

Inspiring Future Scientists
and Engineers

AFRL NM STEM ACADEMY

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The Rocket Report



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Nuclear STEAM Magnets

“You mean to tell me these magnets are *nuclear*?!?”

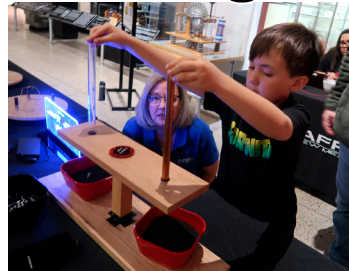
No, Marty, there were ordinary magnets, strong *neodymium* magnets, and even some *electromagnets* at our booth, but none of them were *nuclear-powered*...

...and the STEAM they generated wasn't composed of nuclear-heated water, either.

However, on the far side of the room, there was a suspiciously familiar-looking DeLorean parked over there that looked like it might have gone to 1955 and back...

But back to the present. Visitors to our booth at the National Museum of Nuclear Science & History's [Discover STEAM Day](#) on 22 February 2025 were strongly attracted to various hands-on activities involving magnets.

There was a clear cube with *iron filings* in it that were attracted to a removable magnet in the middle, causing them to align themselves



into a visual 3D version of the *magnetic field* around the magnet. You know, Iron Man might end up in a cube like this one day.

Visitors could test the strength of a hanging magnet's field by seeing how many paper clips it could support...or make ring-shaped magnets on a stick attract or repel each other.

Students and visitors made simple spinning motors using copper wire, a battery, and a pair of magnets... and tested Lenz's Law by comparing the speed of a small steel ball falling through a plastic tube with a magnet trying to fall through a *copper pipe*.

The magnet in the copper pipe



would fall slower than rush-hour traffic on I-40, thanks to the conflicting magnetic fields of the *magnet* and the *pipe* opposing gravity.

Speaking of *current events*, guests discovered a copper coil wasn't very magnetic until an *electric current* was applied. They were able to use a similar *electromagnetic coil* to shoot small metal rings, like a miniature magnetic cannon, into a square cloth bucket.

In partnership with:



Collaborator:



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



Happy first day of Spring!

3/14 3/17 3/20

MYM Met

Dozens of fifth grade Mission to Mars teachers met at our facility on **20 February 2025** for the **Mars Mid-Year Meeting**, and, despite the name, it was anything *but* “mid!”

Mars teachers received a run-down of the procedures for this year's **Link-Up Day** event, the culminating event of the Mission to Mars, which will be held this year at the **Albuquerque Convention Center** on **Thursday, 24 April 2025**.



Teachers learned the basic flow of how the Link-Up Day event will go, including splitting their crew into Blue and Silver Teams that reunite later, sing Sagas, build Habitats,

Continued on page 2

...With Boughs of Holly, McFall-LaLa-LaLa...



Please welcome our newest STARBASE Assistant Instructor, Keilahna “LaLa” McFall. Her call sign comes from her love of music and performing in musical theater.

From Nevada, she recently moved to New Mexico to pursue a Bachelor of Science in UI/UX (User Interface/User Experience of an app or website) design. She loves STEM and working with kids, and was a camp counselor/instructor for a STEM-based summer camp.





Mission to Mars

For Fifth Graders

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

Link-Up Day:
Thursday, 24 April 2025



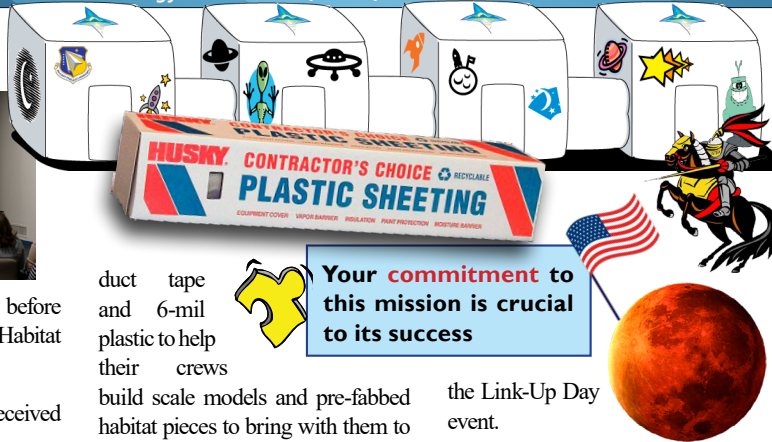
MYM Met

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and link them into a *colony*, before exploring the colony in a Habitat Walk: Knowledge Quest.

Following that, teachers received

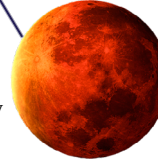


duct tape and 6-mil plastic to help their crews

build scale models and pre-fabbed habitat pieces to bring with them to

Your **commitment** to this mission is crucial to its success

the Link-Up Day event.



