is sealed and remains floating in the water until it is picked up by the recovey boat. Once the payload is back at Wallops Flight Facility the the experiments are returned to the students and postflight checks and data analysis can begin.



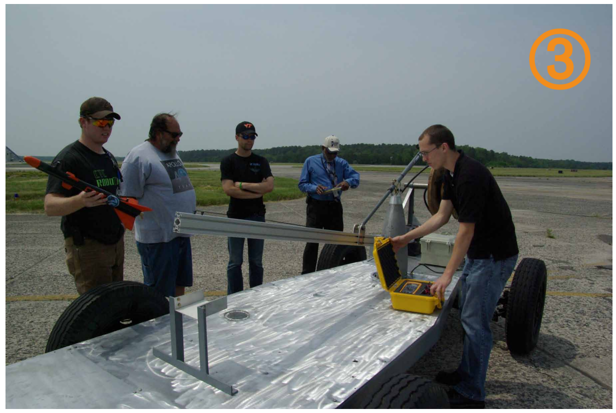


Launch photo by Jacob Owen/Wallops Imaging Lab.

Rocket Report

Picture Place...

1. Two H_2Os, Greg and Frank Waters.
2. RockOn, RockSAT and WRATS teams.
3. Testing the Nano HAD launch system.
4. Paul, Eric and Nick with a Pfaff payload.
5. Getting ready to launch on Inspire Day.
6. Happy people: Dwight, Belinda and John.
7. Nate and Tim working on the Pfaff mission.
8. Pfaff team members from Greenbelt.



Upcoming Launches FY 2011

July

21.140 GE PFAFF/NASA-GSFC WI
21.141 GE PFAFF/NASA-GSFC WI
41.090 GE PFAFF/NASA-GSFC WI
41.091 GE PFAFF/NASA-GSFC WI
41.092 UO ROSANOVA/NASA-WFF WI

September

36.253 US HASSLER/SWRI WS
36.260 UG COOK/BOSTON UNIVERSITY WS
36.264 UH MCCAMMON/UNIV. OF WISCONSIN WS

Rocket Report

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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From the Archives...

Barium and lithium releases from either 33.034 or 33.035 Heppner, launched July 15th and 20th 1983, respectively, from Wallops Island.