AFRL
NEW MEXICO
STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

Star Date: September 2020
Volume XVIII, Issue 1

AFRL
THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

In This Issue...

In partnership with:

NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

Collaborator:

DoD STARBASE
A Department of Defense Youth Program

Reserving school buses for our activities will only be necessary if and when classes resume in our facility on base.

The Rocket Report

Fall Into STEM

It is the summer's
great last heat,

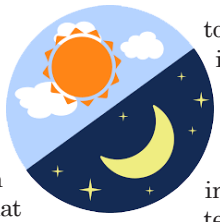
It is the fall's first chill:
They meet.

–*Sarah Morgan Bryan Piatt*

The *autumnal equinox*—also called the *September* or *fall equinox*—was on Tuesday, September 22 this year.

According to the Farmer's Almanac (www.almanac.com), the word "equinox" comes from the Latin *aequus*, "equal," and *nox*, "night."

On the equinox, day and night are roughly equal. During the equinox, the Sun crosses what we call the "*celestial equator*"—an imaginary extension of Earth's equator line into space.



When the Sun crosses the equator from north to south, this marks the *autumnal* equinox; when it crosses from south to north, this marks the *vernal* equinox.

And when it crosses the equator during the year 2020, it has to self-quarantine for 14 days.

AFRL NM STEM Academy is falling head over heels into another year of science, technology, engineering, and math (STEM) activities for students.

For the 2020-2021 school year, we're offering a modified version of our missions. This flexible adaption will be conducted using online resources and hands-on materials.

Pandemic? STEM-demic is more like it!

Mission to Mars

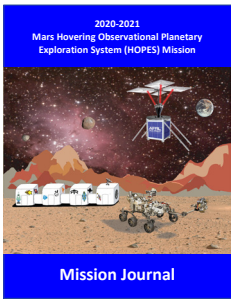
For Fifth Graders

Mars Hovering Observational Planetary Exploration System (HOPES) Mission 2020-2021

There's a New Team in Town

Netflix's *Away* program shows astronauts heading, Artemis-style, from a moon base to a Mars base. It teaches the importance of *teamwork* on manned missions to Mars, because they barely got off the moon and the crew was already quibbling with each other. *Real* Mars missions would encourage better teamwork.

In our modified 2020-2021 Mission to Mars, the Student Mission Journal and the online Base Operations Control Panel, both new this year, also work together as a team.



It's a team of *tools* to assist fifth grade students as they participate in the Mars Hovering Observational Planetary Exploration System (HOPES) Mission this year...

...a mission that hopes to involve a *sailcopter* teaming up with a *rover* to explore Mars!

Mission Journal

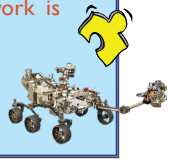
The Student Mission Journal is a great resource for Mars astronauts. It has a Mission Log to track their progress, and places to record the results of their activities, such as designing a mission patch, or writing a saga.

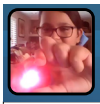
Control Panel

Additional information and resources to help students complete the tasks in their Journal can be found by clicking on the appropriate Base Operations Control Panel button.

Find them at (https://afrlnm.com/stem/2021-mars-hopes-mission/). What a team!

- In any mission to space, even virtual, good teamwork is essential for survival
- Your commitment to this mission is crucial to its success





DoD STARBASE NM

For Fifth Graders

Learning Virtually, Landing Lunarly

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

For the fall semester, we are tailoring this mission as an online program. We developed great new lessons and activities to deliver virtually or remotely. Participants still get an exciting hands-on experience from their homes. The next best thing to being here with us in person!

DoD STARBASE NM has already started piloting our Remote/Virtual program this week, beginning with Albuquerque School of Excellence.

Activities are grouped into five overall categories: Engineering, Physics, Technology, Chemistry, and Space.

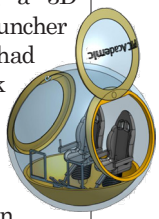
Engineering

The first category students work on, Engineering, uses concepts such as the Engineering Design Process (EDP), Material Properties, and Computer-Aided Design (CAD).

It involves activities like Marshmallow Lunar Lander design, build, test, and redesign; exploration of shock absorber materials, and an introduction to Onshape CAD software with a virtual Scavenger Hunt activity.

