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# Rocket Report

4 1 2008  
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Sounding Rockets Program Office

## 30+ missions scheduled for 2009

### In Brief...

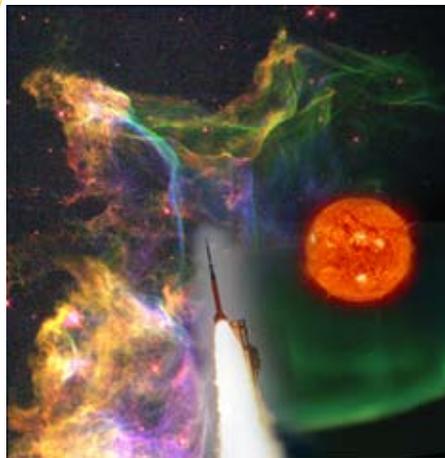
36.207 Kowalski was successfully launched on October 20, 2008.

Possible future Japanese sounding rocket missions from Wallops are being discussed.

The Hands-On Project Experience (HOPE) program plan is under review. This program will provide a training opportunity for NASA Center personnel to design, build and fly a science or technology mission.

The Sounding Rocket Working Group meeting was held at Wallops December 10 - 11, 2008. A briefing on Human Tended Suborbital Science was provided by Paul Hertz/Chief Scientist, Science Mission Directorate.

A Mission Initiation Conference was held for Goynes 41.085. This is a new student outreach mission with the University of Virginia and Virginia Polytechnic Institute involving scram jet technology demonstration. Launch is currently scheduled for November 2010.



Geospace Science, Solar & Heliophysics studies, Astrophysics and test rounds dominate 2009.

A total of 18 NASA science missions, 5 test rounds, and 13 re-imbursable missions, including 2 NASA re-imbursables, are on schedule for 2009.

Kowalski, 36.207, successfully started the launch year on October 20, from White Sands Missile Range, NM.

The 1st quarter of Fiscal Year '09 was dominated by preparations for the Poker Flat campaign. The 2nd and 3rd quarters includes several helio- and astrophysics missions from White Sands. Continued testflights of the Mesquito-Dart, and the new Terrier-improved Malemute also are on schedule for 2009. **More on page 2.**

## Poker Flat Campaign 2009

Bounds, 21.139 & 36.242, and Lynch 40.023 integration and testing was conducted in last quarter of calendar year 2008. These three payloads are part of the Poker Flat campaign starting in January 2009. A total of eight missions, studying various aspects of the aurora, are scheduled for flight in January - February.

Bounds 21.139 and 36.242 Auroral Current and Electrodynamics Structure (ACES) is designed to study electric fields and current structure within an aurora.

Continued on page 2.

Herbie Haugh and Holly Hancock check booms on 21.139 after deployment.



Photo by Berit Bland

## 30+ missions... continued



Payloads for Solar and Heliospheric Sciences in 2009 include:

**The HELium Resonance Scatter in the Corona and HELiosphere**

**(HERSCHEL)** program (36.221 Moses) aims to develop instrumentation to directly image and characterize on a global coronal scale the two most abundant elements, hydrogen and helium. The **Solar Ultraviolet Magnetograph Investigation (SUMI)** (36.213 Davis) experiment will test technologies for making magnetic field measurements in the upper chromosphere/ lower transition region of the Sun.

The **Rapid Acquisition Imaging Spectrograph Experiment (RAISE)** (36.219 Hassler) is an extremely high speed scanning-slit imaging spectrograph designed to observe and analyze dynamics and heating of the solar chromosphere and corona.

The scientific objective of the **Very high angular Resolution Imaging Spectrometer (VERDIS)** (36.239 Korendyke) is to advance the understanding of fundamental solar physics such as coronal heating, solar wind acceleration, flares, and coronal mass ejections.



UV and Optical Astrophysics payloads include:

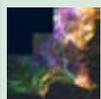
**The Cosmic Infrared Background Experiment (CIBER)** (36.226 Bock)

will conduct a pioneering search for InfraRed Background (IRB) anisotropies.

