# Rocket UNIVERSITY

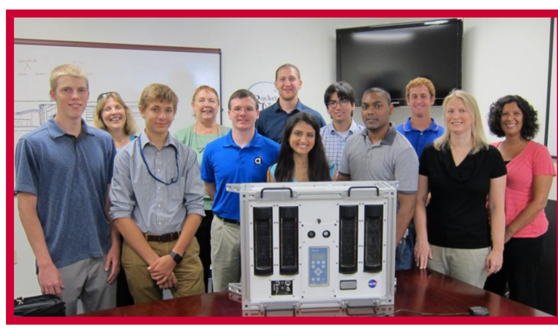
*RU Ready for the Future?*

National Aeronautics and Space Administration

# 2014 Highlights

EMIST floating in the stratosphere! (page 3)


RU climbing to new heights?



Proud RU EMIST team!

Is this the next astronaut class?

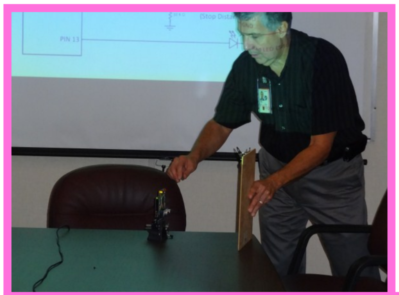
No, it is RU's Welding class June 2014


- 147 active RU participants
- 21 RU courses at KSC
- 248 students attended RU classes
- 10 vendor purchased classes brought to center or close by
- 11 internal classes taught by SMEs

Rocket University RU Ready

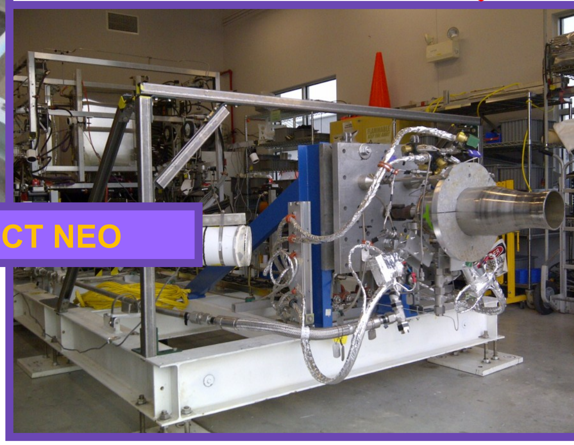
APPEL academy of program/project & engineering leadership

NASA Engineering & Safety Center · Engineering Excellence



What are Avionics Lab students doing?
Look on page 7 to find out

From this to this (page 10)



**PROJECT NEO**

Project NEO on display during Employee Day 2014

**January 2015**

## IN THIS ISSUE



RU supported 2 IPC Soldering classes to satisfy an engineering requirement for the center

IPC Soldering class September 2014




Rocket University RU Ready

aPPEL academy of program/project & engineering leadership

NASA Engineering & Safety Center

# Near Space

## EMIST completes its first mission

## by Nicole Dawkins

In August 2014, a small team of Rocket University participants completed the first mission of a new payload: Exposure of Microbes to the Stratosphere (E-MIST). The flight occurred aboard a high- altitude scientific balloon, generously provided by the Wallops Balloon Program Office (BPO) and launched from a small airport in Ft. Sumner, NM. The mission marked the end of months of hard work by the Rocket U team, and provided valuable data that will aid future E-MIST missions.

The E-MIST science goals were introduced to Rocket University by KSC microbiologist and Principal Investigator David Smith, Ph.D. Dr. Smith requested the development of a payload that would support two scientific goals: measure the survival of radiation-resistance microbes exposed to the earth's stratosphere (the top of the stratosphere occurs at 164,000 ft.) and assess the impact on genomes of the surviving microbes. Because the payload needed to remain in the stratosphere long enough to gather useful data, a balloon mission was the chosen platform. The knowledge gained from E-MIST missions could impact future Mars missions because the stratosphere has similar environmental conditions to the surface of Mars: extreme dryness, low temperature, radiation levels, and ultralow pressure.

*Figure 1: High Altitude Scientific Balloon, Ft. Sumner, NM*

The concept for E-MIST includes four rotating cylinders, nicknamed 'skewers', which hold the microbe samples. The microbes are spore-forming bacteria that were previously isolated from spacecraft assembly facilities at KSC. The samples are first deposited onto aluminum coupons, and then ten coupons are installed onto each skewer just before launch. During launch and ascent, the skewers are 'closed', such that the coupons are facing the inside of the payload. This prevents the samples from gaining exposure to the environment before they reach the desired altitude. Once the payload reaches 70,000 ft., the skewers rotate 180 degrees into an 'open' position, and the samples have full exposure to sunlight. For the first 8-hour mission, the E-MIST was designed to close one skewer every two hours, allowing each set of microbes to experience a different exposure time. When the payload begins its descent, all four skewers should be back to their original positions, where no sunlight can impact the samples. Upon recovery, the coupons are removed and the microbes are routed to microbiology labs for analysis.