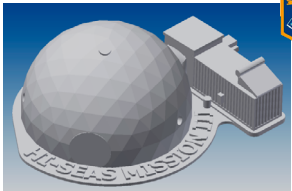
Zak is Back!



Zak Wilson, member of the real-world eight month 2014-15 NASA Mars habitat simulation called *Hawaii Space Exploration Analog and Simulation* (Hi-SEAS III), was guest speaker at our Mars Mid-Year Meeting.

His Mars simulation included experiments with 3D printing.

So, he designed a printable 3D model of his Hi-SEAS Mars Habitat, which you can download from his [blog](#) or from [Thingiverse](#).



Construction Instruction

With dedication, determination, and duct tape, student crews will construct habitats on Link-Up Day.

If the walls of the habitat don't line up perfectly, duct tape is the students' best friend. The crew tapes/joins the connecting tunnels on

both sides of the habitat together, except for the ones at either end of the neighborhood that have only one tunnel.



After Link-Up Day, Habitat Directors take completed habitats with them.

These can be reused/recycled when they "get back" to Earth.

Kahoot! Kontinues

The Mars Fact Challenge Kahoot! games are continuing. Challenge #5 runs from 17-28 March, and then it's on to the last one...Challenge #6!

See <https://aflnm.com/stem-missions/mission-to-mars/mars-kahoot-games/>.



Pre-Fab Prep

Pre-fab before Link-Up Day!

Teams, why rush to finish incomplete pre-fab on Link-Up Day?

Base Operations crews should attach the door panel and fan/connecting tunnels to the appropriate walls before Link-Up Day.



Students tape the **door panel** on the inside front wall of the habitat.

The **fan tunnel** goes in the middle of the back wall *near the ground, taped and flanged, and cut open*.

Attach the **connecting tunnel** to the habitat, *as close to the floor as possible*. Think *short and fat* tunnels.



TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Rocketry and Satellites Missions

Fire and Spectacle

Spring TECH Mission Day 2 makes a spectacular STEM satellite spectacle of itself!

See, satellites scanning space rely on sensitive STEM sensors to leverage certain special, specific aspects of the *electromagnetic spectrum*. Stupendous!

Visible light that our human eyes can see represents only a small portion of the full electromagnetic spectrum. For example, our eyes can't see infrared (heat) waves, but a *Forward-*

Looking InfraRed (FLIR) camera can...and a FLIR camera on a satellite can reveal information in outer space that visible light cannot!



TECH Mission Day 2 students see themselves through a FLIR camera the same way a satellite might.

Different elements have different *spectral signatures*, so, satellites,

and the scientists who work with them, also study objects on Earth and in space using *spectral analysis* to study the electromagnetic signatures they emit.

Day 2 students use a *spectrometer* to study the spectral signatures of gases, and record the patterns in their student logs.

Things get even hotter when students (carefully) take turns flame-testing various chemical elements, and identifying the element based on

the color of the flame. This activity is *fire!*

Students also explore light, lenses, color, and a *micro:bit microcontroller*...

...but that's a story for another day.



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

Beeps and PINGS

Sing

Sing a song

Make it simple

To last your whole life long

Don't worry that it's not good enough

For anyone else to hear

Just sing

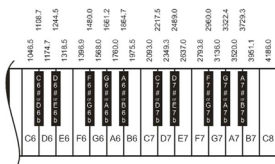
Sing a song

La-la-la-la-la

La-la-la-la-la-la

La-la-la-la-la-la-la...

What's the frequency, Kenneth? Did you know the cyber:bot the Robotics Challenge students



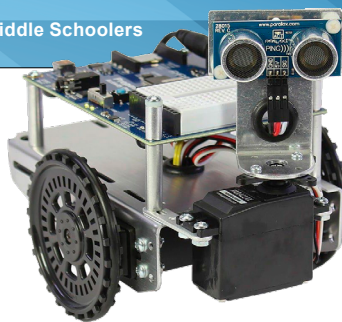
use has its own *piezospeaker*? Students can make it beep using a command like this:

```
bot(22).tone(3000, 1000)
```

Where the "3000" represents a particular tone, or *frequency*, and the "1000" represents the duration of time the speaker will beep.

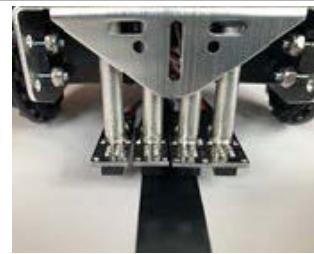


Deeper Dive: String enough beeps together and students can program a song!



How does a robot dressed as a bat get all my press? Students add sensors to their robot, such as the PING sensor pictured above, to use *echo-location*, much like a bat, to avoid obstacles.

Alternatively, they also attach a set of four "QTI" sensors. If the outer two QTI sensors detect *white*, and



the inner two detect *black*, it can act as a *line-following sensor*.

Knowing how to work the speakers and sensors on the robot should help students prepare for the Robotics Expo on 9 May 2025.

