



# AFRL LA LUZ ACADEMY

“CREATING THE POSSIBILITIES”



Inspiring Future Scientists and Engineers

## 2012-13 FLIGHT PREVIEW

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SPECIAL EDITION

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## Inspiring Future Scientists and Engineers

### The Concept

Our world has become increasingly dependent on technological innovations and the scientists and engineers (S&Es) who create them. The AFRL La Luz Academy takes the study of science, technology, engineering, and math (STEM) out of the textbook and into an interactive, hands-on environment in an effort to motivate more students to become S&Es.

gies developed by the Directed Energy and Space Vehicles Directorates of the AFRL.

### The Flights

AFRL La Luz Academy is divided into Flights, designed for certain grade levels, aligned with New Mexico and Common Core State Standards.

The **Mars Missions Flight** is a classroom-based Mars colonization simulation for fifth graders. Students prepare for and simulate going on a manned mission to Mars.

semester. Fall semester focuses on rocketry, while Spring semester uses problem solving and the engineering design process to explore STEM concepts related to specific engineering disciplines.



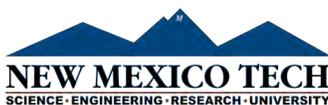
The **Robot Systems Flight** provides an opportunity for middle school students to explore the basics of systems engineering at their school, using robotics as a theme.



The **STEM Challenge Flight** provides an opportunity for teams of three or more high school students to plan and carry out a real-world STEM project using a multi-phase systems engineering approach. Qualifying teams are eligible to compete in the annual STEM Challenge Symposium at KAFB.



### Partners:



AFRL La Luz Academy is an Air Force Research Laboratory (AFRL) education outreach program at Kirtland Air Force Base (KAFB) in Albuquerque, New Mexico, through a Cooperative Agreement with New Mexico Tech. Our goal is to increase student interest in pursuing STEM-related studies and career paths. We target fifth through twelfth grade students.

The interactive hands-on activities we provide focus on applications of the basic STEM concepts behind the technolo-



The **DoD STARBASE Flight** provides fifth graders an opportunity to explore physics, chemistry, technology, engineering, mathematics operations and applications, and STEM Careers, through five 5-hour classes on KAFB.



The **Technology and Engineering Challenges (TECH) Flight**, for middle schoolers, occurs in three 5-hour classes at KAFB in the fall or spring



# Mars Missions Flight

Mars Microbial Asteroid Research Survey (MARS) Mission 2012-13

**“One good thing about Mars is we were using a lot of math.”**  
--2011-12 MM Flight student, La Luz Elementary School

## The Concept

The Mars Missions Flight is AFRL La Luz Academy’s classroom-based Mars colonization simulation for fifth graders.

It’s based on the Challenger Center for Space Science Education’s acclaimed *Marsville®*, *the Cosmic Village* program, and has been modified to include Air Force technologies and terminologies to provide a unique hands-on learning opportunity for students.

## What’s the Mars Missions Flight?

Students work in TEAMS in their classroom throughout the school year on various activities, called Base Operations, that prepare them for their simulated manned mission to Mars.

These activities are designed to be motivating and hands-on, while meeting many of the New Mexico and Common Core State Standards in science, math, language arts, music, and art.

Students work in TEAMS of five to seven students to complete Base Operations at their school. The Base Operations include: writing a *saga* that describes their journey to Mars; designing a *mission patch*, studying *Mars Facts*; and designing a *Life Support System Model* based on those Facts.

Each TEAM also *telecommunicates* with two other TEAMS from different schools; cuts out their assigned 6-mil plastic *habitat* pieces; plans their nutritious, yet space- and weight-saving, astronaut *lunch*; and designs a TEAM *uniform*.



pic by Howard Huttel

The Flight culminates in a Link-Up Day activity in the spring, where TEAMS come together to simulate the Mars Mission.

Each TEAM progresses through a series of holding stations to ensure they have completed the necessary preparations for Link-Up Day, receiving points on a TEAM Mission Log. One of the holding stations involves S&Es from the DoD who review the student-designed life support system models.

On Link-Up Day, students join two other TEAMS from different schools to form a habitat CREW, and construct inflatable plastic habitats measuring 12’ x 12’ x 8’.

Then, the grand finale: Each CREW links up their habitat to several other habitats to form a colony. This is where

**“I learned that teamwork really makes a difference.”**  
--2011-12 MM Flight student, Bellehaven Elementary School

Link-Up Day gets its name. TEAM members and invited guests then participate in an exploration of the colony.

## Teacher Training and Resources

We will be conducting teacher training in October to help teachers understand their role in the Mars Missions Flight. There are two types of teacher training: a full-day session for teachers who have not participated in the Mars Missions Flight before, and a shorter version for returning teachers.