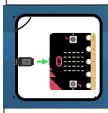
Already Zoomin'

Rocketry is on pandemic hold for now, so STARBASE 2.0 is working on designing a 3D "crossbow" marble launcher game. This month, we had three mentors work with us as we went through Onshape CAD tutorials virtually.



Next month, we begin the actual "crossbow" engineering design project.

We are still hoping to find **four more mentors**, if anyone knows anyone...



TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Satellites Mission

TECH Mission Overview

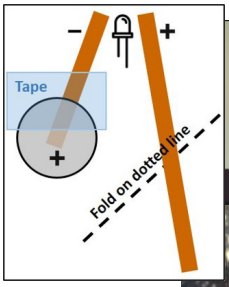
This year's modified Technology and Engineering Challenge (TECH) Mission, conducted using online resources, focuses on STEM and the engineering design process, applied hands-on to **satellite technology**.

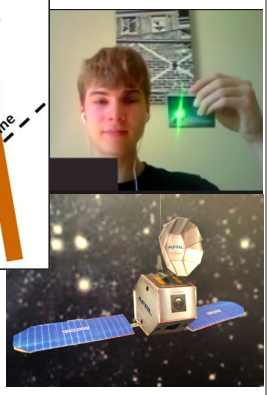
AFRL NM STEM Academy will provide physical materials to facilitate hands-on learning to all participating students, delivered through their teachers.

Our instructors will meet synchronously with students and teachers, wherever they are, to deliver instruction. We plan to interact with teachers, parents and students through Zoom and Google Meet.

Over the course of the mission, students investigate hands-on STEM concepts related to specific satellite engineering disciplines such as circuitry, electronics, and programming.

There will be activities involving Power and Circuits, such as a Paper Circuits/Badge making activity.





Satellite Communications will be explored with a Binary Code activity.

Satellites and their relation to the electromagnetic spectrum will coincide with an infrared camera demonstration, a SSPIDR / LEctenna activity, and a UV Bracelet activity.

Properties of Light, Python programming, and micro:bits will also be explored.

Robotics Challenge

For Middle Schoolers

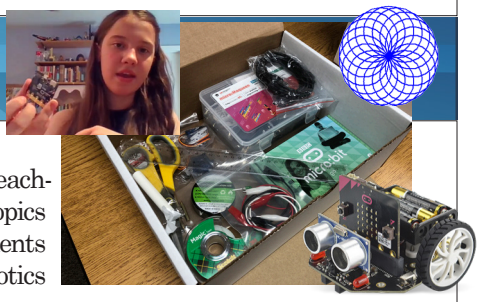
Robotics Challenge Overview

In the **Robotics Challenge** mission, students explore systems engineering, computer science, and robotics. Students learn to build and program small robots to complete tasks and solve problems.

This year, we are offering a modified version of the mission for all participating students, using the **Canvas** online platform, the micro:Maqueen robot, additional emphasis on individual activities, and culminating in an *online* event.

Teachers will receive sample materials kits after the upcoming teacher orientation.

The Robotics Challenge consists of 3 modules of tutorials and 12 assignments that we think you and your students will enjoy.

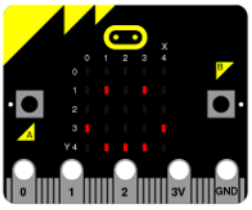


Each module consists of slides teaching a variety of topics that will help students become great robotics engineers and programmers.

Module 1 will help students develop basic knowledge of the Python programming language.

Module 2 introduces students to the micro:bit microcontroller.

Module 3 teaches how to control a robot using the micro:bit and code.



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https://www.youtube.com/channel/UCQuOSd1XTkYuXPONZwlAIHQ/videos

Important Terms and Acronyms

AF: Air Force

AFB: Air Force Base

AFRL: Air Force Research Laboratory

AFRL NM: AFRL New Mexico (AFRL/RD and AFRL/RV), on KAFB

AFRL/RD: The Directed Energy Directorate of the AFRL

AFRL/RV: The Space Vehicles Directorate of the AFRL

DoD: Department of Defense

KAFB: Kirtland Air Force Base, Albuquerque, NM

HOPES: Mars Hovering Observational Planetary Exploration System 2020-2021

MM: Mission to Mars

PRS: Phillips Research Site

S&Es: Scientists and Engineers

STEM: Science, Technology, Engineering, and Math

TECH: Technology and Engineering Challenges

USAF: United States Air Force

Remember, Teachers:
Get those EPA Modification forms in!