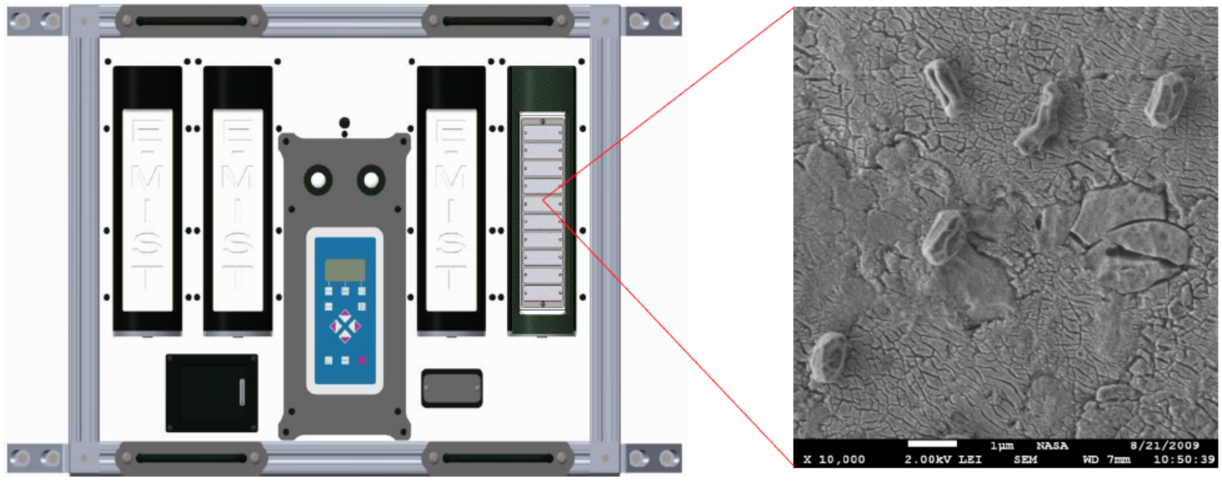


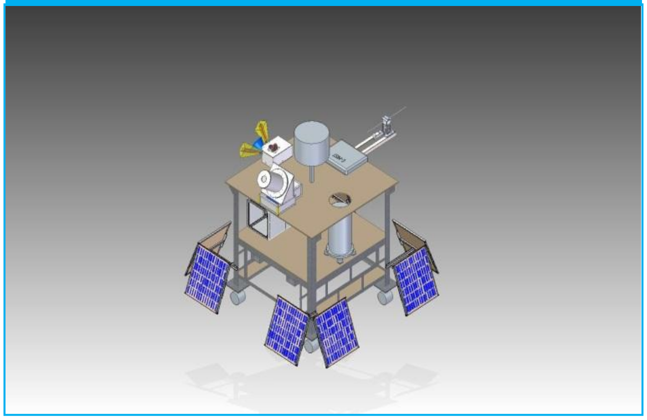

Figure 2: E-MIST

The 90 lbs. payload enclosure was fabricated using a powder-coated aluminum housing with composite internal components and skewer assemblies. Seals installed around each skewer housing ensures that the samples do not see sunlight until they have been rotated to the open position. An avionic shelf houses the lithium ion battery, a data logger (also referred to as a HOBO), and the microcontroller. E-MIST also contains a radiometer and various temperature sensors throughout the payload enclosure. During the design phase of E-MIST, the team worked with mentors such at Teresa Kinney (NE-O) and Gary O'Neil (VA-H3) to perform all of the structural and thermal analysis needed to choose the proper materials and components for the enclosure and subassemblies. Manufacturing took place at the KSC Prototype Development Laboratory by the lead designer, Prital Thakrar (NE-L).

In June of 2014, fabrication was complete for all of the E-MIST subsystems, and the team began integrated testing. While the avionic subsystem had been tested often during development, the fully- integrated test presented several challenges to the team, with only a few weeks remaining before the shipping date. The avionics and electrical team, led by Anthony Bharratt (NE-A), performed several hours of troubleshooting and retest until all issues were resolved and E-MIST had multiple successful runs in the thermal-VAC chamber.

*Figure 3: Vibration Test*

Figure 4: Gondola Configuration, with E-MIST installed on top



**Near Space continued**

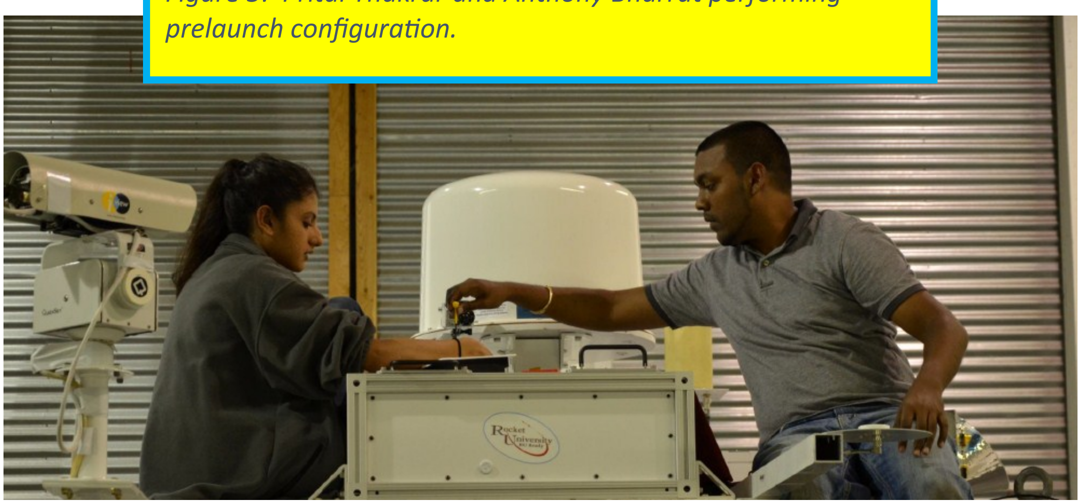
The chamber allowed the team to exercise E-MIST's logic recreating the atmospheric conditions the payload would see during its mission. It also allowed the team to see the skewer mechanism perform as expected. In addition to thermal-VAC testing, vibration testing led the team to discover a minor bolt issue that could have impacted the mission. Finally, in July of 2014, E-MIST met all of the necessary requirements for shipment to Ft. Sumner, NM for its first flight. The microbe samples were not shipped with the payload – to best preserve the integrity of the samples, the prepared coupons were hand-carried to Ft. Sumner by Dr. Smith .