The **Diffuse Interstellar Cloud Experiment (DICE)** (36.244 Green) will sample the interface at the local cavity wall in the Inter Stellar Medium by obtaining high resolution spectra of OVI (oxygen five times ionized) in absorption.

**PICTURE (Planet-Imaging Concept Test-bed Using a Rocket Experiment)** (36.225

Chakrabarti) will demonstrate and validate key technologies for extrasolar planet imaging.



High Energy Astrophysics payload:

**The Cygnus X-ray Emission Spectroscopic Study (CyXESS)**

(36.252 Cash) will obtain x-ray

spectral diagnostics of the Cygnus Loop.

Additionally, two Education Outreach missions, 30.073 Thorsen from Poker Flat, AK and 41.083 Koehler from Wallops Island, and five test-rounds are scheduled for 2009.

## Poker Flat... continued

This mission, uniquely suited for sounding rockets, is taking the next step in developing the detailed measurements to properly investigate auroral electrodynamic and structure and further the understanding of Magnetosphere-Ionosphere-Thermosphere (M-I-T) coupling. Changes in magnetospheric and/or ionospheric parameters, such as electric fields, plasma, conductivity and current, feed back through the entire system. How these interactions work are the topics of interest to understanding the M-I-T coupling. Once these mechanisms are understood, a complete electrodynamic model of the aurora will be possible.

Two payloads are placed at different altitudes at nearly the same time. ACES-low, 21.139 a single stage Brant, will reach an apogee of approximately 130 km and ACES-high, 36.242 a Terrier-Brant will reach an apogee of about 400 km nearly simultaneously. ACES-Low will be launched a few minutes after ACES-High, to ensure that they are as close to magnetic conjunction near their apogees.

Additionally, a wide variety of ground based instrumentation, including the SuperDARN and AMISR radars will be used in conjunction with the ACES mission.

New instruments in the ACES payloads include a flux gate magnetometer from Applied Physics Lab (APL) at Johns Hopkins University. An identical instrument is on its way to planet Mercury onboard the MESSENGER spacecraft.



Dr. Scott Bounds inspecting payload after the operational spin test.

References: 21.139 & 36.242 Design Review Data Package

## 40.023 Lynch

The purpose of the CASCADES2 (Changing Aurora: in-situ and Camera Analyses of Dynamic Electron Precipitation Structure) sounding rocket mission is the investigation of motions and structure of electron precipitation in pre-midnight pole-ward edge discrete aurora. The main scientific objective is the investigation of spatial and temporal structures within electron precipitation and low frequency electric field activity in the topside ionosphere.

This highly complex mission includes the main payload and four sub-payloads: two identical wire-boom electric field subpayloads (E-field subpayloads) with GPS position and timing, and two free-flying particle detector subpayloads (particle-free-flyers, or PFFs) with GPS position and timing.



Dr. Kristina Lynch working on one of the Particle Free Flyers.

Ground based systems included a dedicated narrow-field auroral camera at Kaktovik or Toolik Lake. These images together with those from all-sky cameras and from an onboard, downward-looking camera will provide the auroral context for the in situ plasma measurements.

The Cascades mission is providing a test flight opportunity for the KTH SMILE magnetometer, a new small science magnetometer with potential use for future low-resource small science payloads.

References: 40.023 Design Review Data Package

The outstanding efforts of the NSROC – SRPO team resulted in one hundred percent mission success for Fiscal Year '08. Twelve core NASA missions and five reimbursable missions were conducted successfully from around the world.

Notable accomplishments included the TRICE and SCIFER missions from Norway, made possible by refurbishing an old Athena launcher on loan from the Navy. Two test flights of the new Mesospheric–Dart, also known as the “Mesquito, were conducted in May 2008. Four missions were flown from White Sands throughout the year, and Sub–TECH II was launched from Wallops Island in July. Additionally, NSROC supported the MDA NGSP mission, culminating in a highly successful launch of a Black Brant XI from Wallops. The new celestial ACS continues to be a great success with the science community. A partnership with the Colorado and Virginia Space Consortia resulted in an educational flight opportunity, RockOn!, for 60+ students and faculty members from universities around the country. RockOn! will continue with Koehler 41.083 scheduled for launch in June 2009. In summary: We Rocked in '08!

