

# AFRL

## NEW MEXICO STEM OUTREACH

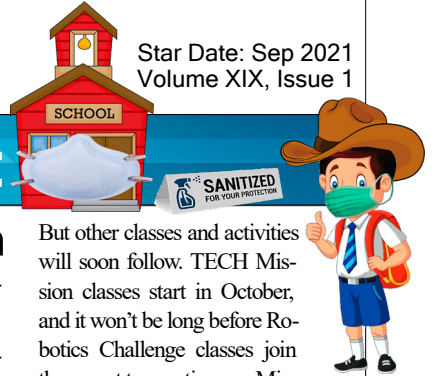
Inspiring Future Scientists  
and Engineers

## AFRL NM STEM ACADEMY

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Volume XIX, Issue 1



# 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!



Sure feels good to be



## Back In the Classroom Again

*Back in the classroom again  
Out where the STEM is our friend  
Where the Eggbert pilots land  
Launching rockets in the sand  
We're back in the saddle again!*

That's right, cowboys and cowgirls, a new school year is starting, AFRL NM STEM Academy has returned to the classroom—and so have our *students*—and *that's* something even Gene Autry would want to sing about!

Precautions are in place, of course... everyone's masked up, there's air

purifiers, sanitizers, social distancing, cohorting, and so forth...

...But we're just so excited to actually have the pitter-patter of student feet walking down our hallways, as opposed to just looking at everyone over a flat Zoom screen, that we may just have to *yodel!* Ahl-dee-oh-lay-eee-hee...

DoD STARBASE NM classes are leading the pack, as are the STARBASE 2.0 classes already getting ready for their rocketry challenge...

But other classes and activities will soon follow. TECH Mission classes start in October, and it won't be long before Robotics Challenge classes join them...not to mention our Mission to Mars and STEM Challenge missions. It's a STEM rodeo, partner!

### STARBASE Hiring!

We're *so* back in the classroom, we're hiring for *another* DoD STARBASE NM Educator! To find out how to apply, contact our own Ms. Esti Gutierrez at [esti@afrlnewmexico.com!](mailto:esti@afrlnewmexico.com)

## Summer STEM Camps

It just wouldn't be summer without a smattering of Summer STEM Camps, and we had them in spades!

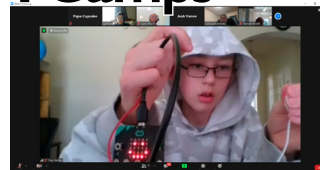
### DoD STARBASE NM Summer STEM Camp



From 14-18 June 2021, we conducted an in-person DoD STARBASE NM Summer STEM Camp for rising 5th and 6th graders. Students flew crash-landing Eggbert moon shuttles, raced CO<sub>2</sub> cars that really *zoomed* down the track, programmed some round rolling robots, and other activities.

### Mid-High Robotics Camp

From 14-18 June 2021, we also conducted a virtual Mid-High



Robotics Camp. Students used the Python language to program micro:bits and Maqueen robots to display happy and sad faces, use sensors to follow lines, change light colors, and other activities.

### Summer STEM Space Camp

Rising 3rd-4th grade students went on an in-person Summer STEM Space Camp from 21-25 June 2021, and the STEM was out of this world! Among other things, students made Constellation Tubes, modeled the distance from



the Earth to the Moon, made the Phases of the Moon using Oreo Cookies, and even underwent a rigorous Astronaut Training Course. Suddenly, outer space doesn't seem so far away!

### TAI Aviation Camp

From 21-25 June 2021, we hosted the annual Tuskegee Airmen Inc. (TAI) Youth Aviation Camp. Participating students learned about the history of the Tuskegee Airmen; explored STEM concepts related to flight; and flew, with an instructor, in actual Civil Air Patrol Cessna airplanes.



### Scavenging, STREAMing, and Stuff

See page 4 for a report on our other summer STEM activities; namely, Super STEM Saturday—Scavenger Hunt Edition, and Career STREAM presentations.



## Virtual Virtues, Multiple Manuals

### Retaining the Virtues of a Virtual Year

Scrambling to convert education, STEM, and the Mission to Mars over to a remote, virtual format for the pandemic was challenging for *everyone*—but not without its virtues. We were forced to rethink and innovate how we approached the entire simulated journey to Mars.

Some of those innovations turned out to be quite popular.