The flight itself was a 'piggyback' opportunity provided to Rocket University by the Wallops Balloon Program Office (BPO) and the staff of the Columbia Scientific Balloon Facility (CSBF). Wallops BPO facilitates dozens of high altitude balloon payloads a year for NASA, universities, scientists, and various other organizations around the country. On many balloon missions, mass is added to the gondola by using ballasts or piggyback payloads. E-MIST has the characteristics Wallops looks for in a piggyback payload: it adds mass without impacting other payloads or flight requirements. A Rocket U launch team of three people from KSC (Dr. Smith, Prital, and Anthony) flew out to Ft. Sumner to oversee the E-MIST operations.

The weather constraints for a balloon mission in Ft. Sumner are conservative, and delays are common.

E-MIST did not actually launch until two weeks after originally scheduled. The team performed all of the E-MIST checkouts and returned to KSC until they received word that the weather constraints had lifted and there was a good possibility of launch. The gondola launched on August 16 at 10 am EST.

*Figure 5: Prital Thakrar and Anthony Bharrat performing prelaunch configuration.*



Real time imagery provided by CSBF gave a clear view of all four skewers, so the team could watch the entire flight and verify that the skewers turned at the proper altitude. All of the E-MIST data was recorded on the payload so that the team could evaluate the sensor data post flight. At approximately 70,000 ft., the skewers turned, one at a time, as expected. However, within seconds, they returned back to their closed positions and remained closed throughout the rest of the mission. The gondola, with E-MIST installed on top, completed its flight and was recovered by CSBF. The team collected the SD card and coupons and returned to KSC so they could evaluate the data and begin troubleshooting the failure that caused the skewers to close unexpectedly.

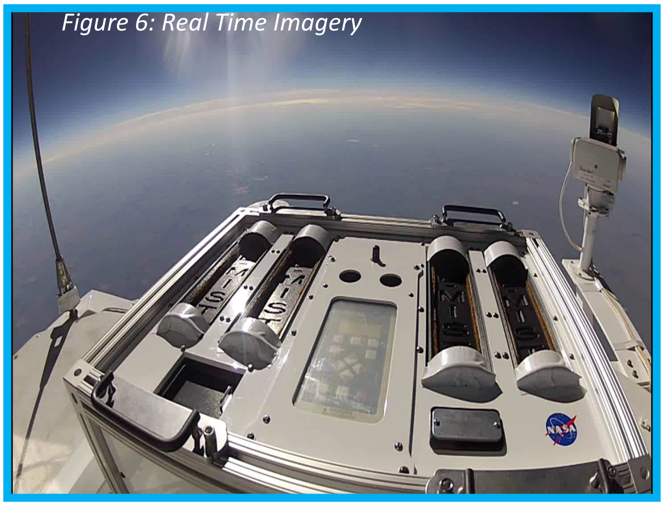
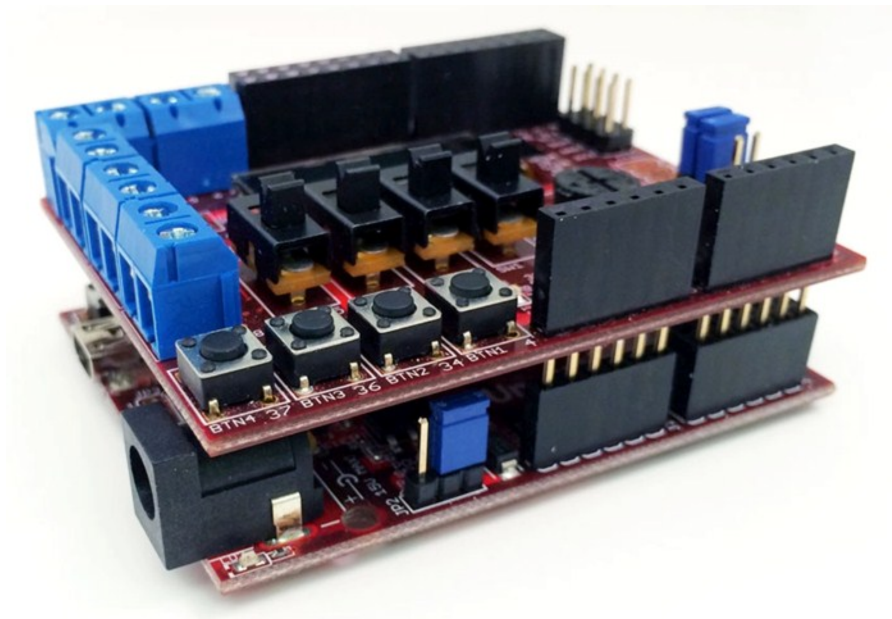


