AFRL La Luz Academy

"Creating the Possibilities"

Inspiring Future Scientists and Engineers

2011-12 Flight Preview

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SPECIAL EDITION

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The Rocket Report

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.

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 students from fifth through twelfth grades.

The interactive hands-on activities we provide focus on applications of the basic STEM concepts behind the technologies developed by the Directed Energy and Space Vehicles Directorates of the AFRL.

The Flights

AFRL La Luz Academy is divided into Flights, each designed for a certain grade level and aligned with New Mexico State Content Standard and Benchmarks.

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.

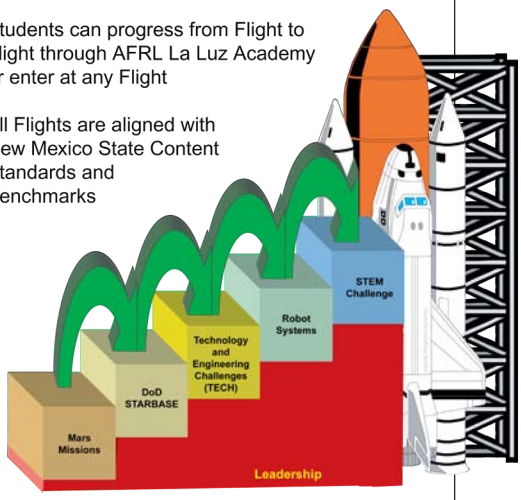
The **DoD STARBASE Flight**, for elementary fifth and sixth graders, is designed to motivate students to explore STEM as they continue their education. The inquiry-based curriculum focuses on required topics which include Physics, Chemistry, Technology, Engineering, Mathematics Operations and Applications, and STEM Careers.

The **Technology and Engineering Challenges (TECH) Flight**, for sixth and seventh graders, explores STEM research topics related to the AFRL's Directed Energy and Space Vehicles Directorates as a springboard for student investigation, in either fall (rocketry) or spring (satellites) semesters.

The **Robot Systems Flight**, for eighth graders, 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 a series of increasingly challenging obstacle courses.

Students can progress from Flight to Flight through AFRL La Luz Academy or enter at any Flight

All Flights are aligned with New Mexico State Content Standards and Benchmarks



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 systems engineering approach. Teams who earn a qualifying score from completing work on the project share their results with peers and other invited guests at the annual STEM Challenge Symposium.

Want to know more? Additional information about each of the Flights can be found inside this newsletter.

Read on!

Mars Missions Flight

Microprobe Evaluation of Lava and Titanium (MELT) Mission 2011-12

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 Content Standards and Benchmarks 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 decribes 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*.

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 systen 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 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 late 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 and sixth 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 also investigate engineering by using computers to design space stations.

Math is embedded throughout the curriculum, and students use 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 demonstrations on the use of STEM in different settings and careers.

For exaple, 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.

TECH Flight

Technology and Engineering Challenges Flight

The Concept

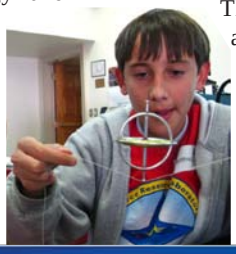
The Technology and Engineering Challenges (TECH) Flight, for sixth and seventh grade middle school students, consist of three non-consecutive days of instruction, in either the fall or spring semesters.

The hands-on curriculum uses STEM research topics related to the Air Force Research Laboratory's Directed Energy and Space Vehicles Directorates as a springboard for student investigation.

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 satellites over the course of three non-consecutive days.

Students engage in a variety of STEM-related hands-on activities, including waves, the electromagnetic spectrum, electricity, electronic components, gyroscope technology, and space weather.

The students explore with light boxes, lasers, gyroscopes, solar telescopes, and other STEM tools.

Robot Systems Flight

The Concept

The Robot Systems Flight, for eighth graders, 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 a series of increasingly challenging 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?

