

AFRL

NEW MEXICO STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

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The Rocket Report



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Creating the Future

February is fantastic for creating the future!



The *National Museum of Nuclear Science & History*

(www.nuclearmuseum.org) creates the future by honoring the Atomic Age of the past and present.



Their **Discover STEAM Week**, 13-17 February 2023, is an annual celebration of all things STEAM—science, technology, engineering, art, and math. During STEAM week, the museum hosts accepted student groups in grades 1-8 (sorry, this year's groups are already selected) for hands-on STEAM activities.

directed by local engineers, physicists, and technicians from organizations such as the local Tuskegee Airmen Chapter and the University of New Mexico.

Admission can be purchased in advance [online](#) (regular, daily admissions apply) or at the door on the day of the event.

But still open is their **Discover STEAM Day**, Saturday, 18 February 2023, 10 am to 3 pm.

The very next week, the future is created all over again. [Creating the Future](#) is the theme of this year's **DiscoverE Engineer's Week**, 19-25 February 2023; a week to celebrate how engineers make a difference in our world.

At Discover STEAM Day, students and families explore hands-on STEAM activities

In partnership with:



Collaborator:



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



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

This year, **Girl Day** happens to fall on 23 February 2023...

...which also happens to be *one* of the days in which *we* help Create the Future! That's the day we're holding our **Mid-Year Meeting** for Mission to Mars teachers.

The future's what you make it...and with STEM (or STEAM), the future's so bright, we've got to wear shades!



I Love STEM!



Dynamic Static Back-to-Back

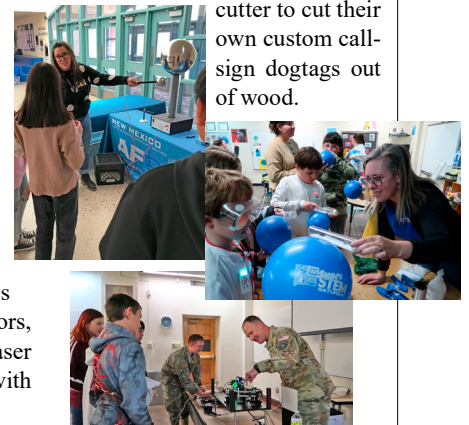
Our STEM Outreach Specialists aren't *static* at all...Just last Wednesday, 18 January 2023, they went to a Career Cafe event at Eagle Ridge Middle School. They talked about STEM careers and demonstrated static electricity activities with students.

The very next day, they went to a STEM night event at Rio Rancho Elementary School, and demonstrated even MORE static electricity activities with students!

The next day after *that*, they *dynamically* hosted Magdalena's Teen Science Cafe students at our facility, and were laser-focused on STEM activities!

AFRL laser experts demonstrated using adaptive optics to stabilize laser light. Students solved laser mazes using carefully-placed mirrors, tested their ability to keep a laser on a rotating target, drew with

lasers on light-sensitive paper, transmitted sound over light to a remote receiver, and used a laser cutter to cut their own custom call-sign dogtags out of wood.





Mission to Mars

For Fifth Graders

Mars Exploration and Transmission Laser (METL) Mission 2022-2023

Food is Good News



The good news? You can now call up meal/meal kit delivery services such as *Hello Fresh*, *DoorDash*, *GrubHub*, and *Uber Eats*, and get pre-proportioned, nutritious meal ingredients and recipes, or complete ready-made meals, delivered right to your door!

The bad news: Ask *any* of them to deliver to your habitat

on Mars, and they'll all tell you the same thing:

Sorry, that destination is outside our delivery service area.

The good news: Our Mission to Mars student crews use teamwork, problem-solving, and *math* to make like their *own* little Martian Hello Fresh/DoorDash service, making and delivering their *own* Link-Up

Day lunch, complete with *mass and volume 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 bring the same lunch as the students.

Free Perciversary STEAM Day Event



In honor of the Mars *Perseverance* rover's 2nd anniversary of landing on Mars, the [New Mexico Museum of Natural History & Science](#) is inviting interested parties to celebrate STEAM Day with them at a "[NM Field Geologist Goes to Mars](#)" event, featuring Dr. Larry Crumpler, a local member of Percy's Mission Science Team, **Saturday, 18 February 2023, 6:30-8 pm**.

Free admission, donations encouraged, but [pre-registration](#) is required, as seats are limited.

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.

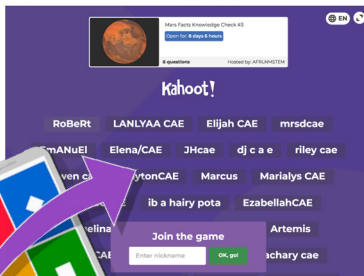
They don't have to be fancy; matching T-shirts and jeans will do. Mission patches, headgear, and other accessories are optional (see pp. **77-78** in the Teacher's Resource Guide).

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

- School, Student, and Teacher Name;
- Colony Habitat Number (the habitat each crew is responsible for building).

Kahoot! Kontinues

The Mars Fact Challenge Kahoot! games are continuing. Challenge #3 will be up 14-28 February 2023, and then it's on to Challenge #4!



