AFRL
NEW MEXICO STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

Star Date: Feb 2025
Volume XXII, Issue 6

AFRL THE AIR FORCE RESEARCH LABORATORY

The Rocket Report

In This Issue...

In partnership with:

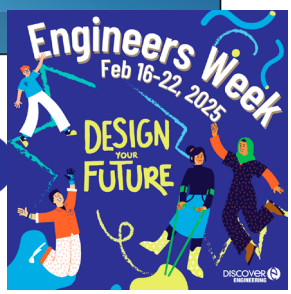
NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

Collaborator:

DoD STARBASE
A Department of Defense Youth Program

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

Design Your Future February



Short February is long on STEM!

The "E" in "STEM" is for Engineering. DiscoverE's Engineers Week is 16-22 February this year, a week-long celebration of how engineers make a difference in our world.

This year's theme, **"Design Your Future,"** is appropriate, because the engineers of today will design the solutions of tomorrow, in fields from artificial intelligence to biotechnology and everything in between. We need students to step up and help!

DiscoverE's website lists engineering activities students can explore; everything from using matierials found around the house to design an "Action Contraption" Rube Goldberg device, to using the Engineering Design Process to sketch out the process for making toast.

After all, *someone* had to invent the toaster!

DISCOVER ENGINEERS WEEK
FEBRUARY 16–22, 2025

D-12

1-A-1

(General Electric introduced the first commercially successful electric toaster, *Model D-12*, in 1909. Charles Strite's Waters Genter Company came out with the first modern auto pop-up, double-sided, adjustable browning toaster, the *Toastmaster 1-A-1,* in 1925.)

On DiscoverE's **Introduce a Girl to Engineering Day**, volunteers, educators, and others act as role models, facilitate engineering activities, and show girls how engineers change our world.

DISCOVER GIRL DAY
FEBRUARY 20, 2025

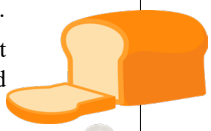
This year, Girl Day happens to fall on 20 Feburary 2025...which is also the date of our **Mission to Mars Mid-Year Meeting!**

We'll have designs on a booth at the National Museum of Nuclear Science & History's Discover STEAM Day on 22 February 2025...

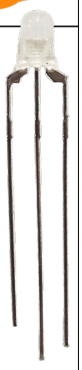
...the same day NM Tech is hosting the 2025 Science Olympiad!

STEM in February...

...it's the greatest thing since sliced bread!

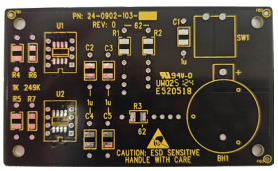


Futuristic TECH Tech Designed



Big thanks to our friends at MPC, for designing our new LED badges! It's new tech for TECH, and a quantum leap forward for STEM! Among the improvements:

MPC DESIGN TECHNOLOGIES, INC



Circuit Board

The **circuit board** has been redesigned with a more logical grouping of components, better labeling, and a gold text-on black color scheme that's easier to read than our old white text-on-green boards.

Capacitors

The **capacitors**, which store energy until needed, used to be relatively tall, black barrel-shaped components. They were *polarized*; it mattered which lead (positive or negative) went into which via (hole).

Plus, there were two different capacities, which could be confusing, and they would have to be carefully folded down flat to fit into the clear vinyl sleeve later.

The new gold-colored capacitors are much better; there's only one capacity, they're shaped similarly to the resistors, so, not as tall, and the leads can go into either via.

LEDs

The old two-prong red and yellow **LEDs** were polarized; they could be put in backwards, which would cause them to not light up. The new dual-color LEDs have *three* leads, such that if they're put in backwards, they just switch color.

Thanks, MPC! It's the greatest thing since sliced breadboards!

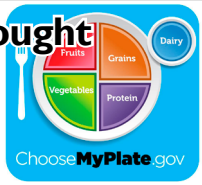
Mission to Mars

For Fifth Graders

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

Link-Up Day: Thursday, 24 April 2025

Food for Thought



Food for thought: Think about food on Mars, and on the way *to* Mars. NASA does!

