

Inspiring Future Scientists
and Engineers

AFRL NM STEM ACADEMY

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The Rocket Report

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In partnership with:



Collaborator:



Remember, Teachers:
It's never too early to make
bussing arrangements for
our classes and events!

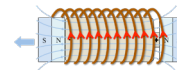
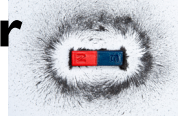


STEM at the Fair

We had a booth at the New Mexico State Fair on 13 September 2024, for their Science, Technology, and Environment Appreciation Day.

We attracted old friends, and made new ones, while visitors explored various hands-on activities involving magnetic fields, electromagnets, and superconductors. KOB-TV4's Eddie Garcia came to share the story.

Operation Paperclip: Visitors to our booth tested the strength of a magnetic field by weighing down



a paperclip...using *other* paperclips. Visitors lined up iron filings over a magnet to *see* the magnetic field, and made colorful magnetic rings hover and stack to match a diagram.

They saw cold liquid nitrogen turn oxygen liquid, and observed its *paramagnetism* with a balloon and a magnet. They also made simple copper wire "*homopolar*" motors using copper wire, a battery, and a magnet.

It was *superconductive* to all who attended.



STEAM Night at Rio Rancho Elementary

Our magnetic fields, electromagnetism, and superconductor activities were attracting students at Rio Rancho Elementary School's STEAM Night on 8 October 2024!

They saw what looked like a small, black version of Marty McFly's Hoverboard from the year 2015 levitating on a metal track using *cool* superconductivity.



Remember *Wooly Willy*, the card with a face on it, and a magnetic wand that attracted and moved iron filings around, so you could "draw" a beard and

eyebrows onto Willy? There was a similar iron filing and magnet activity (Willy not included) that allowed you to "see" the magnetic field around the magnet!



Mars New Teacher Training

Returning Mars teachers were welcomed back in one of several online Returning Teacher Orientations during September 2024.

Teachers *new* to the Mission to Mars completed *in-person* training for new teachers at our STEM Academy facility at Kirtland AFB on **Friday, 4 October 2024**.



Teachers built mini habitats, assembled them in a neighborhood,

Continued on page 2

New-Bee

Oh, *bee*-have! Isabella "*Bee*" Eisenbach is our newest new-bee STARBASE Assistant Instructor. (Her Nonna used to call her "*Bee*.") Originally from Tuscon, AZ, she worked at a Santa Fe-based photography gallery for years, and takes pictures old-school with *film* cameras! She's excited to join us; she loved studying STEM as a kid.

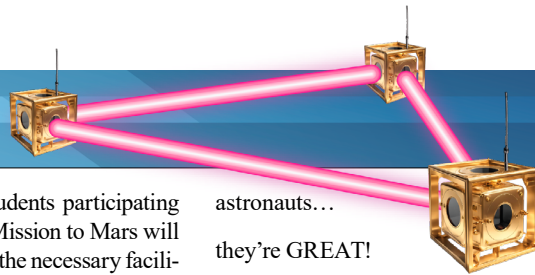
As Arnold Schwarzenegger used to say, "I'll 'Bee' Eisenbach!"





Mission to Mars

For Fifth Graders
Mars Gravitational Research Energy Antenna Test (GREAT) Mission 2024-2025



GREATest Mission Ever!

It's the GREATest Mission to Mars we've ever done!

Background

NASA scientists are working with Vanderbilt University to create a Laser Interferometer Lunar Antenna (LILA)—three boxes shooting lasers at each other, in a giant triangle, across a lunar crater.

An Earth-based counterpart called LIGO (Laser Interferometer Gravitational-wave Observatory) works in a similar way.

These laser setups are able to detect faint gravitational waves—ripples in the fabric of space-time that spread outwards from black holes and neutron stars, which are the remnants of the most massive stars in our universe.

These collisions create heavy elements such as gold, platinum, and silver! By putting this technology on the Moon, LILA could detect gravitational waves that are too faint for LIGO to detect on Earth.

Mission Objective

Expanding on the LILA concept, Mission to Mars scientists are



Mars Gravitational Research Energy Antenna Test (GREAT) Mission 2024-2025

embarking on the Mars Gravitational Research Energy Antenna Test (GREAT) Mission, to bring this technology to the Red Planet, as well! Our great scientists and engineers will travel to Mars to establish and test a three-way laser gravitational wave detector antenna, using technology developed by the AFRL's Directed Energy directorate, placed in a triangular formation across a large Martian crater.

Personnel supporting the 2024-2025 Mars GREAT Mission will require a colony of long-term living quarters and food on Mars.

Fifth grade students participating in this year's Mission to Mars will plan and build the necessary facilities and life support resources, and present them at the culminating Link-Up Day event in the spring.

STEM and Mission to Mars

astronauts...
they're GREAT!



