



# AFRL LA LUZ ACADEMY

“CREATING THE POSSIBILITIES”



Inspiring Future Scientists and Engineers

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## The Rocket Report

### STEM Modeling, Simulation Showcased at I/ITSEC Conference

The Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) "promotes cooperation among the Armed Services, Industry, Academia and various government agencies in pursuit of improved training and education programs, identification of common training issues, and development of multiservice programs."



Modeling and simulation in science, technology, engineering, and math (STEM) was the theme when AFRL La Luz Academy manned a booth in the STEM Education section of the 2012 I/ITSEC conference on 3-6 December 2012 in Orlando, Florida.

Visitors to our booth received information about AFRL La Luz Academy, saw an interesting slideshow of our STEM Challenge Flight, examined the *Rock-Sim* rocketry flight simulation software our rocketry activities use, and tried their hand at constructing model plug-and-play satellite components.

Ms. Diane MacAlpine also presented information about our program to conference attendees, including dignitaries such as Dr. Laura Adolfe, Director of the STEM Development Office, Research Directorate Office of the Assistant Secretary of Defense for Research and Engineering, Department of Defense.

### STEM Award



The AFRL STEM team on Kirtland Air Force Base, including AFRL La Luz Academy, has been awarded the national level Federal Laboratory Consortium (FLC) for Technology Transfer 2013 STEM Award for outstanding work supporting STEM education. Team members recognized include:

- Ms. Casey Deraad,
- Ms. Ronda Cole,
- Dr. Tony Hostutler,
- Mr. Mitch Thierry,
- Dr. David Voss, and
- Dr. Stacie Williams.

Way to go, team!

### Simulation Takes Flight

The fall semester of the fifth grade DoD STARBASE Flight has come in for the final approach with Flight Simulation activities in Day 5.

Pilots and flight enthusiasts such as Mr. Mark Smith, pictured at right, brought in flight helmets, flight pressure suits, night vision goggles, and other flight



Continued on page 2





# Mars Missions Flight

for fifth graders

Mars Microbial Asteroid Research Survey (MARS<sup>2</sup>) Mission 2012-13

## Uniform of the Day, With Nametag

Uniforms give teams a polished appearance and a group identity. Astronauts wear them, and so do



Mars Missions Flight teams on Link-Up Day (different teams from the same classroom can use the same uniform).

A team uniform doesn't need to be elaborate or expensive; we're not talking Buckingham Palace here. It can be as simple as matching-colored shirts and

jeans for each team member. Optionally, it can include accessories such as mission patches and headgear (see pp. 99-101 in the handbook.)

The uniform includes a nametag. Teachers and other assisting adults must also wear a nametag. The nametag should show:

- School, Student, and Teacher Name
- Docking Habitat Number (the habitat the teacher is Flight Director for, and has their Team A at; where students report when departing for Earth)
- Colony Habitat Number (the habitat each team is responsible for building; same as the team number).



Photo by Anita Collins

## Team Registration

Blank copies of the Mars Missions Flight Team Registration Form are included with this newsletter. Please send us one completed form per team by 27 February 2013.

Please print legibly. These forms will be used to generate the official certificates we distribute to each student at the end of the mission.



## Life Support

To support life on Mars, each student team makes one of eight types of **life support system model** (handbook, pp. 61-80). (Note: It's just a model. It doesn't have to actually *function*.)



Photo by Anita Collins

Once a team has defined the parameters of their life support

system, they decide how it will operate and what it will contain.

Incorporate four "Mars Facts" (pp. 57-60) into the system design.

Label three of the Facts on the



Your **commitment** to this mission is crucial to its success

model; label the fourth fact with a "?" and make it the answer to a multiple-choice riddle displayed on a **poster**.

During the Technical Briefings on Link-Up Day, teams will award audience members bonus cards for correct answers to their riddle.

So, in addition to the life support system model and the riddle poster, have students prepare ten **bonus cards** (p. 63) to award for correct answers to the riddle.

Teams may want to consider incorporating their **mission patch** (pp. 39-56) into the design of their bonus cards.



# DoD STARBASE Flight

for fifth graders

"My son had such a fantastic experience at STARBASE...enthusiastic in sharing all the cool experiments he was able to do and eager to share what he had learned."--2012-13 Fall DoD STARBASE Flight parent, Petroglyph Elementary.

## Simulation Takes Flight

Continued from page 1

gear for the students to examine and try on for size. The pilots discussed their experiences flying fighter jets, helicopters, gliders, and other aircraft, and the educational steps they took to get where they are in life.