*Figure 6: Real Time Imagery*

As soon as it arrived back at KSC, E-MIST was placed in the Thermal VAC chamber, using the flight profile from Ft. Sumner. The payload performed as expected, and did not reproduce the failure seen during the mission. The team has reviewed that data from flight, and collaborated with CSBF and Wallops on what could have caused the skewers to close so quickly after opening. In addition to determining the most likely cause(s), the team is planning modifications to Revision 2 of E-MIST that will increase the chance of a successful mission. Despite the issue during its first mission, E-MIST was able to verify several of its design requirements, and the launch team gained first-hand knowledge about the launch operations at Ft. Sumner. A tentative Wallops flight is planned for the summer of 2015, and the E-MIST team is looking forward to their next opportunity.

*Figure 7: E-MIST Team: from left: Evan Williams, Teresa Kinney, Jackson Kinney, Susan Kasica, Pierce Louderback, David Smith, Prital Thakrar, Greg Wong , Anthony Bharrat, Brad Shea, Susan Danley, Nicole Dawkins*

# Avionics / Embedded Systems Lab



## Hands-On With Embedded Systems

**By Kelvin Ruiz**

Rocket University has excelled in offering meaningful hands-on opportunities for engineers at KSC. Three years ago, I joined Rocket U's programs and quickly started seeing the benefits of hands-on training. As a result of this training, I have expanded my skills in embedded systems and electronics and have been part of many exciting projects. This past year, I created a new structured curriculum, to help the next group of Rocket U participants learn avionics and embedded systems. Research shows that students retain 10 percent of what they see and about 40 percent of what they see and hear. Not surprisingly, when you add the "doing" component, retention goes up to 90 percent. I wanted to keep the "doing" aspect in the forefront of all activities for this year in true Rocket U fashion.

Research shows that students retain 10 percent of what they see and about 40 percent of what they see and hear. Not surprisingly, when you add the "doing" component retention goes up to 90 percent.

### Curriculum

The curriculum I developed consisted of three activities, spread out throughout the year to minimize the impact on the participants' main duties. The first course was "Introduction to Microcontrollers." In this course students learned the internals of microcontrollers and interfacing to them using the most common peripheral technologies. Peripherals like Universal Asynchronous Receiver Transmitter (UART), Serial Peripheral Interface (SPI), and Inter Integrated Circuit (I2C) where covered along with timers, Pulse Width Modulation (PWM) and Interrupts. My goal was for every student to have their own development environment to work on the lab exercises not only during the class, but also for them to continue learning after the class had ended.

*"It has been a great experience; great learning and a lot of fun too.*

**— Dean Orr, Chief Flight Computers, Data & Software**

We chose a kit from Digilent's line of ChipKit development boards based on Microchip's PIC-32 microcontrollers. In addition to the main microcontroller, the Uno32 board, an add-on board called the "Basic I/O Shield" was provided. This "Shield" contains many peripherals; perfect to apply the skills learned in class. Buttons, switches, built-in display, memory and temperature sensor are all part of the kit. The entire setup came at a cost of less than $100 dollars per student.


**ZedBoard™ is a complete development kit for designers interested in exploring designs using the Xilinx Zynq®-7000 All Programmable SoC.**

The second course was on Embedded Design with Linux. In this course the students learned, or refreshed their skills, using the Linux operating system. They also learned how peripherals are interfaced with Linux in comparison to a microcontroller which has no operating system. For this course the students were provided with a development board called the ZedBoard, which contains a Xilinx System on Chip (SoC) device with a dual-core processor and also a FPGA on the same chip. This low cost board allows for hybrid embedded Linux and FPGA development.

The third training activity, and perhaps the most important one, was a project that each student would need to complete with the skills learned in the previous courses. Using their development kit of choice they would have the remainder of the year to work on the project at their own pace. Some guidance was provided but they were allowed to use their imagination and develop a project of their own choosing.

Over the course of several months I monitored their progress and was very impressed with the students interest in learning and with the questions I was getting from them as it showed the great progress they were making. Let's take a look at some of the projects:

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**Allan and Elias during their project demo.**

### Ground Special Power TCP-Server Socket Simulator

In this project, Allan Villorin (NE-C4) and Elias Victor (NE-E2) created a simulator that can be used to test Ground Special Power end-items on the field. In addition to the additional testing capabilities, the project provides a portable and affordable solution to current existing testing hardware, which is much larger and limited to a single channel test.