STEM Bytes

For the 2020-2021 school year, we are putting the STEM Challenge Mission on hold for fall semester. We are working on alternate activities for high school students and will continue to monitor conditions to determine whether we can offer this Mission beginning in the spring.

NM Science Fiesta 2020

A week-long celebration of science! Held virtually this year, from 18-26 September, 2020, the New Mexico Science Fiesta (www.explora.us/programs/science-fiesta/#expo) aims to inspire interest in science, technology, engineering, art, and math (STEAM).

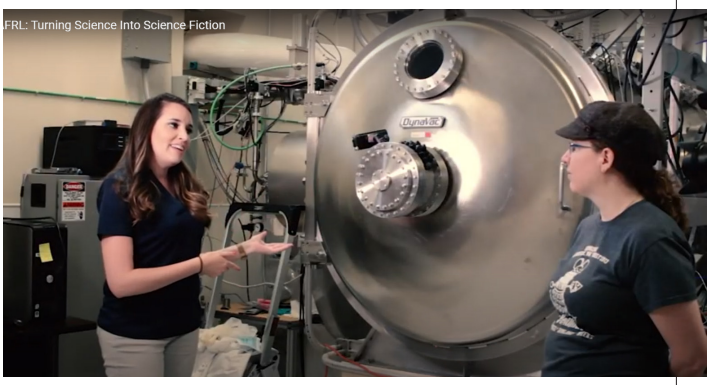
During the week-long NM Science Fiesta, many science activities and presentations were featured, including launching a weather balloon, a visit from Science Girl, a tour of the National Solar Thermal Test Facility, and other events.

AFRL NM STEM Outreach contributed by conducting two virtual AFRL tours, a Career Path presentation, and a "Fun with Propulsion" STEM Demo, which can be seen at the 3:03:00 mark in the NM Science Fiesta Channel's YouTube video.

AFRL NM STEM Academy's YouTube channel videos also feature Dr. Oscar Martinez demonstrating a mighty seltzer rocket launch like at the Fiesta.

Turning Science Fiction Into Fact

With Ms. Rachel Delaney



Bubonicon (www.bubonicon.com) says they are New Mexico's "best and longest-running Science Fiction and Fantasy literary and arts convention, started in 1969."

Every year, Bubonicon likes to "put the science in science fiction, by highlighting a local scientist or engineer."

The engineer they happened to pick recently to highlight, on their YouTube channel, was none other than AFRL Space Vehicles (RV) mechanical engineer Ms. Rachel Delaney!

Host Mandy Self interviewed Ms. Delaney from inside an RV laboratory. Ms. Delaney, who was an intern with *us* when she was in high school, discussed the many satellites AFRL currently has in orbit.

They also discussed an exciting new project that blurs the line between science fiction and science fact, by beaming power from space to Earth.

ROSA, the Space Station Party Favor

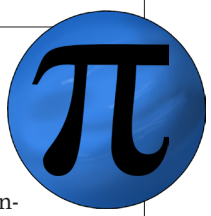
AFRL's Roll-Out Solar Array (ROSA), has been to the international space station!

ROSA is a special flexible solar panel that can roll up in a tube, and unfurl when needed. NASA says "it rolls open in space like a party favor."

On our AFRL NM STEM Academy YouTube channel, you'll find a video there that discusses how AFRL's ROSA panels were sent to the ISS in 2017.

There, NASA scientists tested ROSA's deployment, retraction, vibration, and other measures of its durability in space.

Pi Planet



Scientists studying data from the Kepler Space Telescope have confirmed an Earth-sized exoplanet 187 light-years away that orbits its star every 3.14 days.

See www.livescience.com.

Coming Next Issue...

- The Mars Hovering Observational Planetary Exploration System Mission
- STARBASE Physics

Watch for it!