During Day 5, the students studied the *four forces of flight* (lift, thrust, drag, and gravity), and

*flight control surfaces* like ailerons, wings, and elevators. They explored hands-on with activities like *Bernoulli Bags*, which use Bernoulli's Principle to help the students blow extra air into a tube.

Then the students took to the skies in simulated Cessnas, using yoke and rudder pedal controls to practice taking off, turning, navigating, and landing, while the pilots watched and gave flying tips.

We enjoyed our fall semester participants and look forward to a new group in the spring. Teacher Orientation for the Spring semester was held in December 2012.



## STARBASE 2.0 Rocket Building

Van Buren and Wilson Middle School STARBASE 2.0 students have completed their original rocket designs and simulated the flight of these rockets using *RockSim*.

Now it's time to continue preparing for the Team America Rocketry Challenge by building real rockets from their simulated rocket designs.



At least one week in advance, please give us the name of each adult per driver's license, the last four digits of their Social Security Number, and the estimated number of students you're bringing. Don't forget to turn in your Media Release forms, too!





## TECH Flight Law School

TECH Flight Day 3 middle school students have been brushing up on their legal studies by actively putting Newton's Three Laws of Motion to the test.

The students split up into three stations (one for each Law). At the first station, the students test the *law of inertia*. Students quickly push or pull flat objects out from under washers and pennies, which have too much inertia to move.



At the second station, students experiment with the  $Force = mass \times acceleration$  law using motion sensors to track the acceleration of a car pulled by a weight hanging off the edge of the table.

At the third station, students find that *for every action, there is an equal but opposite reaction* by building and launching a balloon rocket along a string.



As any good legal beagle knows, the First Law of Dubstep is: *D-D-D-Drop the Bass*. Well, the first law of TECH Flight Day 3 is: *D-D-D-Drop the Egg*. Students use engineering design to see who

can build the egg-drop vehicle with the slowest *velocity*.

Students do take a post-test afterwards, but fortunately it's a little easier than passing the bar!

## TECH Orientation

Spring semester orientation was held 13 December 2012. Deputy Director Diane MacAlpine discussed spring curriculum and estimated value of the TECH Flight.



At least one week in advance, please give us the name of each adult per driver's license, the last four digits of their Social Security Number, and the estimated number of students you're bringing. Don't forget to turn in your Media Release forms, too!



## Robot Systems Flight

for middle schoolers



## It is Useless to Resist

In *Star Wars: The Empire Strikes Back*, Darth Vader defeats Luke Skywalker in a lightsaber battle, then hisses, "You are beaten! It is *useless* to resist!"

But to middle school students participating in the Robot Systems Flight, resistance *isn't* useless...it's merely the ratio of the degree to which an object opposes an electric current running through it, measured in units called *Ohms*.

The students actually find resistance quite useful when building a test circuit on their *stamp board*, using components such as *resistors* and *light-emitting diodes*, as they construct their Boe-Bot® robots.

Those colorful bands you see on resistors aren't decorations, by the way—they're *resistor codes* that tell how much resistance in Ohms the resistor produces.

Reading left to right, the first two bands tell you the first and second digits of the resistance number, as shown on the chart. The third band tells you how many zeros to add to the right of these numbers. The gold or silver (or blank) band on the end tells you the percentage, or *tolerance*, of error. Hmm...I wonder if lightsabers have resistance codes printed on the handle?

Actually, Darth Vader would've probably *liked* the Robot Systems Flight. In the *Star Wars*

Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9



prequel movies, we learn that Darth Vader actually built the chatty robot C-3PO himself, when he was just a roughly middle-school aged boy named Anakin. Sigh...If only Darth Vader knew the *power* (clenching fist)...  
...of STEM!



## STEM Challenge Flight

for high schoolers

### Building on Past Successes

Happy new year, and welcome back to our exciting saga about the STEM Challenge Flight, where hard-working high school teams build a device to safely deliver an egg payload through a hoop and onto a target, with a budget of only \$100!

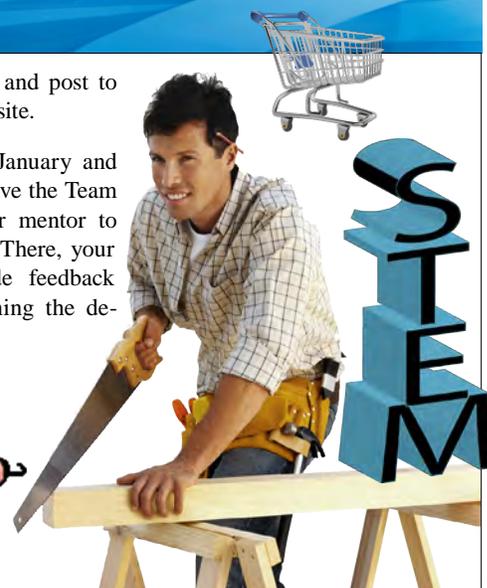
Teams should have wrapped up their materials shopping by now. If not, the Team Coach needs to schedule a **Home Depot shopping day** with us before the end of the month. We'll accompany the coaches to Home Depot and

purchase the items the teams have identified. Call us in advance to ensure we're available. Remember, no purchases should be made without us along, or before the mentors have approved the materials list and pitch.