For example, NASA thinks tortillas are better than bread: They're easily stored since they lay flat; and they don't make crumbs that could interfere with equipment. NASA also discourages seasonings, as they can get messy in a spacecraft.

Sodas don't work well in space, because it turns out microgravity doesn't mix well with the carbonated bubbles.

Fortunately, the only space travel our Mission to Mars students do is on a *school bus*, so we're not as restrictive as NASA!

Crews use teamwork, problem-solving, and math to plan their own Link-Up Day lunch, taking into consideration *mass, volume,* and *nutrition* requirements.

Lunches should include at least *236 mL* (8 fluid oz.) of liquid per crew member; total food and liquid mustn't exceed *568 grams* (20 oz.) per crew member, carried in 12 or fewer 1-gallon zip-lock bags. (Teacher's Resource Guide pp. 79-80). Teachers and adults follow the same lunch requirements as the students.

Gauntlet Thrown

During his inauguration speech on 20 January 2025, President Trump made an interesting statement:

"...The United States will once again consider itself a growing nation—one that...carries our flag into new and beautiful horizons.

And we will pursue our manifest destiny into the stars, launching American astronauts to plant the Stars and Stripes on the planet Mars."

You listening out there, Mission to Mars students? The gauntlet has been *thrown.*

Your commitment to this mission is crucial to its success

Uniforms

Uniforms provide groups with a sense of identity, safety, spirit, and purpose. Each Mission to Mars crew designs their uniforms in advance of their journey.

Uniforms don't have to be fancy; matching T-shirts and jeans will do. Mission patches, headgear, and other accessories are optional (see pp. 77-78 in the Teacher's Resource Guide).

Students, teachers, and assisting adults also wear a *nametag,* as part of their uniform, including:

- School Name,
- Student Name, and
- Teacher Name.

Kahoot! Kontinues

The Mars Fact Challenge Kahoot! games are continuing. Challenge #3 begins 17 February 2025, and then it's on to Challenge #4 on 3 March 2025!

See https://afrlnm.com/stem/missions/mission-to-mars/mars-kahoot-games/.

Mark Your Mobile

It's not too early to Mark Your Mobile, specifically the calendar app in it, for the mandatory Mission to Mars Mid-Year Meeting., on **20 February 2025**, 12:30-3:30 pm, which also happens to be DiscoverE's "Girl Day."

Make your arrangements now!

TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Rocketry and Satellites Missions

Paper Satel-LIGHTS

The Spring semester of the TECH mission has started. The overarching theme for the three-day semester is *satellites* and *satellite technology.*

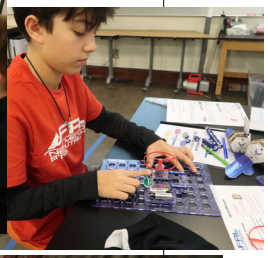
See, a few years back, AFRL's Space Vehicles Directorate pioneered a new, more streamlined way to build satellites. Instead of custom-building each new satellite from scratch, they came up with a faster, more versatile "Plug-and-Play" design.

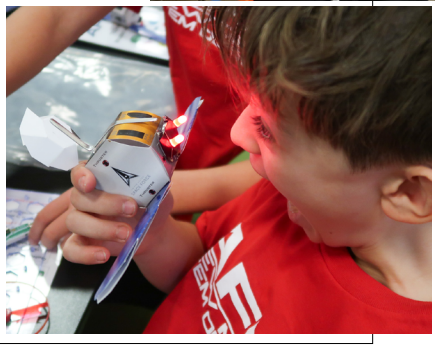
TECH Day 1 students explore the basics of streamlined satellite construction when they assemble a **paper HexSat** from a single sheet of paper and three metal links.

These satellites are not light on STEM, either; students add LED lights to their paper satel-LIGHT.

Students explore the basics of streamlined circuitry construction when they snap components onto a board to build series and parallel Snap Circuits.