The schedule for 2009 is filled with science and technology flights. A total of 22 core missions, including science, technology, and vehicle test–flights, and 13 reimbursable missions, are scheduled for FY '09. January 2009 will come to a flying start when the Bounds, Lehmacher, Lynch and Thorsen teams arrive at Poker Flat to launch eight rockets to study various aspects of the Aurora. IRVE is returning for a second test flight of the ballute re–entry system. Eight missions are scheduled from White Sands. Four more test–flights of the Mesquito are planned, as is a test–flight of a new vehicle, the Terrier–Improved Malemute. 2009 is shaping up to be another busy and exciting year!

Your dedication to teamwork, mission success and the Wallops can–do attitude takes the Sounding Rocket Program to new heights every year. Thank you! It makes me very proud to be part of this successful team and I look forward to another year of working with you.

Phil Eberspeaker  
Chief/Sounding Rocket Program Office

2008 has been a very good year for NSROC. Our accomplishments are many as we maintain a high mission success rate while introducing several technical innovations and continuously improving our processes. We should not lose focus, however, as 2009 will have early challenges. We have 14 missions scheduled in January and February from Poker Flat, White Sands, and Wallops. We are better prepared for this upcoming launch campaign than I can remember from years past. Completing design, fabrication, integration and test on several Alaska missions, months in advance, was a tremendous help to the workload at the end of the year. Thanks to the Lehmacher project team and the supporting functional areas for the insight to complete this work early; and to the Bounds and Lynch teams who continue to work long hours to ensure that payloads are integrated, tested and shipped on schedule.

January 2008 presented equally complex challenges to NSROC's Business and Financial Management group – the transition to a new financial accounting system impacted every area of operations by requiring extensive training, the implementation of new processes, the introduction of hundreds of new charge numbers, and new systems for time cards, expense reports, payroll, procurement, accounts payable, invoicing, etc. Most of the major transition issues have now been resolved thanks to the hard work and dedication of the NSROC business office staff and the patience and cooperation of our NSROC employees and our NASA customer. During the next year we will benefit from the additional capabilities this new system has to offer.

In just one more month, we will complete 10 years of the NSROC contract. I am proud to say that, by any measure, NSROC has been very successful. We've maintained or exceeded the launch rate and mission success rate of the 10 years prior to award of contract despite the increased complexity of mission requirements. On average, we have introduced three major innovations per year resulting in better processes, efficiencies, and improved system performance for our science customers. Our safety processes and procedures have been vastly improved and we now have a robust safety and quality program. We've introduced new equipment in the machine shop, electrical shop, ground stations, and T&E lab to increase capabilities – and every machine, every innovation, every improvement represents the positive thinking, the "can do" attitude, the willingness to learn, train, perfect, meet and defeat our challenges that have, for an entire decade, characterized "the NSROC Team." Without each and every one of you, the success we've achieved would not have been possible – employees truly are our most important asset!

As we enter the holiday season, please take some time for yourself and your families, reflect on the past year, and stay safe. 2009 will be a challenge but I am confident that, together, we can and will achieve our objectives. Thank you for all you do every day to support me, the NSROC Program and our NASA Managers.

Rob Maddox  
NSROC Program Manager

# Virginia Tech Aerospace Engineering Student Has Key Role in NASA Project

by Jan Jackson

Mark Peretich, a Virginia Tech senior who joined the NASA Sounding Rocket Operations Contract's Attitude Control Systems (NSROC/ACS) team as a co-op student in 2007, was a key player in the development of a system called Real Time Attitude Solutions (RTAS) that could prove beneficial in reducing costs of rocket flights.