See <https://afrlnm.com/stem/2023-mars-metl-mission/>.

Mark Your Mobile

Mark Your Mobile, specifically the calendar app in it, for the mandatory Mid-Year Meeting coming up on 23 February 2023, 12:30-3:30 pm. Make your arrangements now!



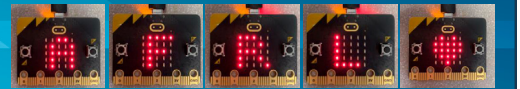
Your commitment to this mission is crucial to its success



TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Rocketry and Satellites Missions



Satellite Stuff

The TECH Mission Spring semester has started, and the classes all orbit around one thing: Satellites!

Once upon a time, Earth only had *one* satellite, and it was made with all-natural ingredients: *The moon*.

Then, one day in 1957, we sent up *Sputnik*, a man-made silvery basketball with four creepy-long antennas... and suddenly, man-made satellites were a *thing*, and the Great Space Race was *on*.

These days, there are *thousands* of man-made satellites orbiting Earth, providing everything from GPS and

television signals to weather information and internet. The James Webb Space Telescope is a big satellite; so is the International Space Station.

And that number is growing rapidly... largely thanks to SpaceX and their laser-connected *Starlink* satellites, which provide internet services even to remote areas like Antarctica. They already have a "constellation" of at least 3,875 so far...and they hope to get up to around 30,000...and put a similar "constellation" around *Mars*.

AFRL knows all about satellites, because they have a whole Directorate on Kirtland Air Force Base working on satellites and satellite technology, such as their *Roll-Out Satellite Array*

(ROSA), a flexible, roll-up solar panel for satellites. They invented a "Plug-and-Play" configurable satellite construction system to make building custom satellites almost as easy as stacking Legos together.

TECH Mission Day 1 students explore various aspects of artificial satellites, starting with making their own paper "HexSats." Elon Musk, eat your heart out!

Every man-made satellite has various electronic components, like cameras, sensors, and antennas, which require

electrical *power*, flowing in *circuits*. TECH Mission Day 1 students explore making their own electrical circuits using *snap circuit boards*.

Students take a "byte" of binary code by exploring the language of 1s and 0s that computers and satellites speak.

They also try a "bit" of Python programming to control a *micro:bit microcontroller*, much like the microchips on satellites.

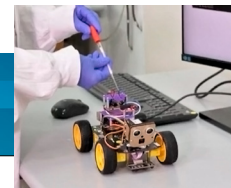


By the Tuesday of the week before the first class in the series, session, or semester, we will ask you for the name, driver's license number/state of issue, date of birth, and the FULL Social Security Number, of every adult coming through the base gate for that series of classes.



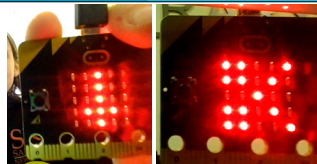


Robotics Challenge For Middle Schoolers



I, 2, 3, T-1000

Robotics Challenge **Module 1, Intro to Programming**, closed on **27 January 2023**, so look for even more Python Turtle mosaics to be posted to our website [Turtle Mosaic Gallery!](#) Some of them are pretty fancy!



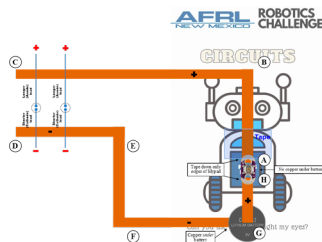
Module 2, Using the micro:bit, wraps up on 17 February 2023, and boy, have our students been getting the hang of programming a micro:bit microcontroller! They've mastered making flashing and scrolling images, and using the micro:bit's input buttons

and sensors to play micro-sized video games!

Now, students are moving on from microcontrollers and rolling into **Module 3. Building and Controlling Robots!** Well, on paper, at least.

Once students complete Module 2, we send them the kits they need to build their own working, rolling robots, called Cyber:bots, which use a micro:bit microcontroller for a brain!

Their robots will be connected to the microbit using electronic circuits, so their first Module 3 challenge is no



paper tiger. They have to design an electronic circuit, using flat copper tape for the wires!

Fortunately, the robots the students build will be much less creepy than the real-life version (as reported in the scientific journal [Matter](#)) of the liquid metal Terminator T-1000-like robot that can "melt" through iron bars and solidify again. Or the [robot](#) that uses a combination of artificial intelligence and antenna from an *actual desert locust* to detect smells.

Questions? Suggestions? Don't melt into a puddle of liquid metal! Contact lynn@afri.newmexico.com!



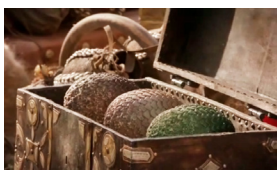
STEM Challenge For High Schoolers

Int-egg-ration

Suggested Timeline: Feb-Mar

This is the leg of the STEM Challenge mission where catapults get their sea legs—when high school teams int-egg-rate (combine) and test their payload protection and launching devices.

Teams place a 3' target 30' away from the launching device, select a launch configuration (arm stop setting, tension setting, arm length, number of rubber bands, etc.), and launch a



raw hen's egg multiple times and record/analyze the results.