There is a mandatory mid-year meeting for Mars Missions Flight teachers in February, to help prepare teachers for Link-Up Day.

Mars Missions Flight teachers also receive a Teacher’s Resource Guide manual, and monthly newsletters with valuable Mars Missions Flight tips and information.



# DoD STARBASE Flight

## The Concept

DoD STARBASE is a premier educational program sponsored by the Office of the Assistant Secretary of Defense for Reserve Affairs. AFRL La Luz Academy implements this program for fifth grade elementary school students as the DoD STARBASE Flight.

Students come to the AFRL La Luz Academy for five non-consecutive days during the school year. The inquiry-based curriculum focuses on topics which include Physics, Chemistry, Technology, Engineering, Mathematics Operations and Applications, and STEM Careers.

Air Force Core Values (*Integrity First, Service Before Self, and Excellence in All We Do*) are embedded in the activities students complete.

## What’s the DoD STARBASE Flight?

During the five curriculum days, students engage in many hands-on, mind-on activities. Teamwork is stressed as the students work together to explore, explain, elaborate, and evaluate concepts. They study Newton’s Laws and Bernoulli’s Principle, and explore nanotechnology, navigation, and mapping. Students investigate engineering using computers to design space stations.

Math is embedded throughout



the curriculum, using metric measurement, estimation, calculation geometry, and data analysis to solve questions.

Scientists, engineers, and military volunteers from AFRL and KAFB apply abstract principles to real world situations by assisting with the implementation of activities and giving interactive demonstrations on the use of STEM in different settings and careers. For example, cryogenics experts from the AFRL use liquid nitrogen to freeze various objects as students explore states of matter and thermal dynamics.

The DoD STARBASE Flight teaches STEM in ways that teachers may not have the time, resources, and expertise to do in a regular classroom. It’s experiential,



exploratory learning, and it ties directly to local educational content standards and benchmarks.

To extend the impact of DoD STARBASE, we conduct DoD STARBASE 2.0 programs at select middle schools serving former DoD STARBASE Flight students. This program incorporates mentoring and STEM projects to increase student interest, knowledge, school attachment, and career awareness.

**“They make you want to be a scientist or engineer, and go to college and get a math or science scholarship.”**  
2011-12 DoD STARBASE Flight student, Mesa View Elementary School





# TECH Flight

Technology and Engineering Challenges Flight

**"I just feel smarter about STEM. I think I can make a living in these fields."**  
--2011-12 TECH Flight student,  
Van Buren Middle School

## The Concept

The Technology and Engineering Challenges (TECH) Flight, for middle school students, consist of three non-consecutive days of instruction at AFRL La Luz Academy, in either the fall or spring semesters.

The curriculum also incorporates teamwork and the Air Force Core Values (*Integrity First, Service Before Self, and Excellence in All We Do*).

## What's the TECH Flight?

The fall semester of the TECH Flight focuses on rocketry over the course of three non-consecutive days, during which

students engage in a variety of STEM-related hands-on activities. They use teamwork and engineering design skills to build six-foot rockets. Students also run a computer simulation of the anticipated flight of the rocket using RockSim

software to predict what the rocket would do when flown. Students explore hands-on



Global Positioning Satellite (GPS) activities similar to what they will do on Rocket Launch Day.

The spring semester of the TECH Flight focuses on problem solving and the engineering design process over the course of three non-consecutive days. Students investigate STEM concepts related to specific engineering

**"It made me feel more confident about science, technology, engineering, and math by teaching me how to do things and solve problems."**

--2011-12 TECH Flight student,  
San Felipe Middle School

disciplines. For example, students learn about circuitry and electronic components before soldering their own light-emitting diode (LED) badge as they explore electrical engineering concepts.



# Robot Systems Flight

## The Concept

The Robot Systems Flight, for middle school students, is a school-based initiative in which students explore the basics of systems engineering and robotics by learning to assemble and program small wheeled robots called Boe-Bots® to run through obstacle courses.

Teamwork and the Air Force Core Values (*Integrity First, Service Before Self, and Excellence in All We Do*) are incorporated in this Flight.

## What's the Robot Systems Flight?

At a teacher training session, teachers learn the basics of assembling and programming the Boe-Bots® and then return to their classrooms with materials to teach their students these concepts over the course of the fall semester. Scientists and engineers from KAFB provide assistance to the teachers

**"I feel like if I can build a robot, I could succeed in technology, science, and math."**

--2011-12 Robot Systems Flight student,  
Valencia Middle School

and students as they work on the robots at their school sites during the school year.

After building their robots, students use their new programming skills to make the robot do some simple tasks and maneuver through a series of increasingly challenging obstacle courses.