Day 1 students also learn binary math and begin programming a micro:bit microcontroller.





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.

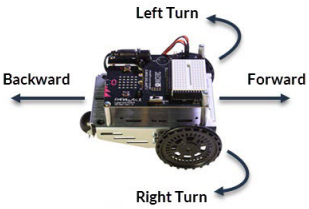
Robotics Challenge For Middle Schoolers

Pivotal Motion

As Robotics Challenge teams work through **Module 2,** a pivotal moment in their cyber:bot robotics exploration on the way to the Robotics Expo, on 9 May 2025, is when they learn how to control their robot's *motion.*

By coding either a *positive* or *negative number* in their servo_speed() command, students can determine whether a particular wheel rotates *clockwise* or *counterclockwise.* Manipulating how the wheels turn determines the motion of the robot.

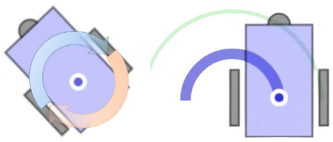
Because the wheels are on opposite sides of the robot, to make the



cyber:bot go *forward*, its left wheel has to turn *counterclockwise*, while its right wheel turns *clockwise*, and the reverse of that to make it go *backwards.*

To make the robot spin in place, the students code *both* wheels to turn in the *same* direction.

To make the robot pivot in a *circle* around *one wheel*, they'd code one

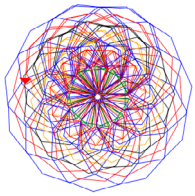


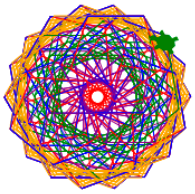
wheel to *spin* while the other wheel stays *still.*

Questions? Suggestions? Contact stem@afrlnewmexico.com for more information.

Mosaics

More mosaics! We've updated the Turtle Mosaics page in the Robotics Challenge section of our website.





STEM Challenge For High Schoolers

Characterization Challenges

It's less than two months away! The STEM Challenge Symposium is coming 10 Apr 2025.

To prepare for this event, STEM Challenges #5 and #6 have students collect data, and process that data using the "M" in STEM: *Math*.

Challenge #5: Launching Device Characterization

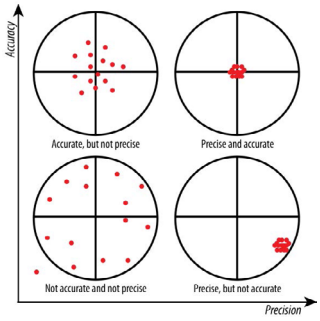
STEM Challenge students have built and tested their launching and payload protection devices.

Now they apply math and science concepts to describe how their launching device works.

In this challenge, they use their *hacky sack* to characterize how *accurate* and *precise* the launching device is.

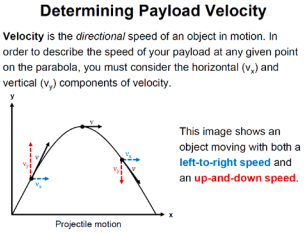
They gather *data* to calculate the *equation* of the flight path *parabola*, in both *standard* and *vertex* form.

The slides in Canvas explain in detail how to complete this task.



Challenge #6: Payload Protection Device Characterization

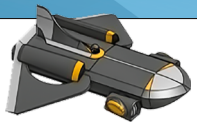
In this challenge, students calculate the payload *launch time*, its *velocity* at several points along its *trajectory*, and the *kinetic energy* of the payload in motion using the 30 ft launch configuration. The slides in Canvas explain in detail how to complete this task.



Math, start mathing! Contact deb.novak@afrlnewmexico.com for more info.

DoD STARBASE NM For Fifth Graders

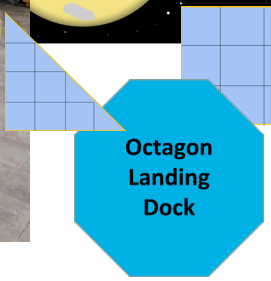
STEM Scavenger



In the five-day DoD STARBASE NM program, Day 1 fifth grade student engineers explore 3D CAD software PTC *Onshape* to help a character named Bunsen search a computer aviation model called *Starship: USS Zirconium* to look for hidden objects in a virtual *scavenger hunt.*

Knowing how to determine the mass of objects comes in handy when the students design, test, and redesign a restraint system to save Eggbert the Space Shuttle Pilot as he crashes on the "moon."