***"What I liked most was the technology refreshment aspect of the courses. We engineers tasked to work on a specific project day in and day out, do not get this opportunity. For that, I'm very grateful. I'm also glad that the project I picked for the course was related to my day-to-day work."***

**— Elias Victor, Data Hardware Systems**
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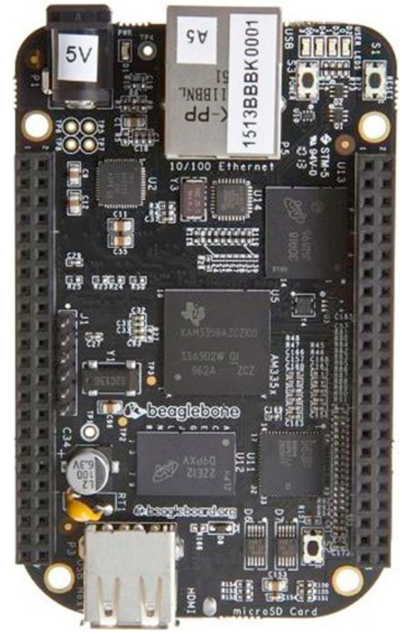
## Wearable Oxygen Deficiency Monitor

Michael McDonough and Allan Villorin developed a wearable oxygen monitoring system by interfacing an oxygen sensor to the UNO32 microcontroller board and then interfacing that to a Google Glass apparatus. For this project they utilized the skills learned in both previous courses. The project was presented at a KSC Engineering Academy (KEA) session and was very well received by the audience and the KEA program dean. Taking these courses and working on this project motivated Allan and Mike to submit a proposal to STMD's Early Career Initiative to develop wearable technology to be used in ground and space applications. Their proposal team was selected and their project is starting in FY15. Rocket U gave them the tools they needed to become the next generation of Engineers and Technologists to further NASA's goals.

## Parking Stop Point Indicator

In this project, Glenn Perez developed a stop point indicator that can be used for automobiles and other proximity sensitive applications, using an ultrasonic transducer and interfacing it to the UNO32 kit used in class. The project involved directing the transducer via pulses to send out signals and then measuring the response using the Input Capture peripheral. The system had built-in alerts using colored light indicators.




**BeagleBone Black is a low-cost, community-supported development platform for developers and hobbyists.**

***"Rocket U allows us to be at the top of the industry's new technologies and opens the door to future research and development that will advance NASA's mission."***

## Path Forward

In addition to taking these skills back to their jobs, the engineers that completed the curriculum can now take part in Rocket U's projects, which include High Powered Rockets, High-Altitude Balloons, CubeSats and Unmanned Aerial Vehicles (UAVs). With continued support, Rocket U is planning on continuing its course offerings in FY15. For FY15 we plan to focus on a series of courses on VHDL. VHDL is a hardware description language used in electronic design automation to describe digital and mixed-signal systems such as field-programmable gate arrays and integrated circuits.

***"These classes coupled with the project, gave us the opportunity to gain new technical skills in the growing sector of microcontrollers and embedded Linux. These activities ensure that KSC Engineers continue to be on the cutting edge of new technologies and be better prepared for the evolving future."***

**—Allan Villorin, Computer Engineer**

From left to right, Glenn Perez, Michael McDonough, Kevin Grant, Kelvin Ruiz, Elias Victor, Allan Villorin, Jaime Toro, Dean Orr, William Denis, Kurt Leucht after final avionics presentations

## 2014 Accomplishments by Kyle Dixon

2014 was an exciting year for APPELs Rocket University Project NEO as we made excellent progress towards completing the NEO engine test fixture, firing the NEO rocket engine -planned for the first quarter of 2015- and continuing the development of challenging training classes.

We focused on the four major areas over the last year, all of them critical to meeting APPELs goal of Applied Learning, i.e., teaching Project Management principles to NASA engineers via hands on laboratories.

The first focus area over the last year was continued technical development of the NEO test fixture (Skid). The NEO team, composed of full-time KSC NASA engineers, MSFC NASA engineers, NASA Pathways / KEEP students and contractor collaborators, overcame several technical challenges that required ingenuity, creativity and persistence. A few of those accomplishments are listed below:

- Completed the design, analysis and installation of the hold down system needed to bolt down the test fixture to the test site.
- Completed the igniter spark bench assembly and testing, installation is substantially complete
- Completed NEO engine igniter x-ray, CAT scan and independent analysis collaboration agreement
- Completed skid fluid line fabrication and precision cleaning
- Completed and passed skid low pressure leak checks
- Completed Integrated Cold Shock Procedures
- Completed engine gimbal lock set fabrication
- Completed engine solid mount design, analysis and fabrication
- Completed engine load cell transfer plate design, analysis and fabrication
- Completed software / hardware thrust actuator characterization
- Completed skid mobility design for low cost transport of the skid
- Completed 90% of skid electrical wiring

Each one of these accomplishments has a depth-of-support story behind it but the bottom line is the skid will be ready to support an engine firing in early 2015.

The second area of focus, schedule development and maintenance, for an essentially volunteer staffed effort can be difficult. Over the last year, as the NEO team has conducted weekly tagup meetings, we have gained more and more confidence in our integrated schedule and streamlined our method for updating and maintaining the schedule. We have simply gotten a lot smarter in understanding how long it takes to accomplish tasks with the manpower we have available and the environment we are in with much higher priority programs and projects in play. The practical experience of developing a reliable schedule under these circumstances is invaluable to RU students. We continue to hone our schedule and our scheduling techniques using NPR 7120 System Engineering guidelines. To date we are currently tracking to a NEO engine first firing in the first quarter of 2015.

Assessing risk was the third and perhaps most critical, from a safety perspective, of the four areas. The Rocket University Project NEO NASA operations safety and software safety representatives led the effort to conduct a Risk Assessment per NPR 7120 and continue to help finalize the products required for NEO's upcoming KSC NASA Engineering internal safety review, known as the NHOWG (Non-routine Hazardous Operations Working Group) and the Center's NASA Safety review, known as the GRRP (Ground Risk Review Panel). Both these review preparations are proceeding well and have resulted in the completed products listed below.

