AFRL
NEW MEXICO
STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

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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!


## STEM is STEAMing Forward

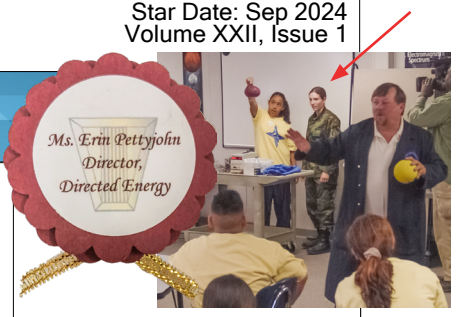
### Classes Starting Up

Another school year has started! Classes are in session, the STEM is STEAMing forward, and teachers and mentors are getting oriented.

Fresh off their 30th anniversary, Mission to Mars is getting ready to launch; Teacher Training is on the horizon, and the updated registration form and this year's Mars Mission and Graphic are up on the website.

Following their 20th anniversary year, DoD STARBASE NM is STEAMing ahead; they're bringing fifth grade schools in for 5 days of STEM curriculum.

STARBASE Advanced schools are working on rocket designs as they prepare for this year's American Rocketry Challenge. TECH Mission students are busy building their four-foot rockets, which they will launch next month.




### DE Director Familiar

AFRL Directed Energy Directorate's new Director, Ms. Erin Pettyjohn, looks very familiar; we think we've seen her somewhere before. Congratulations, Ms. Pettyjohn!

Our other programs, too, are also steaming ahead, preparing for another year of STEM!

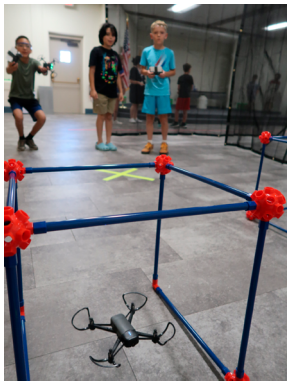
## What We Did This Summer

STEM doesn't take the summer off around here!

### DoD STARBASE NM Summer STEM Camps

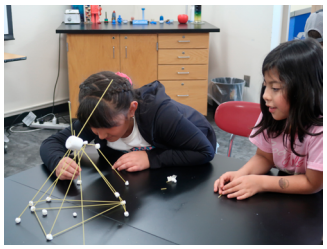
We held *three* separate weeks of STARBASE Summer STEM Camp in June 2024!

Rising 5th-6th grade students made molecular models, tried to drop eggs without breaking them, tried to catapult marshmallows without breaking them (which was easier to do), programmed Ozobots, flew drones through obstacle courses, and much more!



### Summer STEM Space Camp

There were two separate weeks of Space Camp, for rising 3rd-4th graders, from 3-13 June 2024. Students did everything from making alien slime and spaghetti and marshmallow communications towers to sampling astronaut food and cryogenically frozen popcorn!



### SB Advanced Camp

Rising 7th to 9th grade STARBASE Advanced Camp students explored Onshape CAD software and built and coded LEGO® robots.

### TAI Aviation Camp

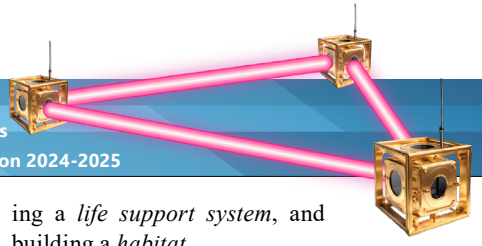
The five-day Tuskegee Airmen, Inc. Summer Youth Aviation Camp, 3-7 June 2024, which we support, taught students enough about aviation to fly Civil Air Patrol (CAP) Cessnas with a CAP copilot.

### Other Events

See p. 4 for more summer fun, such as the Career STREAM presentations, and the booth we had at the AFRL Picnic!

# Mission to Mars For Fifth Graders

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




## Mission to Mars News

Here's the latest on our Mission to Mars program: The Teacher's Resource Guide and Student Mission Journals have been updated, and Teacher Training sessions for new and returning teachers are coming soon!