Your commitment to this mission is crucial to its success

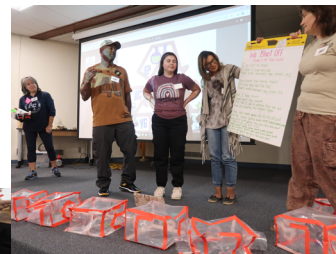
Mars New Teacher Training

Continued from page 1

wrote sagas, designed mission patches, and made life support system models.

Teachers also built and linked together a pair of bigger, full-sized habitats the same size as the ones their students will build on Link-Up Day,

Teachers are well-prepared for the Mission to Mars now.



TECH Mission

For Middle Schoolers
Technology and Engineering Challenges—Rocketry and Satellites Missions

Excitement is Building

TECH Mission Day 1 has wrapped! Students have been busy preparing for the big rocket launch day, and the excitement is building!

Students assembled the *booster tube*, *payload tube*, and *motor mount* sections of their rocket, giving the rocket a name like *Gemini*, *Atlas*, *Apollo*, or *Phoenix*.

Students simulated rocket flight with the software program *Rock-Sim*. Day 1 students also practiced their global positioning satellite (GPS) rocket tracking skills.

Day 2, Rocket Launch Day, is scheduled for **22 October 2024**, weather permitting.



Launch Day Tips

Teachers, if the weather looks bad on launch morning (22 October 2024), call the **Rocket Launch Hotline** at (505) 401-5456 and verify launch is still a **GO!**

Note: Our office is **CLOSED** on Rocket Launch Day. We'll all be out at the launch site!

When getting ready that morning, consider the desert environment: It can start off kinda chilly and get warm later, so wear weather appropriate **layers**.

Students **must** wear their red T-shirts.

Sunscreen and sun hats are a

good idea, too.

Launching rockets in the desert is thirsty work, so bring lots of **water**.

Protect your **feet** from things they might *meet*: Wear appropriate desert **footwear**. **Shoes** and **boots** are safer than *flip-flops* and *sandals*. And, very important: Remember to bring **lunch** for the **launch!**

At the launch site, **safety first!** Teams monitor weather and wind conditions, making sure the wind doesn't huff and puff too much. Teams stay in assigned areas, and *everyone* stands during launch, even spectators.



By the Tuesday of the week before the first class in the series, session, or semester, we will ask you for the name, driver's license number/state of issue, date of birth, and the FULL Social Security Number, of every adult coming through the base gate for that series of classes.



Robotics Challenge For Middle Schoolers



Module I--Intro to Programming and Microcontrollers

To prepare students to participate in the Robotics Expo, the Robotics Challenge mission is broken up, on Canvas, into four *modules*.

Each module contains a series of lessons, Challenges, and quizzes. Student completing the Challenges and quizzes will earn points for their team!



If they see this “Deeper Dives” trophy symbol, students can click on “Modules” in the left side of the Canvas screen and scroll down to the “Deeper Dives” module to complete *additional* Challenges and quizzes,

to earn *more* points for their team!



Module I

Before Robotics Challenge students begin building ‘bots, they must become familiar with *programming* and *microcontrollers*. Module 1 starts out with an introduction to programming in *Python*, the computer language (or “code”) used in the Robotics Challenge. It’s not a snake, but it might *byte* you.



Python was first introduced in 1991, and has been one of the top

ten programming languages since 2003. Big names use it, like Wikipedia, Google, and NASA.

In Module 1, students learn programming terms like *function* and *variable* (I, for one, can’t *function* in the morning without *coffee*, and my variables are *cream* and *sugar*).

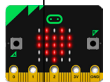
And right away, they’ll see “deeper dive” challenges available for things like *binary numbers* and *variables*.

They learn how to program things such as making vertical lists using the “\n” function, and they learn how to *debug* their programs.

As any Saturday morning cartoon aficionado knows, the problem with eating a bowl of Fruit Loops cereal in the morning is, you can only eat it *once*.

But with *For Loops*, students can repeat lines of code (actions) as many times as they need.

After all that, students will explore using Python to program a *micro:bit* microcontroller, a tiny programmable computer with grids and sensors and buttons.



Contact caitlin.everhart@afrinewmexico.com for more info.

STEM Challenge For High Schoolers

Team Ident-egg-ty

To solve the technical problem of how to remotely launch an *egg payload* through a vertically suspended *hula hoop* and have it land, intact, on a *target* 30 feet away, the STEM Challenge Canvas website guides students through *seven* distinct STEM Challenges:

Team Identity, Projectile Motion Simulation, Launching Device Design/Build, Payload Protection Device Design/Build, Launching Device Characterization, Payload Device Characterization, and Data and Results Summary.

The first challenge, **Team Identity**, involves creating a *team name* and designing a *team logo*.

Some examples from last year are shown on the banners at right.

When students complete Challenges, they’ll upload the results on the STEM Challenge Canvas website to earn points. Start your egg timers!