Students will have an opportunity to share their work using an online environment where scientists and engineers may provide feedback.

The Robot Systems Expo is held in February at our facility on



Kirtland Air Force Base. At the Expo, student teams demonstrate how their Boe-Bot® can run through the various obstacle courses.



# STEM Challenge Flight

## The Concept

The STEM Challenge Flight provides an opportunity for teams of three or four high school students to plan and carry out a real-world STEM project, using a multi-phase engineering design process, much as real-world scientists and engineers (S&Es) do.

## What's the STEM Challenge Flight?

The three phases of the engineering design process used are: Proj-

ect Research and Development (R&D) and Pitch; Build, Test, Modify, and Retest; and Final Presentation. Student teams complete assignments for the phases of the project and submit their work using an online environment.

As part of this process, teams formally address and document project details such as: goal, constraints, requirements, concept, design, budget and materials, construction, testing, data collection, and results. Throughout the project, students can earn



points for submitted assignments. S&Es from the Air Force Research Laboratory and elsewhere provide technical support and feedback to the student teams as they complete project assignments.

Teams earning a set mini-

mum number of points on their assignments are invited to compete at the annual STEM Challenge Symposium. All student teams are invited to share their project results with peers and other invited guests at the Symposium, as they watch competing teams demonstrate how their devices will meet the set objectives of the project.

**"I plan to pursue engineering now, because I experienced it here."**

--2011-12 STEM Challenge Flight student,  
Hot Springs High School





### AFRL LA LUZ ACADEMY

AFRL La Luz Academy  
PO Box 9556  
Albuquerque, NM 87119

(505) 846-8042  
[AFRLLaLuzAcademy@Kirtland.af.mil](mailto:AFRLLaLuzAcademy@Kirtland.af.mil)

Web: [www.af.mil/afmla](http://www.af.mil/afmla)

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Mr. Steve Burke, Technical Writer, or  
Ms. Ronda Cole, Director.

### 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 Expeditions

## What are STEM Expeditions?

AFRL La Luz Academy STEM Expeditions for various groups at its classroom facility on Kirtland Air Force Base. These short visits, typically one to two hours long, are scheduled as time availability permits, and can be customized to address specific STEM concepts.

STEM Expeditions are ideal for extracurricular groups such as New Mexico Mathematics Engineering Science Achievement (MESA) Inc., Scout troops, Junior ROTC groups, and Civil Air Patrol cadets.

Hands-on activities that students have participated in during a STEM Expedition include:

- Trying to inflate a Bernoulli Bag using nothing but lung power and knowledge of Bernoulli's Principle (faster moving air creates lower pressure), correlate that experience to the role of airplane control surfaces such as rudders, ailerons, and yokes, and applying these experiences to computer flight simulation.

• Soldering electronic components such as resistors, 555 timers, capacitors, and light-emitting diodes (LEDs) to a printed circuit board to make a working "I have the power!" flashing LED badge;

- Exploring the states of matter



by participating in an interactive cryogenics demonstration using liquid nitrogen to flash-freeze marshmallows, balloons, and other items.

In 2009 we added a Summer STEM Camp to our STEM Expeditions. During the summer, as resources allow, we provide a summer STEM camp for upper elementary children of military personnel on Kirtland Air Force Base. Students spend the week engaged in a variety of hands-on/minds-on STEM activities exploring topics such as flight simulation and robotics.



# STEM Bytes

## We're Looking for Volunteers

Are you a scientist, engineer, and/or expert in a science, technology, engineering, or math (STEM) subject interested in sharing your knowledge?

You can see for yourself throughout this publication what we at AFRL La Luz Academy are doing to inspire future scientists



and engineers.

Well, here's your opportunity to help! AFRL La Luz Academy has lots of opportunities for volunteers. For example, you could:

- Help us set up or run a Mars Missions Link-Up Day;
- Share your STEM expertise with students involved in one of our Flights;
- Share your pilot/flight expertise and experiences with students participating in our Flight Simulation activity;
- Be a mentor for middle school students at our after-school STARBASE 2.0 program;
- Be a judge at our Robot Systems Expo;



- Assist students with their final rocket preparations at our Rocket Launch event;
- Be a technical advisor or a review mentor for a high school STEM Challenge Flight team.

Time commitments for volunteers vary, depending on the task; some commitments are for as little as a few hours or less.

We'd love to have you on our team! Contact us for more information.

## Spotlight Successful STEM Students

Teachers, have any of your students gone on to win a STEM competition, pursue a STEM degree, or work in a STEM field? Tell us about them and we may spotlight them in a future issue of

the newsletter! Email [AFRLLaLuzAcademy@Kirtland.af.mil](mailto:AFRLLaLuzAcademy@Kirtland.af.mil).