Students also work with shapes and areas in a Landing Dock activity, and discuss various scientific tools.



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Website:
www.afrlnm.com/stem

YouTube Channel:
https://www.youtube.com/channel/UC-QuOSd1XTkYuXPONZwlAIHQ/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

GREAT: Mars Gravitational Research Energy Antenna Test Mission 2024-2025

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

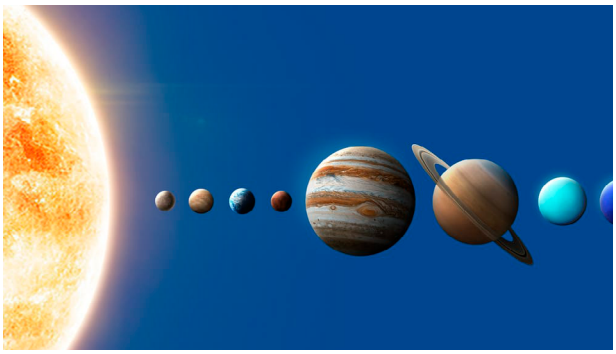
USAF: United States Air Force

USSF: United States Space Force

Remember, Teachers:
Get those EPA Participation forms in!

STEM Bytes

Planets on Parade



Around 24-28 February, an alignment of the five brightest planets—Venus, Jupiter, Mars, Mercury, and Saturn—will be visible in the night sky.

You won't need any special equipment–just go outside when you have a clear, unobstructed view of the horizon. look up around dusk, and you should be able to see them.

Two of these planets, Mercury and Saturn, will appear especially close together on Monday, Feb. 24 — the highlight of this month-long planetary display.

Spotting two, three, or even four bright planets at once is not unusual, but the chance to see all five together doesn't come around often.

A similar alignment will occur in late October 2028, though that event will take place before sunrise, so you'd need to be an early riser. See www.starwalk.space/en/news/what-is-planet-parade.

2025 AYWiSTEM Scholarship Open

To assist and encourage young women pursuing a STEM career, the 2025 Advancing Young Women in STEM scholarship application ($500, $750, and $1,000) is now open through **8 March 2025**.

NMOST New Mexico Out-of-School Time NETWORK

Questions? Contact Sarah Pratt, spratt@nmost.org.

STEMYS Nominations Open

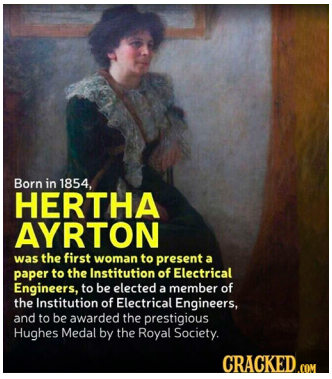
STEMYS Excellence in STEM Awards

Nominations are now being accepted for the 2025 New Mexico Excellence in STEM Awards, aka The STEMYS.

The STEMYS honor New Mexicans doing exceptional work in, and in support of, science, technology, engineering, and math education.

Q Station hosts the STEMYS in partnership with the Air Force Research Lab's Tech Engagement Office, which created the awards in 2018 to highlight STEM work throughout the state of New Mexico.

Nominations for the 2025 STEMYS will be accepted through March 28, 2025 at www.qstation.tech/stemevents.



New Glenn Up

Jeff Bezos' space rocket company successfully launched its big 7-engine rocket, *New Glenn* (named in honor of NASA astronaut John Glenn), on 16 January 2025.

They missed catching the booster on the way back down, but hey... practice makes perfect. See www.space.com.

Coming Next Issue...

- Mars Habitat Construction
- DoD STARBASE Day 2