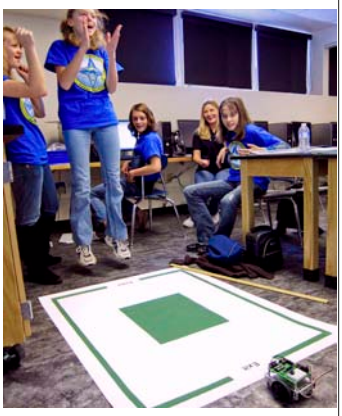
At a teacher training session, teachers learn the basics of assembling and programming the Boe-Bots® and then return to their classrooms with materials to teach their students these concepts over the course of the fall semester.

Scientists and engineers from AFRL attend the training and then provide assistance to the teachers and students as they work on the robots at their school sites.

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 receive monthly robotics and programming challenges via an internet social media web page we set up, and earn points towards an invitation to participate in the Robot Systems Expo in early December.

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 more high school students to plan and carry out a real-world STEM project using a systems engineering approach.

This activity is evolving to include the use of social media to provide opportunities for more interaction between AFRL scientists and engineers and the student participants.

What's the STEM Challenge Flight?

Teams of three or more students use a systems engineering approach to complete a STEM project. As part of this process, teams formally address and document the following project details: goal, constraints, requirements, timelines, plan, design, work breakdown, testing, and results.

In addition to completing work on their STEM project, each team is accountable for several key scheduled events, or milestones, during the course of the school year.

As students complete these milestones, they earn points that gain them access to additional support and resources to assist them in completing their project.

Teams who earn a qualifying score from completing work on the project participate in the STEM Challenge Symposium held in April each year.

During the Symposium, students share their project results with peers, and other invited guests.

Top performing teams will be offered an opportunity to participate in a summer workshop to further explore the STEM project during the summer.

AFRL La Luz Academy

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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

MELT: Microprobe Evaluation of Lava and Titanium

PRS: Phillips Research Site

PWN: Pinpoint WeatherNet

STEM: Science, Technology, Engineering, and Math

TECH: Technology and Engineering Challenges

T²: Technology Transfer

TTE: Technology Transfer for Education

USAF: United States Air Force

Teacher Institute

What is the Teacher Institute?

The Teacher Institute is a week-long STEM professional development activity for teachers, with support from AFRL scientists and engineers.

During the Institute, teachers work in teams to complete an assigned STEM project that they present to their peers at the end of the week. Teachers tour AFRL facilities, listen to guest speakers, and engage in various hands-on STEM activities. Their project presentations demonstrate understanding and appreciation of the concepts they have been introduced to.

Teacher Institute participants are expected to develop and implement a STEM lesson during the school year immediately following the Institute. They may also opt to receive graduate credit for their participation in the Institute.

Institute participants who successfully complete the one-week summer session become Teacher Institute Fellows for the following school year. AFRL La Luz Academy provides ongoing support

during the school year for these Fellows and provides opportunities and resources as they develop their STEM lessons.

In the spring, Teacher Institute Fellows present their STEM lessons and share their experiences at the Teacher Institute Symposium with their peers.

STEM Expeditions

What are STEM Expeditions?

AFRL La Luz Academy offers STEM Expeditions for various groups at its classroom facility on KAFB. These short visits, typically one to two hours long, are scheduled as time availability permits.

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 STEM activities students have participated in during a STEM Expedition include:

- Trying to inflate a Bernoulli Bat using lung power and knowledge of Bernoulli's Principle;
- Using teamwork and leadership skills to sucessfully navigate a set of Intergalactic Skis;
- Soldering electronic components to a printed circuit board to make a flashing "I have the power!" LED badge.

The Summer STEM Camp is a week-long STEM Expedition, held annually during the summer, for rising fifth, sixth, and seventh grade children of KAFB military personnel.

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?

AFRL La Luz Academy has lots of opportunities for volunteers to help us inspire future scientists and engineers. 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 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.