RTAS is part of Mission 41.075, a sub-tec demonstration launch designed to showcase, test and evaluate new sounding rocket capabilities and technologies. The RTAS technology provides a converging software routine that melds data from a group of onboard sensor suites. RTAS uses an aptly named Gumstix micro-computer running the extended-Kalman filter to calculate three-axis attitude solutions onboard in real time from solar and magnetic fields and a MEMSense three-axis rate integrating gyroscope with integrated digital magnetometer and accelerometers.

Peretich's software skills allowed the Gumstix microcomputer to provide body-fixed, independent angular measurements with regard to the solar vector and magnetic fields and to combine data collected from those fields with simple coordinate transformations to provide inertial orientation angles within five degrees.

The RTAS team included Peretich, an aerospace engineering student, as the primary software developer. His mentor and senior ACS Engineer Dave Jennings handled hardware, and GNC Tech Pat McPhail managed integration. Together, they turned RTAS into one small but mighty system. The project was completed in an extremely short, three-month timeframe, integrated with the Sub-TEC payload, monitored during extensive tests in NSROC's Testing & Evaluation Lab, and successfully launched on 14 July.

Compared to ACS Systems like the GLN-MAC, which measures internal payload activity with a high rate of accuracy and equally high cost, RTAS offers a new alternative to NASA scientists and investigators seeking low-cost flights. "This was a phenomenal achievement for NSROC, NASA and the business, academic and scientific communities they serve," said Jan Jackson, outreach manager.

For Peretich it was a rare opportunity for an undergraduate student to work with senior engineers in the field of his choice, accept a formidable challenge, and succeed in actually creating a brand new technology. "We're proud of the 90 students who have worked in our co-op and intern programs," added Jackson. "Many have gone on to get advanced degrees; others are making significant contributions to the aerospace industry. Mark Peretich is among the best of the best!"

## Rocket Report



Photo by Berit Bland

Above: Sub-TECH II payload on spin/balance table.



Photo by Berit Bland

Left: Mark Peretich (left) with his mentor Dave Jennings.

Below: Sub-TECH II launch from Wallops Island.

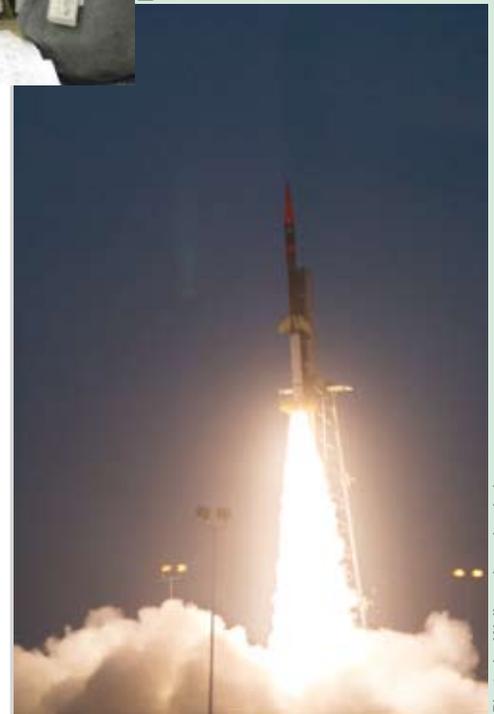


Photo by Wallops Imaging Lab

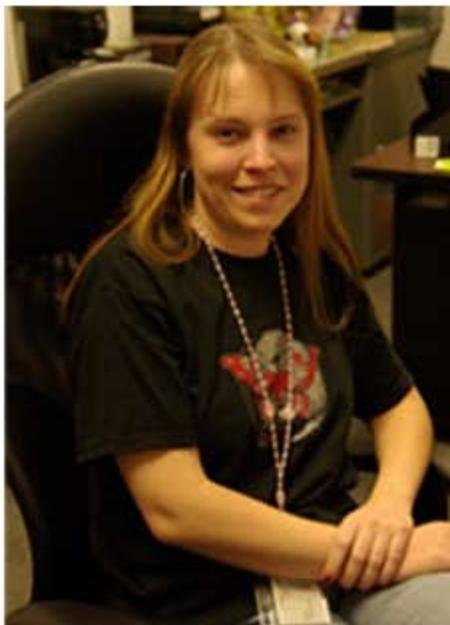
# Rocket Report

## Picture Place...

- ① Brian Creighton and Wayne Taylor with Lynch 40.023
- ② Dave Burkhead testing pyros.
- ③ Dr. Kristina Lynch, PI on 40.023, with Joe McGee.
- ④ Herbie Haugh and Larry Lockhart with Bounds 21.139
- ⑤ Mick Sharpe and Nate Wroblewski with Bounds 21.139