For example, we moved many activities onto our Mission to Mars [website](http://www.afrlnm.com/stem/missions/mission-to-mars) at [www.afrlnm.com/stem/missions/mission-to-mars](http://www.afrlnm.com/stem/missions/mission-to-mars). Students input responses, such as sketch-



ing a Mission Patch, in their **Student Mission Journal**.

Response to these innovations was positive, so we will continue using them this school year.

### Manual Overhaul

We are revising our **Teacher Resource Guide** this year; making it more generic year-to-year involving Base Operations, and pulling out the Link-Up

Day part into its own separate **Link-Up Day Guide** which will be distributed at the Mid-Year Meeting in February.

### New Teachers

For teachers new to the Mission to Mars, there's an *in-person* training for new teachers at our facility on **Tuesday, 9 November 2021**.

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

You'll get hands-on experience doing some of the activities you'll be completing with your

students. You'll also receive an updated copy of the Mission to Mars Teacher Resource Guide manual.

### Returning Teachers

Returning teachers, *welcome back!* There's a virtual "refresher course" scheduled for **Tuesday, 19 October 2021**.

### Register Online

To register for the Mission to Mars this year, go to the [www.afrlnm.com/stem/missions/mission-to-mars](http://www.afrlnm.com/stem/missions/mission-to-mars) page, and click the Registration button near the bottom.

This takes you to an online Registration form to fill out.



## NASA's For Real

If our own AFRL NM STEM Academy Mission to Mars isn't enough for you, NASA's got their own *real-world* simulation called CHAPEA ([www.nasa.gov/chapea](http://www.nasa.gov/chapea)).

It stands for *Crew Health And Performance Exploration Analog*. Starting Fall 2022, it's a series of "analog missions that will simu-




late year-long stays on the surface of Mars. Each mission will consist of four crew members living in *Mars Dune Alpha*, an isolated 1,700 square foot habitat.

During the mission, the crew will conduct simulated spacewalks, and provide data on a variety of factors which may include physical and behavioral health, and performance.

The 3D printed habitat will include private crew quarters, a kitchen, and dedicated areas for medical, recreation, fitness, work, and crop growth activities, as well as a technical work area and two bathrooms."



- 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



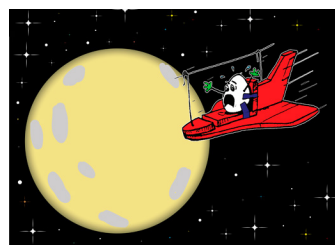
By the Tuesday of the week before the first class in the series, session, or semester, we will ask you for the name, driver's license number/state of issue, date of birth, and the FULL Social Security Number, of every adult coming through the base gate for that series of classes.

## Eggbert Alert

DoD STARBASE NM is back, and the pitter-patter of little feet are in our hallways again! We can hardly mask our excitement! Woo-hoo!!

But those little feet don't *all* belong to the fifth grade DoD STARBASE students. No, no. In Day 1—Engineering, *some* of those little feet belong to a very brave egghead of a shuttle pilot named *Eggbert*, heading to his *space shuttle*.

He intends to crash-land on the moon, and the students are scrambling to make sure he doesn't get scrambled in the process!



Students have to engineer a payload protection device—a pressurized spacesuit—for Eggbert, using the Engineering Design Process.

*Grandmas* are not required when students determine the identity of metal samples by measuring the amount of matter in *grams*. Students also use *Onshape* CAD software to scavenge up some STEM!

## Now with 2.0 Schools!

STARBASE 2.0 is building back better with *2.0 times* the number of participating schools!

This year, STARBASE 2.0 students from Albuquerque Institute for Mathematics and Science (AIMS) and Albuquerque School of Excellence (ASE) are *both* building and launching model rockets in preparation for this year's *The American Rocketry Challenge* (TARC)!

TARC is "the world's largest model rocketry competition," with nearly 5,000 students competing nationwide each year.



This year's challenge: Build a model rocket that carries two large hen eggs (mounted sideways) to an altitude of exactly 835 feet, stays airborne for between 41 and 44 seconds, and returns the rocket to the ground *safely—eggs intact*.

They may want to consult with the DoD STARBASE NM students for some pressurized spacesuit tips!



# TECH Mission

For Middle Schoolers

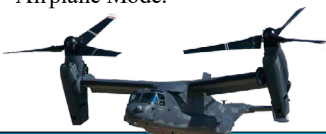
Technology and Engineering Challenges—Rocketry and Satellites Missions

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.