- Completed NEO Integrated Hazard Analysis and Risk Assessment
- Completed NASA KSC Explosive Safety Office approval of NEO firing operations on KSC
- Completed NEO Software Safety Plan
- Completed NEO engine acoustics assessment and clears impact
- NEO ASME B31.3 Pressure Vessel System certification in work
- NHOWG / GRRP combined review discussions and products in work

Generation of these products is in preparation for NEO's combined Preliminary Design Review/Critical Design Review currently planned for early 2015.

Cost factors were the fourth RU Project NEO area of focus where we made great strides in 2015. The KSC Rocket University Project Management team worked closely with the NEO team to secure funding and arrange specific funding mechanisms that were crucial to the continued success of NEO because of the procurement flexibility needed when scheduled events could fluctuate. Key funding accomplishments for 2015 included:

- Completed ISC (Institutional Servicing Contract) precision cleaning, fuel and services JON established and in use
- Completed NEO Command Trailer buildup procurement
- Substantially completed NEO Power trailer buildup procurement
- Completed establishment of inaugural Fundamental of Rocket Engine Design 3 day class (well attended and well received)

Over the last year, Project NEO has continued to operate within the budget provided by RU and to make use of recovered assets from the Shuttle Program.

**Looking Ahead**

Early 2015 will see the culmination of all the work and planning of the previous years. Within the first quarter of 2015, Rocket University's Project NEO plans to complete all final assembly of the skid, complete the required engineering and safety reviews and authorizations, perform final system testing, fire the NEO engine, and then use the operational skid as the basis for continued RU curriculum development throughout 2015.

## Genesis 2.0
## by Mike DuPuis

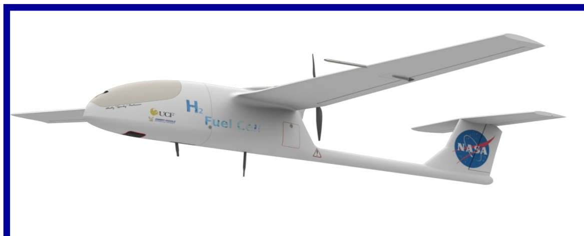


**Figure 1. Genesis CAD model**

You know the feeling; that hollow pit you get in your stomach when your hard work goes up in smoke (sometimes literally). On the afternoon of the inaugural Unmanned Aerial Systems (UAS) competition held at KSC's Shuttle Landing Facility (SLF) last year, the Rocket U UAS Lab's road to recovery and the ultimate triumph that followed began with just such a feeling, and seven heart wrenching words. On a routine lap around the competition search area, Genesis (the fixed-wing UAS designed and developed by Rocket U personnel) suddenly pitched down and began an inexorable spiral towards the SLF's eastern drainage canal. "That's not me!" shouted UAS pilot Marty Pontecorvo. "I don't have it!"

**Figure 2. Genesis taking a break from competition**

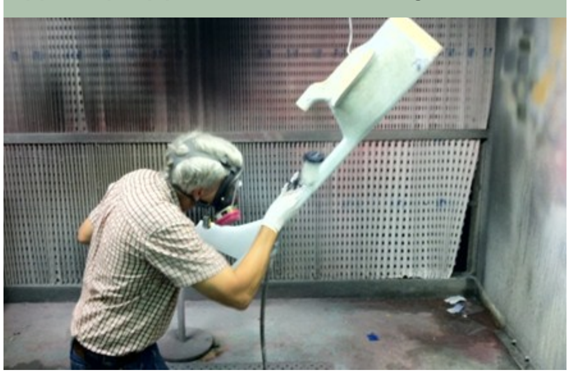
Indeed he didn't. What he *did* have was an aircraft that lost its RF communication link and initiated a pre-programmed flight termination sequence designed to keep the aircraft from exiting the competition area. The vehicle, largely in-tact, ultimately came to rest in several feet of water just east of the competition area. The silver lining here was the credibility earned with our Range Safety Office. As Chuck Loftin, the competition's Range Safety Officer stated after the event, "I believe you now…, it did exactly what you said it would do." Kind words to be sure, but not so encouraging when your aircraft is floating in the cat tails.

So began the road to recovery for the Genesis aircraft. During the post-mortem analysis we learned that, other than some shorted instruments, the vehicle was in surprisingly good shape. The core material in the fuselage and tail boom's composite skin was a little waterlogged, but structurally sound, requiring only time to fully dry out. The upper-forward section of the fuselage had also experienced some minor de-laminations on impact, which the UAS team re-bonded and reinforced with S-glass/epoxy patches.

**Figure 3. Rocket U's Michael Knutson building Genesis composite wing set**

The horizontal stabilizer was also in good shape, showing evidence of only minor cracking along its fiberglass hinge line. Since the hinge was integral to the stabilizer's skin, the team elected to build a new stabilizer rather than repair the old one. This gave the team the opportunity to change the way the hinge line was constructed, making fabrication time faster and resulting in a more robust part.