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



STEM Challenge For High Schoolers

In Summary

It's less than one month away! The STEM Challenge Symposium is **10 April 2025**, and rumor has it there may be a couple of interesting projectile motion challenges and an egg drop challenge.

Challenge #7:

Data Summary Slides

Now that STEM Challenge students have completed all the preliminary work, it's time for them to create **five slides** summarizing their data:

- Team Identity
- Building/testing the launching device

- Building/testing the payload protection device
- Launching Device Characterization
- Payload Protection Device Characterization



Making these slides should be excellent preparation for the Performance, Interview, and Quiz Bowl sections of the Symposium.

This is getting egg-citing!

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

Logo Drop

Here are some of the team logos the students have been dropping:



DoD STARBASE NM For Fifth Graders

Fizzical

Sir Issac Newton said that for every action, there's an equal and opposite reaction.

In DoD STARBASE NM, our fifth grade student engineers in Day 2, Physics, learn that STEM is the action, and learning is the reaction.

Day 2 students put Newton's "force equals mass times acceleration" second law to the test when they get *fizzical* with CO₂ dragster racecars.

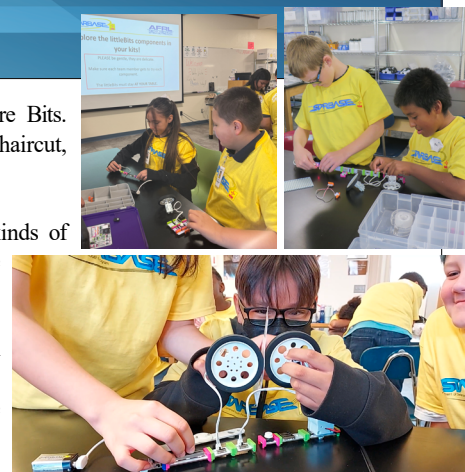


Students also run the STEM circuit by transferring a little bit of energy from a battery in a Power Bit component, into little littleBits® components like Input and Output Bits,

running current over Wire Bits. Beats getting a shave and a haircut, two bits.

The students invent all kinds of little gadgets with these things!

Imagine what he could have invented if Thomas Edison had had some littleBits to play with!



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AFRL NM STEM Academy
PO Box 9556
Albuquerque, NM 87119
(505) 846-8042

AFRL.RDOX.NMSTEMOutreach@us.af.mil

Website:

www.afrlnm.com/stem

YouTube Channel:

<https://www.youtube.com/channel/UC-QuOSd1XTkYuXPONZwIAHQ/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 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

Sciencey Stuff

Bee-havior

Did you know that bee behavior is electric?



As a bee flies through the air, friction rubs negatively charged electrons off its body, making the bee *positively* charged. When it lands on a flower to drink its nectar, the *negatively* charged pollen from the flower gets attracted and sticks to its body.

Then the bee flies to another flower and pollinates it!

World's Smallest Movie

Big blockbusters are fun, but have you ever heard of the world's *smallest* movie?



In 2013, IBM used a scanning tunneling microscope and some carbon monoxide molecules to make an *atom-sized* stop-motion movie called *A Boy and His Atom*.

It's literally listed in the Guinness Book of World Records as the world's smallest movie.

But the most *impressive* part is trying to eat the atom-sized bucket of popcorn!



Beam Me Up, Scotty

It's somewhat reminiscent of the way people beam down to planets in *Star Trek*!



Scientists at Northwestern University recently did what no one thought was possible. They demonstrated *quantum teleportation* of a photon state... through 30 kilometers of ordinary fiber optic cable, alongside high-speed internet traffic!

This might pave the way for developments like quantum computers, internet, encryption, and sensors.

STEM All Around



The City of Albuquerque has some educational STEM activities coming up soon. There's a Spherobot activity at the Albuquerque Main Library on 29 March 2025; registration required.

Also, the STEM/STEAM Club is having a Do-It-Yourself Barometers Day at the Lomas/Tramway Library on 3 April 2025.



Meanwhile, STEM Santa Fe is hosting a Julia Robinson Mathematics Festival

on 5 April 2025 at the Santa Fe Teen Center. Free, fun, hands-on math puzzles and games for kids of all ages, and free snacks will be provided!



STEMYS Nominations Open



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.



Space News

- Oldest living astronaut Jim Lovell (Tom Hanks in *Apollo 13*) turns 97 on 25 March 2025.



- In February 2024, Intuitive Machines landed its Odysseus lander on the moon, the first-ever private moon landing. On 2 March 2025,



Firefly Aerospace's Blue Ghost moon lander became the *second-ever* private spacecraft to soft-land on the moon. See www.space.com.

The NASA Vehicle Assembly Building in Florida has its own indoor weather system.



At 526 feet, it is the tallest single-story building in the world. The building interior volume is so massive that rain clouds form below the ceiling on humid days.

Coming Next Issue...

LUD things to know/bring, STARBASE Days 3 and 4, Symposium Symposed, Expo in May