# New employees in 2008



Christine Power  
Guidance, Navigation & Control Engineering



Belinda Serabian  
Vehicle Systems Engineering



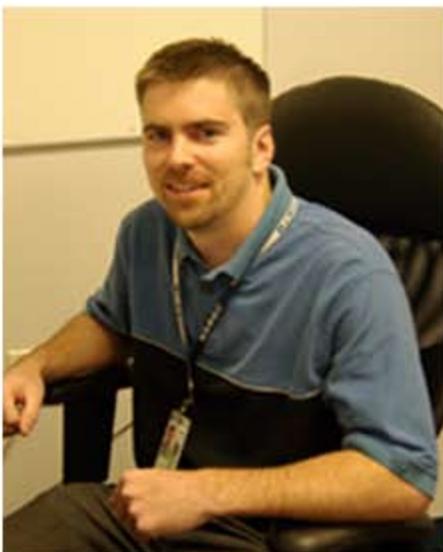
Christian Amey  
Electrical Engineering



Daniel Bowden  
Electrical Engineering



Christopher Gabbard  
Electrical Engineering



Brian Banks  
Electrical Engineering



Jason Reese  
Mechanical Engineering



Keith Foster  
Mechanical Engineering



**James Alexander**  
Safety & Quality Assurance



**Lynn O'Donnell**  
Safety & Quality Assurance



**Jonathan Daughton**  
Drafting



**Michael Scott**  
Flight Performance/ACS Tech.



**Jonathan Farrell**  
Machine Shop



**Ryan McCready**  
Stock Room



**Ted Gacek**  
White Sands Missile Range



**Mike Wheeler**  
Business Management

# New employees in 2008

Additional new employees will be pictured in the next 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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Email: Charles.L.Brodell@nasa.gov  
or  
Berit Bland  
Phone: #2246  
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## From the archives...

## FY '09 Launch Schedule

### January

36.221 DS MOSES/NRL WS  
12.068 GT HICKMAN/NASA-WFF WI  
12.069 GT HICKMAN/NASA-WFF WI  
36.242 UE BOUNDS/UNIVERSITY OF IOWA FB  
21.139 UE BOUNDS/UNIVERSITY OF IOWA FB  
30.073 UO THORSEN/UNIV. OF ALASKA FB

### February

12.070 GT HICKMAN/NASA-WFF WI  
12.071 GT HICKMAN/NASA-WFF WI  
40.023 UE LYNCH/DARTMOUTH COLLEGE FB  
41.076 UE LEHMACHER/CLEMSON UNIVERSITY FB  
41.077 UE LEHMACHER/CLEMSON UNIVERSITY FB  
41.078 UE LEHMACHER/CLEMSON UNIVERSITY FB  
41.079 UE LEHMACHER/CLEMSON UNIVERSITY FB  
36.226 UG BOCK/CAL TECH WS FEB

### April

36.213 NS DAVIS/MSFC WS  
36.219 US HASSLER/SWRI WS  
12.067 GT HALL/NASA-WFF WI

### May

36.244 UG GREEN/UNIVERSITY OF COLORADO WS

### June

41.083 UO KOEHLER/UNIVERSITY OF COLORADO WI  
36.252 UH CASH/UNIV. OF COLORADO

### September

36.239 DS KORENDYKE/NRL WS

### TBD

36.225 UG CHAKRABARTI/BOSTON UNIVERSITY WS TBD



Bill Doughty with Kelley 29.020. The payload was launched in March 1983 from Peru. The picture was taken at Wallops in 1982.