### New Teachers

New Mission to Mars teachers sometimes look like a deer in alien headlights. There's just so much information to learn!

But don't worry, there's a full-day (9:00 am to 4:00 pm) ***in-person*** training for new teachers on **Friday, 4 October 2024.**

We'll give you instructions and tips on completing Mission to Mars with your students, and how to prepare for the big Link-Up Day event at the end of the school year.

You'll get hands-on experience designing a *mission patch*, making a *life support system*, and building a *habitat*.

This will make it easier for you to explain these processes to your students. You'll also receive copies of the updated Mission to Mars Teacher's Resource Guide and Student Journal.

The activities all align with Common Core, NGSS, and national standards, so don't worry, teachers, it will fit right in with your existing curriculum.

### Returning Teachers

Returning teachers, *welcome back*! There's shorter ***online*** refresher training courses on **19 September** (5 pm), **24 September** (4:30 pm), or **30 September** (4 pm)...but, don't worry—you only have to come to *one* of them!

Contact amanda@afrlnewmexico.com for more info.

## Mars Missions News

Meanwhile, in the world of "real-world" Mars Missions, simulations, and preparations:

The *Perserverance* rover is finally leaving Jezero Crater, where it's been since it landed in 2021, to go exploring the rest of Mars.

NASA is currently considering a future mission to *terraform* Mars (make the environment more Earth-like and habitable) using an *Ingenuity*-like helicopter to scatter iron and aluminum "glitter" particles into the Martian atmosphere to create a "greenhouse" effect.

NASA is running a series of four-man 45-day Mars simulations called Human Exploration Research Analog (HERA). One concluded on 18 March 2024, one on 24 June, one wraps up this month on 23 September, and one concludes on 20 December 2024.

Another Mars simulation, Crew Health And Performance Exploration Analog (CHAPEA), finished its first, 378-day, simulation on 6 July 2024. A second CHAPEA simulation is scheduled for Spring 2025, and a third one in 2026.

One year from now, in September 2025, NASA hopes to send the first manned *Artemis* mission to the moon, leading to potential manned missions to Mars by 2040 or so.

Elon Musk thinks his SpaceX company can beat that; he recently announced he plans to send unmanned missions to Mars within two years, and manned missions within four, by 2028.

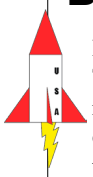
Of course, these plans and timelines can change and slip; in 1948, Wernher von Braun wrote out a plan for a manned mission to Mars by 1985! *That* didn't happen. In 1987, first female astronaut Sally Ride wrote a report saying NASA could send manned missions to Mars by 2005. *That* didn't happen, either. But we're definitely getting closer! See www.nasa.gov.

- In any mission to space, good teamwork is essential for survival
- Each student impacts the crew; the crew impacts many crews from other schools
- Your commitment to this mission is crucial to its success

# TECH Mission For Middle Schoolers

Technology and Engineering Challenges—Rocketry and Satellites Missions

## Build and Go Seek



Ladies and gentlemen, the TECH Mission Rocketry semester is blasting off! Over the course of three non-consecutive curriculum days, TECH Mission middle school students are exposed to basic concepts in *rocketry* and *aerospace engineering*:

- Designing and predicting how rocket parts will work together
- Building and launching a rocket
- Collecting and analyzing rocket flight data.

On Day 1, starting this month, TECH Mission students learn about basic rocketry components

as they build four foot long rockets.

Students assemble the *booster tube, payload,* and *motor mount* sections, including parts such as *centering rings*, *fins*, a *shock cord*, a *long coupler*, and a *nose cone.*

Students choose a rocket name from options such as *Gemini*, *Atlas*, *Phoenix*, and *Apollo.*

They also simulate its flight with a software program called *RockSim.*

Day 1 students also practice their global positioning satellite (GPS) rocket tracking skills, too.

On Day 2, weather permitting, scheduled for **22 October 2024**, students will finish rocket assembly, attaching a motor and a parachute, and launch the rockets from a remote field on the outskirts of Rio Rancho, NM.