**Figure 4. David McLaughlin of KSC's Prototype Shop applies epoxy primer to Genesis fuselage**



While the fuselage came through the impact with only minor damage, the wings did not fair quite so well. Major de-bonding occurred along the span of both wings, separating upper and lower wing skins along their trailing edges. While repair was indeed possible, given the unknown structural integrity of the wing ribs and spars, the team also elected to build a new wing set for Genesis' return to flight.

*After* many months of repairs, remanufacturing, and filling/fairing body work, the vehicle finally went to paint, receiving a base coat of grey epoxy primer followed by a "NASA research aircraft white" epoxy primer top coat.

**Figure 5. Genesis poised for flight on rail launch system**

With her new paint fully cured the team set about installing a new power train, control servos, batteries, and receiver board. All systems were exhaustively tested on the bench, first independently, then as an integrated system within the airframe. With all systems performing nominally, Genesis was at last ready for her shakedown flights.

As luck would have it, the UAS team was already supporting Nimbus flight operations (see DARPA/NIMBUS article in this edition) so the restricted airspace above the SLF had already been scheduled. After assembling its rail launch system, and during a lull in Nimbus flight operations, on September 11th and 12th, 2014, Genesis conducted 3 flawless, manually-piloted shakedown flights. These sorties, conducted in relatively high winds, not only demonstrated the stability and controllability of the aircraft, but they also revealed a startling level of flight endurance. A post-flight evaluation of the aircraft's power usage showed that the vehicle had averaged 199 watts of power consumed throughout all phases of flight.

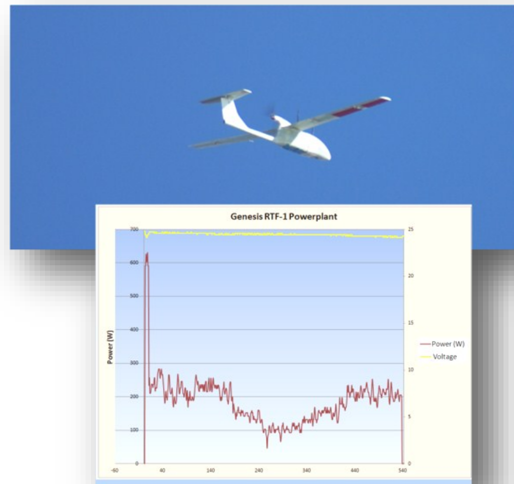



**Figure 6. Genesis in flight with power consumption plot**

For a hand-launched foam aircraft this power consumption would be good. For a rail-launched composite aircraft with a 9 foot wingspan weighing over 15 lbs, this frugal power consumption is phenomenal. To put this endurance into perspective, a typical battery powered UAS has a maximum endurance of about 45 minutes. Genesis, on the other hand, has about 2 hours of flight time on a nominal compliment of batteries.

Up to that point, the Genesis team had been planning to modify the airframe with a gasoline engine for increased flight time to support follow-on lightning research missions. Given the stunning performance the vehicle demonstrated during its manual shakedown flights, we are seriously rethinking the need for this gas engine mod.

**Figure 7. NASA KSC Intern Kirsch Davis testing hydrogen fuel cell slated for Genesis 2.0**

The Genesis team is currently integrating the vehicle's autopilot into the airframe, with autonomous tuning flights planned for the spring.

After autonomous flight tuning, the UAS team plans to integrate a hydrogen fuel cell into the Genesis airframe to test the viability of a hydrogen-powered UAS for KSC operations.

With a host of research and reconnaissance missions awaiting Genesis' autonomous flight capability, we have only begun to realize the potential of this Rocket U-developed UAS, just as we've only begun to conceive the role UAS's will play in supporting KSC's missions of the future.

## *Rocket U UAS Team Supports DARPA Lightning Research*

***By Mike Knutson and Mike DuPuis***

From late Spring through early Fall 2014, the Rocket University (Rocket U) Unmanned Aerial Systems (UAS) Lab hosted four week-long UAS flight campaigns in support of the Defense Advanced Research Projects Agency's (DARPA) Nimbus program.

According to the program's website, "Nimbus is a fundamental science program focused on obtaining a comprehensive understanding of the lightning process, its associated emissions (such as x-rays), and its ionospheric components to better protect troops, ordnance, and other military assets." Given the near-daily thunderstorm activity typical of Central Florida summers, KSC offers an ideal environment for conducting these kinds of research flights. But DARPA isn't the only organization interested in this type of research. Robert Brown, Technical Manager for KSC's Ground Systems Division (GP-G) stated in a recent interview that "NASA is keenly aware of the dangers lightning poses to personnel, launch vehicles, and facilities, and shares DARPA's interest in advancing lightning detection and forecasting capabilities."

As the trailblazer for UAS flight hardware certification and UAS flight operations at KSC, Rocket University was asked to manage the approvals process for the Nimbus program to access the restricted airspace above KSC. With logistical support supplied by GP, Rocket U was also tapped to manage the flight operations of the Nimbus research aircraft which were instrumented with electric field (e-field) and x-ray sensors.

During the first flight campaign, focus was mainly on familiarizing the Nimbus team with KSC flight area processes/procedures, and to certify the research aircraft. The initial phase of this campaign was conducted with a pilot in the loop and with the aircraft restricted to visual range. Subsequent phases were conducted with autonomous flight profiles, allowing the vehicles to fly higher and farther, as would be required for the research missions to follow. The remaining three campaigns were conducted to meet the Nimbus program's primary flight objective; the acquisition of airborne e-field and x-ray measurements in and around active storm cells.