## Rocketry Returns

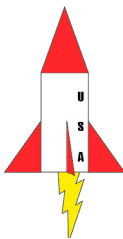
Kirtland Air Force Base trains student pilots how to fly a specialized airplane called a *V-22 Osprey*. It's an aviation technology that has two modes: *Helicopter* and *Airplane*.

It takes off vertically, like a helicopter. Then, using its tilt-rotors, the dual propellers rotate forward 90 degrees...shifting it into "Airplane Mode."



After a "virtual" year with just a *single* mode, the TECH Mission is once again another kind of TECH with *two* modes: One for each semester.

In Fall semester, for three curriculum days, it's in "Rocketry Mode." In the Spring semester, it brings on a *new* batch of middle school classes, and shifts for three more curriculum days into "Satellite Technology Mode."



Right now, it's in *Rocketry Mode*. Over three non-consecutive curriculum days, TECH Mission middle school students explore rocketry by building, launching, and analyzing the data from rockets.

In Day 1 (classes start in October 2021), TECH students study basic rocketry principles such as *lift* and *thrust*, and begin building four foot long rockets.

Students assemble the *booster tube*, *payload*, and *motor mount* sections, and 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 explore global positioning satellite (GPS) rocket tracking, and build *straw* rockets, too.

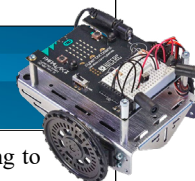
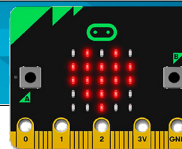
On Day 2, currently scheduled for 26 October 2021, weather permitting, students will finish rocket assembly, attaching a motor and a parachute, and launch the rockets from a remote field on the outskirts of Rio Rancho, NM.

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



## Robotics Challenge

For Middle Schoolers



### Why Study Robotics?

"Warning, Dr. Smith! Warning! Warning!" This is what "The Robot" would say on the TV show *Lost In Space*. But what *is* a robot, exactly, and why do we want to devote an entire Mission to studying Robotics?

The word *robot* comes from the Slavic root, *robot-*, referring to physical labor. It was first used in a 1920 Czech-language play called R.U.R. (*Rossumovi Univerzální Roboti – Rossum's Universal Robots*) by Karel Čapek.

The first commercial, digital, and

programmable robot, called *Unimate*, was sold to General Motors in 1961 to lift pieces of hot metal from die casting machines. It was basically a big box with a mechanical arm on top.

Modern robots come in all shapes, sizes, and functions. Some resemble humans, some don't. There's robots to help feeble patients get out of bed; vacuum the floor; search for mines in a minefield; or people trapped in a burning house.

And they keep coming. Website

[www.techjury.net](http://www.techjury.net)

reports there were 12 million robotic units worldwide in 2020; between 2020 and 2022, there would be a 12% *increase* in shipments of robots worldwide. Global spending on *military* robotics alone will be *\$16.5 billion* in 2025.

The robotics industry already employs about 150,000 people worldwide in engineering and assembly jobs, and 88% of businesses worldwide plan to adopt robotic automation into their infrastructure.

So yes, there's going to be a lot of robots soon, a lot of money spent on them, and a lot of jobs becoming available involving robotics and coding. We need students studying these things! Can you help?

To register as a coach for the Robotics Challenge, go to the [www.afrlnm.com/stem/missions/robotics-challenge](http://www.afrlnm.com/stem/missions/robotics-challenge) page, and click the Registration button at the bottom. This takes you to an online Registration form to fill out.



## STEM Challenge

For High Schoolers

### Let's Hatch a Plan

An *egg-gineer* applies scientific knowledge, mathematics, and egg-genuity to develop solutions to technical, social, and egg-conomic 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

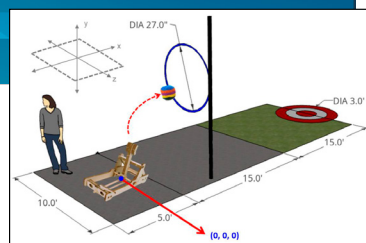


by having teams of 3-4 high school students solve the technical problem of how to remotely launch an *egg payload* through a vertically suspended *hula hoop* and have it land, intact, on a *target* 30 feet away.

There are six distinct STEM Challenge assignments: Team Identity, Launching Device Investigation, Payload Protection Device Design, Payload Protection Device Investigation, Device Integration, and Final Report.