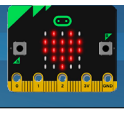
On Day 3, they'll analyze the launch data they collected on Day 2 and compare it to their computer simulation.

**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

canvas



## The Robots are Coming

Besides drones and self-driving cars, website therobotreport.com shared (in August 2024) that humanoid robots are increasingly popular, including some new humanoid BMW auto manufacuring robots and Boston Dynamic's pushup-performing Atlas robot.

The International Federation of Robotics (www.IFR.org) recently predicted there will be in excess of 600,000 industrial robots in 2024 alone, and growing!

That's a lot of robots out there, and so a lot of *jobs* need filling involving robotics, coding, and AI (artificial intelligence). Students need to start studying these things! That's where the *Robotics Challenge* mission comes in (the Coach registration form is on our website).

Students explore the basics of systems engineering, computer science, and robotics by assembling and programming small robots to complete tasks. Students submit work for each challenge to the Robotics Challenge Canvas website. They must *complete* one module before moving on to the next one.

- **Mission Module 1**: *Intro to Programming and Microcontrollers* explores Python programming using a micro:bit.
- **Mission Module 2**: *Building a Robot* has students assemble a cyber:bot with a micro:bit for a brain.
- **Mission Module 3**: *Programming a Robot* gets students learning to code the robot's movements.
- **Mission Module 4**: *Expo Readiness* gives students a chance to practice specific coding skills they might find useful at the Robotics Expo.
- There's also a **"Deeper Dives" Module,** with additional challenges teams can work on for extra points.

This mission culminates in a **Robotics Expo event** in which the top 30 qualifying student teams demonstrate what they have learned through robot performance, team creativity, and a Quiz Bowl game.

**New this year:** Updated modules, quizzes, and Challenges; a Coach's Guide to help with troubleshooting; and reorganizing the program to get to the "robots" part sooner!

Contact caitlin.everhart@afrlnew-mexico.com for more info.

# STEM Challenge

For High Schoolers

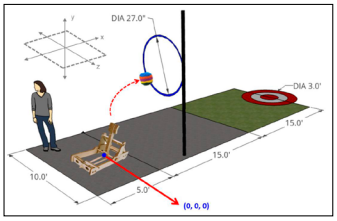
## Let's Hatch a Plan

An *egg-gineer* applies scientific knowledge, mathematics, and egg-ginuity to develop solutions to technical, social, and egg-onomic problems.

The *Egg-gineering Design Process* provides steps that assist an egg-gineer in clearly understanding a problem and developing a solution to *crack* that problem.

The STEM Challenge Mission plan we've hatched introduces students to egg-gineering by having teams of 3-4 high school students 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.


There are *seven* distinct STEM Challenge 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.*

When students finish challenges, they'll post the results on the STEM Challenge Canvas website. Start your egg timers!

canvas

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

# DoD STARBASE NM

For Fifth Graders

## To the Moon

On Day 1, Engineering, of DoD STARBASE NM, "STEAM" stands for Students Taking Eggbert the Astronaut to the Moon.

Using the Engineering Design Process, and their own noodles, students steam ahead like real space contractors and design and build a safety restraint system to protect brave shuttle pilot Eggbert as he crash-lands on the moon.


They have a working "budget," and like real engineers, they have to work out how much all the design components cost...and graph the results.

"On time and under budget," while still being functional.

For the return trip home, students use mathematical area formulas to determine Eggbert's optimal landing dock shape, a *rectangle* or an *octagon.*

Aboard the Onshape 3D CAD starship Zirconium, students help Bunsen the robot find a bunch of misplaced objects in a virtual scavenger hunt.

So, if you misplace an octopus, is that an octo-gone?

onshape®


**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.**

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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 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)

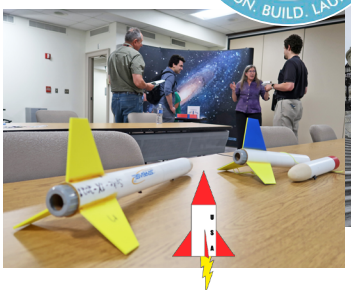
## Advancing Again

**STARBASE Advanced NM,** for middle/high school students, is underway!

Students from Albuquerque Institute of Mathematics and Science (AIMS), Albuquerque School of Excellence (ASE), and Del Norte High School are participating.