Actually, with the price of hen's eggs lately, maybe we should just have students integrate some dragon eggs from *Game of Thrones*. Much cheaper, and the scales would probably help protect them from breaking.

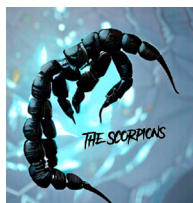
Logos!



Team 03— Wild Donkey



Team 09— The Grapes



Team 10— The Scorpions



Team 11— WunderWaffe



DoD STARBASE NM For Fifth Graders

STEM is the Engine

STEM is the engine in DoD STARBASE NM Day 1, when students explore being *engineers* for a day.

For example, STEM matters when they explore mass, the amount of matter in an object. Mass can be measured in *grams*, using a *Triple Beam Balance*. Students use the Triple Beam Balance to mass different cubes, representing different metals, to determine the composition of each cube.

Knowing how to determine the mass of objects comes in handy

when the students design a restraint system to save Eggbert the Space Shuttle Pilot as he crashes on the "moon." There's a high price on his egg-head, and he knows it!

The students, just like real-world engineers, have certain parameters to follow. They can choose from a variety of different materials to build their restraint system, but each has a price tag and a certain mass.

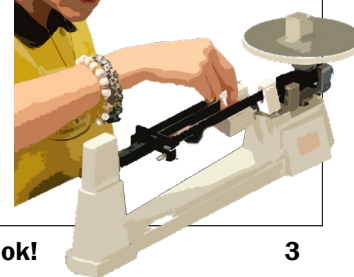
Student teams are allowed a budget of so many "dollars" to build with, and the mass of the device and the lancer cannot exceed so many grams.



They also explore 3D CAD software PTC *Onshape* to help a character named Bunsen search a computer aviation model for hidden objects in a virtual *scavenger hunt*.



It's hard to mass the pixels, though!



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

AFRL.RDMX.NMSTEMOutreach@us.af.mil

Website:

www.afrlnm.com/stem

YouTube Channel:

<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

KAFB: Kirtland Air Force Base, Albuquerque, NM

METL: Mars Exploration and Transmission Laser Mission 2022-2023

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 Modification forms in!



2.0 is Counting Down

The countdown is on! Less than two months until The American Rocketry Challenge's qualification flight scores are due, and the STARBASE 2.0/3.0 students are counting down the *days* as fast as their *rocket launches!*

Albuquerque Institute of Math and Science and Albuquerque School

of Excellence middle schools, and Del Norte high school, are working hard to prepare and practice to qualify, with rocket names like *Worcestershire*, *Easter Egg Delivery System*, and *Friend Zone*. Some teams are already trying qualifying launches!

5...4...3...2...



STEM Bytes

Gabe Carothers, Future Created

In honor of Black History Month, KOAT-TV7 is running a great story on our friend and mentor, Gabe Carothers. Did you know? At 17, he's the youngest pilot in New Mexico, and the youngest African American pilot in New Mexico HISTORY.

By age 8, he was taking the controls of an airplane in flight during



an "Experimental Aircraft Association Young Eagles" event. At 14, he designed and built his own flight simulator.

And, of course, he's been helping us at events like the Tuskegee Airmen, Inc. Aviation Camp, held in our facility every summer, for years.

He likes to inspire other students, too. "Leaving a trail behind, leaving a path for other kids to follow, really lightens up my heart...They can do something like this at my age and for practically no money—just come to school and learn."

Gabe Carothers: Future created.



Read the full article or watch the video on the KOAT website here:

<https://www.koat.com/article/black-history-month-gabriel-carothers/42768917>.

World in 80, Mars in 45

In Jules Verne's 1872 book, Phileas Fogg went around the world in only 80 days. As it stands now, a trip to Mars takes about six months.

But NASA is working on a new idea, a bimodal "Nuclear Thermal and Nuclear Electric Propulsion" system

that could reach Mars in only 45 days!

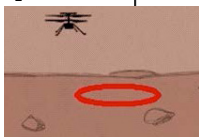
They're also working on another idea, a *rotating detonation rocket engine*, which would use less fuel and also get us there faster.

See www.space.com.

Code 'Copter

Celebrate the Mars *Ingenuity* helicopter's 2nd birthday by coding one of your own!

See <https://www.jpl.nasa.gov/> to learn how.



STEM Scholarship



The Future STEM Leaders Scholarship program will provide a **\$5,000 scholarship** to a selected Albuquerque high school junior/senior (juniors preferred) interested in pursuing a STEM degree.

See <https://aerospace.org/> for more info. Apply by **21 April, 2023**.



Science Olympiad



New Mexico Tech will be hosting the 23 STEM events of the **New Mexico State Science Olympiad** on **Saturday, 25 February 2023**.

They're still looking for some Event Supervisors and volunteers to help them.

See <https://www.nmt.edu/stem/olympiad/index.php>.

Coming Next Issue...

- Habitat Construction and Neighbors
- DoD STARBASE NM Day 2
- STEM Challenge Final Report, and *Interviews!*

Watch for it!