Contact deb.novak@afrinewmexico.com for more info.



DoD STARBASE NM For Fifth Graders

Physics, and Little Bits of Force

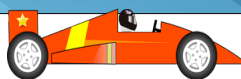
Master Yoda had it easy. To make something as big and heavy as an X-Wing Fighter move, even though he was no bigger than a muppet, all he had to do was close his eyes and lift his hand.

For most of the rest of us, if we want to “use the Force” on anything, we have to *push* or *pull* on it hard enough to make it move. Do, or do not; there is no try.

In Day 2, Physics, of DoD STARBASE NM, students learn all about force and Newton’s Laws of Motion.

For example, they build little wedge-shaped dragster cars (that sort of look like a Star Destroyer on wheels) out of balsa wood.

Instead of a giant Star Destroyer ion engine, they power them with little carbon dioxide (CO₂) canisters.



Some of the canisters provide more *force* than others, so they put them side by side and *race* them, just to see what happens.

Day 2 students assemble littleBits® electronic components using *power bits* (connected to a 9 volt battery), *input*, *wire*, and *output bits*.



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<https://www.youtube.com/channel/UC-QuOSd1XTkYuXPONZwIAIHQ/videos>

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Mr. Steve Burke, Technical Writer.

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

GREAT: Mars Gravitational Research Energy Antenna Test Mission 2023-2024

KAFB: Kirtland Air Force Base, Albuquerque, NM

MM: Mission to Mars

S&Es: Scientists and Engineers

STEM: Science, Technology, Engineering, and Math

TECH: Technology and Engineering Challenges

USAF: United States Air Force

USSF: United States Space Force

Remember, Teachers:

Get those EPA Participation forms in!



DoD STARBASE NM (continued)

Advanced Launch



The first launches for **STARBASE Advanced NM**, for middle/high school students, are underway!

Student teams from Albuquerque Institute of Mathematics and Science (AIMS), Albuquerque School

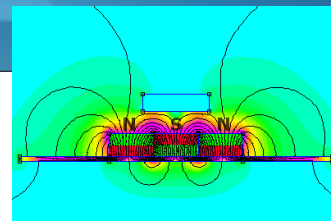
of Excellence (ASE) pictured here, and Del Norte High School, working with STEM mentors, are already launching model rockets in preparation for entering the American Rocketry Challenge (ARC):

<https://rocketcontest.org/>.



STEM Bytes

Superconductors



Recent outreach events have been incorporating an amazing levitating magnet *superconductor* demonstration. But what is a [superconductor](#)? How do you make one?

Well, it's actually pretty simple. Take Beethoven, Bach, and Brahms, put them in a particle accelerator, smash them together at high speed, and BAM! You've got yourself a *superconductor*.

No, no, I'm kidding. Actually, one way is to supercool some yttrium barium copper oxide – YBCO, using cold liquid nitrogen.

An electric current flows near the surface, without any resistance, and creates a magnetic field, which is called the Meissner effect.

The superconductor is *diamagnetic*; it repels other magnetic fields near it, but microscopic

flaws in the superconductor allow enough magnetic flux lines through to make a magnet *hover* and *levitate* in place a short distance above the superconductor.

It's a useful trick for MRI scanners, MagLev trains, and Beethoven-Bach-and-Brahms-smashing particle accelerators.

Video Game Science

[GameRant](#) recently released a list of good video games, for your PC, Xbox, Playstation, and other platforms, that teach science.

Among their recommendations:

Car Mechanic Simulator teaches players about the intricacies of repairing and fine-tuning cars, providing a detailed introduction to engineering.

Infinifactory offers accessible problem-solving and engineering challenges.

It allows players to create objects on an assembly line and solve increasingly complex puzzles.

Study Studies Student STEM

A [study](#) from the University of Nottingham's School of Psychology, recently published in *Research For All*, examined the impact of Summer Scientist Week, an annual five-day out-of-school "science engagement" event for 4 to 11-year olds and their families, plus data from previous 14 to 17-year old attendees.



They concluded that participation in STEM activities such as this, and a child's family's interest in STEM, "can increase both student knowledge and interest in science, resulting in a higher likelihood of studying a STEM subject at an advanced level."

NASA Pumpkins

NASA has some tips for carving cool space-themed pumpkins for Halloween! See www.nasa.gov, or a safer version for younger students, www.spaceplace.nasa.gov.



Opportunities



- [AFRL Scholars](#) Summer 2025 paid high school internship applications are open 10 October 2024 to 10 January 2025. AFRL-Scholars@usra.edu.
- [Registration](#) is open now for STEM Santa Fe's STEM Pathway for Girls [2024 Conference](#) (5th-8th grade) on 19 October 2024.



Coming Next Issue...

- TECH Rocket Launch!
- Robotic micro:bits
- STARBASE Tech