A total of 27 UAS missions were conducted during these campaigns, with a mix of checkout and research flights. Post-flight data analysis from the "in-storm" missions demonstrated that the vehicle had successfully measured and recorded the requisite data.

An additional flight campaign is tentatively scheduled for early 2015, with the potential for subsequent flights following in April. Rocket U is also modifying its own fixed-wing Genesis UAS to fly the Nimbus instrumentation into and around active storm systems above KSC. Though Genesis turbulent stability must still be characterized, employing the Genesis UAS for lightning research stands to substantially increase the amount of data collected per-mission, since Genesis has a much greater endurance and ability to climb to an altitude greater than the current Nimbus aircraft.

Individuals and organizations who contributed to the successful execution of the Nimbus flight campaigns are too numerous to mention here. However, Rocket U and the Nimbus Team would like to acknowledge the significant material support contributed by the following organizations: The Shuttle Landing Facility Flight Operations group, the Ground Processing Directorate (GP), NASA Information Technology, the NASA Test Director's office, NASA Range Safety, and the Chief Engineer's office.

**Figure 1. Lightning strike near Endeavor on launch pad. Credit: NASA/Bill Ingalls**


**Figure 2. DARPA's Nimbus "Spear" lightning research aircraft.**

**Figure 3. Dr. Kenneth Cummins (foreground), University of Arizona lightening researcher, reviews weather data in Nimbus' control center (courtesy of**

## Meet the New Rocket University (RU) Program Manager

### Timothy A. Pirlo, M. Ed

The program management for the KSC Rocket University (RU) program transferred from the NE Directorate (Chief Engineer's Office) to the BA Directorate (HRDRO) in April 2014 with accompanying CMO guidance to revise and restructure this technical development program. With the change in oversight, Timothy Pirlo, BA-E was appointed as the Rocket University Program Manager.

Pirlo, a Human Resources Specialist (Human Resources Development) is the Institutional Training Lead at KSC and has been working for NASA since 2007. In addition to managing the RU program, he is also the APPEL POC for KSC and further serves as the technical expert for institutional training at the Center.

Pirlo holds a bachelor's degree in Business education from the University of Central Florida and he also received a master's degree in technical education from UCF. He is currently preparing to pursue a doctorate degree in education.

"I am excited with the planned changes to the Rocket University (RU) program beginning in 2015." These enhancements include:

- Formalized 18-month, Center-sanctioned technical development program
- Call, Nomination application, and Selection of RU participants by HRAB
- Selection of 15 member cohort for 1st Center-sanctioned RU program
- Anticipates 20% individual's normal work time to be allocated, allotted and approved for selected individuals to participate in RU program
- Utilize integrated teaming approach working collaboratively and collectively on cohort-selected RU Final Project

RU call anticipated release in February 2015 with actual program start in March/April 2015. For more information about the Rocket University (RU) program at KSC, please contact Tim Pirlo timothy.a.pirlo@nasa.gov at 867-8760 or Susan Kasica, KISS III RU Training Specialist susan.kasica@nasa.gov at 867-5373.

| number of classes | 2014 classes held | number of participants |
|---|---|---|
| 1 | Cryogenic Propulsion Systems | 24 |
| 2 | IPC Soldering | 20 |
| 2 | Welding | 35 |
| 2 | Intro to Rockets | 37 |
| 1 | Embedded Design with Linux | 18 |
| 1 | Intro to Embedded Linux | 18 |
| 10 | Intro to Additive Manufacturing1 | 68 |
| 1 | Intro to Microcontrollers | 17 |
| 1 | Prototype Design and Manufacturing Fundamentals | 11 |
| **21** | TOTAL | **248** |

# Rocket University FY14 In Review

## Congratulations to these past Rocket University participants!

(in red below)

**2014 KickStart Project Winners**

On Oct. 30, during this year's Innovation Expo, 17 KSC innovators presented their innovative ideas to a panel of judges. The audience also was able to judge the proposals by casting their votes using iClickers provided by APPEL. After tallying the scores, **14 projects were selected** to kickstart their innovative ideas. Funding was provided by the following programs: Commercial Crew Program, Ground Systems Development and Operations Program, Space Station Program, KSC Chief Technologist Office and Launch Services Program. Listed here are the project titles, the innovator who presented for the team and the amount of funding requested and awarded.

~**CubeSat Microstrip Patch Antennas, Nick Pack**, $5,000

~Natural User Interface, William Little, $4,500

~Cooling Garment for Florida Summer, Greg Galloway, $3,900

~**Novel and Robust Charging System for Mobile Robots, Kurt Leucht**, $2,200

~Virtual Engineering Dashboard, Laurie Griffin, $5,000

~KSC Balance Initiative, Mary Kirkland, $4,600

~VeggieGoRound, Chris Blakeley, $4,000

~Bird Spikes, Skyler Kleinschmidt, $600

~Active Watering System for Veggie, Oscar Monje, $4,400

~Smart Autonomous Sand-Swimming Excavator, Joshua Johnson, $3,000

~Paperless Remote Engineering, Vanessa Martins, $3,000

~Innovation Space, Sarah Cox, $5,000

~**Prototype/Proof of Concept Kelp Growth System for ISS, Marc Butler**, $4,000