Now on to Phase 2: Device Construction. This is the fun part, where you actually get to *build* stuff! Gather your materials and build the device, trigger mechanism, and payload protection. Take some pictures or video

of what you made, and post to the Coursesites website.

Then, between 18 January and 8 February 2013, have the Team Coach contact your mentor to arrange a meeting. There, your mentor can provide feedback and advice concerning the devices you build.





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### Important Terms and Acronyms

**AF:** Air Force

**AFB:** Air Force Base

**AFRL:** Air Force Research Laboratory

**AFRL/RD:** The Directed Energy Directorate of the AFRL (formerly AFRL/DE)

**AFRL/RV:** The Space Vehicles Directorate of the AFRL (formerly AFRL/VS)

**DoD:** Department of Defense

**KAFB:** Kirtland Air Force Base, Albuquerque, N.M.

**LF:** Leadership Flight

**MARS:** Microbial Asteroid Research Survey

**MM:** Mars Missions

**PRS:** Phillips Research Site

**PWN:** Pinpoint WeatherNet

**RS:** Robot Systems

**STEM:** Science, Technology, Engineering, and Math

**TECH:** Technology and Engineering Challenges

**T<sup>2</sup>:** Technology Transfer

**TTE:** Technology Transfer for Education

**USAF:** United States Air Force

# STEM Bytes

## Profile of a 2.0 Mentor: Capt Moran

One of the best things about AFRL La Luz Academy is that our students get to work with some really great mentors from AFRL and elsewhere. Take USAF Capt Gregory Moran, AFRL/RVBX, for example. He is mentoring our STARBASE 2.0 afterschool program middle school students as they build model rockets and prepare to participate in the Team America Rocketry Challenge.

Capt Moran has a BS in Aerospace Engineering from Texas A&M University, and an MS in Astronautical Engineering and an MS in Systems Engineering from the Air Force Institute of Technology. His current Air Force duties include project management and chief engineering for space research and development at ARFL/RVBX. There, he helps build the next generation of prototype sensors to detect and forecast space weather effects.

Capt Moran also works with two non-profit organizations, including Quelab, a membership-based community workshop and makerspace inspiring people of all ages to learn, create, and build, enabling hands-on projects of all types, shapes and sizes; and Mach 30, a national non-profit dedicated to advancing humanity into a spacefaring civilization.



About his time mentoring STARBASE 2.0 students in rocketry, Capt Moran says, "These kids are awesome! We started with simple waterbottle rockets, and ended with a completely custom-built amateur rocket system."

The coolest part of being a mentor in the STARBASE 2.0 program this year, he says, is being able to simulate the student's custom rocket designs on the computer using *RockSim*, and then actually build and fly them.

What the students don't realize, he continues, is "they are learning important lessons about systems engineering and requirements traceability, all while getting to build rockets."

"I've really enjoyed seeing the students progress through the program," Capt Moran says.

"I'm really proud to have made a positive impact and made learning fun."

See the STARBASE 2.0 article on page 2 of this newsletter for more information about this year's STARBASE 2.0 program and additional pictures of Capt Moran mentoring our students.

### Expand Horizons



Free online registration is going on now for the Albuquerque Expanding Your Horizons event, 26 January 2013, 8:30 am, at UNM's Dane Smith Hall. The annual event, for girls grades five-nine (boys welcome, too!), features hands-on STEM activities, and opportunities to meet STEM role models and learn about STEM careers. See [www.expandingyourhorizons.org/conferences/Albuquerque/](http://www.expandingyourhorizons.org/conferences/Albuquerque/) for more information.

### Coming Next Issue...

- Telecommunicating on Mars
- Robot Expo coming!
- Sugary hearts and chocolate...lots of chocolate

**Watch for it!**



## Our Deepest Condolences

Our deepest condolences go out to the community of Newtown, Connecticut, and the families of the victims of the Sandy Hook Elementary School tragedy.

The twenty youngest victims of that horrible event weren't even old enough to have participated in our program.