Teams of students, working with STEM mentors, are already building model rockets in preparation for entering the American Rocketry Challenge (ARC) https://rocketcontest.org/.

We had a team go all the way to Nationals last year; can we make it a double-header?



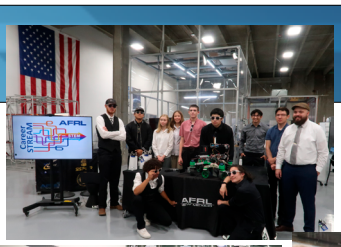
# STEM Bytes

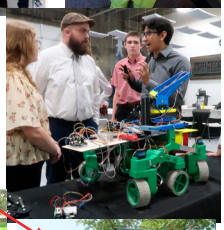
## Summertime

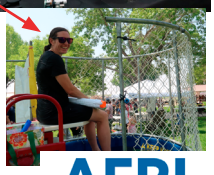
July 2024 was pretty HOT for STEM! **Career STREAM** teams gave their final robotic lunar rover invention presentations, and discussed the CAD, data science, and computing skills they learned, at the New Space NM facility.

We also had a booth at the **AFRL Picnic**. Visitors played with musical boomwhackers, built LED badges, explored an interactive liquid nitrogen demonstration, and more!

We even got to see Directed Energy Director Erin Pettyjohn get dunked in a water tank! I swear we've seen her somewhere before...







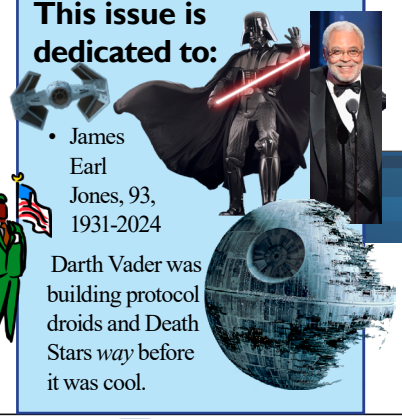
# Grants Overview

Grants and grant resources you might want to look into for *your* school:

- AFA: The Air and Space Forces Association aerospace educator $599 STEM grant applications are open now through 15 December 2024. Also has Civil Air Patrol and JROTC Aerospace grants.
- AIAA: The American Institute of Aeronautics and Astronautics offers up to $500 grants for STEM Aerospace. Application window *closes* 30 September 2024.
- APS: Albuquerque Public Schools Education Foundation offers $500-$5000 STEM grants between 3 September and 25 October each year.
- Target: Local Target stores offer up to $500 for schools each February to December, through what they are now calling a "Giftcard donation program."
- Toshiba: Toshiba America Foundation offers up to $1000 STEM grants for grades K-5. Application window *closes* 1 October 2024. Also, *ongoing* 6-12th grade STEM grants of $5,000 or more throughout the year.
- See www.stemgrants.com for a list of *other* possible K-12 grants; but be advised, the information seems to be current only through 2022.

## This issue is dedicated to:

- James Earl Jones, 93, 1931-2024



Darth Vader was building protocol droids and Death Stars *way* before it was cool.

# Opportunities

AFRL SCHOLARS PROGRAM

- AFRL Scholars Summer 2025 paid high school internship applications are open 10 October 2024 to 10 January 2025. Email AFRL-Scholars@usra.edu.
- Registration is open *now* for STEM Santa Fe's STEM Pathway for Girls (5th-8th grade) 2024 Conference on 19 October 2024.
- Solve real-world Earth/Space problems! Registration now open for two-day NASA Int'l Space Apps Challenge "hackathon," 5-6 October 2024, at Q Station. Contact Raven at admin-founder@scope-nm.org.

## Coming Next Issue...

- State Fair STEM booth report
- A great Mars Misssion
- Rocket Launch Prep