Of these, only the first one, **Team Identity**, is mandatory to be considered a participating STEM Challenge team. Recommended for **September/October**, this assignment involves creating a *team name* and designing a *team logo*.

A virtual **STEM Challenge Coach Orientation** session is



scheduled for **23 September 2021** at **3:30 pm**.

To register as a coach for the STEM Challenge, go to the [www.afrlnm.com/stem/missions/stem-challenge](http://www.afrlnm.com/stem/missions/stem-challenge) page, and click the Registration button at the bottom. This takes you to an online Registration form to fill out.



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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

**KAFB:** Kirtland Air Force Base, Albuquerque, NM

**MM:** Mission to Mars

**PRS:** Phillips Research Site

**S&Es:** Scientists and Engineers

**STEM:** Science, Technology, Engineering, and Math

**TECH:** Technology and Engineering Challenges

**USAF:** United States Air Force

**VIVA:** Mars Vast Interferometer Variable Array Mission 2021-2022

### Remember, Teachers:

Get those EPA Modification forms in!



# STEM Bytes



## Career STREAM

Career STREAM (STEM Trajectories: Research Engagement for Apprentices and Mentors) is a paid summer apprenticeship where diverse high school students work with college mentors to solve problems in STEM.

During the summer, student teams went on a virtual tour of the Very Large Array in Socorro, NM, and worked on their projects over a seven-week period. On 30 July 2021, four Project Teams gave presentations at the Q Station facility:

- **CubeSat2021** – a muon detector cubesat;
- **Space Scavengers** – a robot to collect space debris;



- **HydroPLANT** – a portable farming concept; and
- **Groundbreakers** – a look at growing plants in Mars regolith.

## Super STEM Saturday

On Saturday, 12 June 2021, we scavenged up some STEM at the Q Station, and The Force was With Us.

It was the annual Super STEM Saturday Event, Scavenger Hunt Edition!

Visitors could download an app called Scavify that provided clues to scavenger hunt items in Q station and around town. Upon entering Q station to search for those scavenger items, they could also make a paper circuit lightsaber and get creative making things out of miscellaneous knick-knacks.



AFRL's Matt Fetrow was apparently demonstrating how data gets lost in the cloud, since *he* got lost in a liquid nitrogen cloud!



## Percy Drills It, Ginny Kills It

Percy, the Perseverance Rover, doesn't know her own strength. Her first attempt at drilling a Martian rock sample apparently just crumbled the sample into dust.

But her second attempt drilled it! She got the sample.

Meanwhile, Ginny, the Ingenuity helicopter, is killing it...She keeps making successful flights on Mars! See [www.space.com](http://www.space.com).

## China Mars News

Percy's not the only rover on Mars. Zhurong, China's Tianwen-1 rover, recently celebrated 100 days there by taking a selfie.

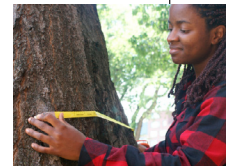
Move over, Ginny: China has developed their own prototype miniature helicopter for surveillance work on future Mars missions. And China also has plans to build miles-wide "megastructures" in Earth orbit which could be used, among other things, as "gas stations" to Mars. See [www.space.com](http://www.space.com).

## Hug a Tree

In these pandemic times, what better way to study STEM than in the great outdoors?

Project Learning Tree (PLT) has some great ideas (96 of them!) for outdoor STEM in PLT's PreK-8 [Environmental Education Activity Guide](#).

The ebook price is only \$19.99, but you know what they say: *Money doesn't grow on trees.*



If that's too much green for you, don't just make like a tree and *leave*, check out their [Activities for Families](#), which are *free* to download individually!

## Pi Record Claimed

Swiss university *Fachhochschule Graubünden* researchers say they have broken the world record for calculating the digits of Pi, out to *62.8 trillion* digits. And did you notice?? 628 is exactly *two times* 314! See [www.livescience.com](http://www.livescience.com).

In other news, those *same* researchers may *also* have set the world record for hardest to pronounce university.

## TE Award

Congratulations to the PRS Tech Engagement Team (AFRL/RDOX) on recently winning the Air Force Award for *Excellence in Technology Transfer*, for the 3rd quarter of 2021.

Hey, wait a minute!... That's *us!*



## Coming Next Issue...

- Viva STEM!
- TECH Rocket Launch Prep

**Watch for it!**

