AFRL
NEW MEXICO
STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

Star Date: Sep 2022
Volume XX, Issue 1

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!

Fun in the Sun

Summer brought the sun. STEM brought the *fun!* You couldn't walk *three feet* in June without running into a summer STEM camp, or some other fun STEM activity!

DoD STARBASE NM Summer STEM Camps

We held *two* separate weeks of STARBASE Summer STEM Camp, from 6-17 June 2022, and boy, was it full of STEM! Rising fifth grade students explored National Guard helicopters, flight simulators, rolling and reaching robots, making slime and ice cream, and pretty much everything in between!

Thanks to all the AFRL and National Guard mentors who helped make this summer camp STEM-tacular!

Summer STEM Space Camp

We *also* held two separate weeks of Space Camp, for rising 3rd and 4th graders, from 13-24 June 2022. Students did everything from astronaut training and making Galaxy Slime to constructing Oreo Cookie moon phases and rocking with rolling robots!

3D Summer STEM Camp

They weren't playing around in the Summer 3D Design Camp! Rising 7th-9th grade students learned how to use Onshape CAD software to design and print 3D objects. They used *that* knowledge to design and 3D-print game pieces for a marble-shooting target game. Then they brought over the 'rents to test the games out!

TAI Aviation Camp

By the end of the five-day Tuskegee Airmen, Inc. Summer Youth Aviation Camp, 6-10 June 2022, which we helped support, 19 students had learned enough about aviation to fly Civil Air Patrol (CAP) Cessnas with a CAP copilot.

STEMYS, STREAMing, Science Fiesta

See page 4 for other summer STEM activities, like the STEMYS, NM Science Fiesta, and Career STREAM presentations.

Moving Right Along

Classes are starting up again, and it's just the *most!*

Teachers who visited our facility last year probably noticed we've already expanded our STARBASE classrooms to *three*: Zuni, Cibola, and now, the Cochiti room. Yes, it's true: we have cooler room names than the *Holiday Inn Sheraton.* Naturally, we've added teaching staff to match.

We have some new STARBASE activities this year, as well.

STARBASE 2.0's two middle schools are now joined by a STARBASE 3.0 *high school.* Mission to Mars has a new mission this year, the most metal mission *ever!* TECH Mission rocketry classes start this month, and robots and eggs are ready to be challenged!

Moving right along, it'll be all sunshine and roses at our upcoming NM State Fair booth on 16 September 2022; we're bringing some solar-powered STEM with us!

Mission to Mars

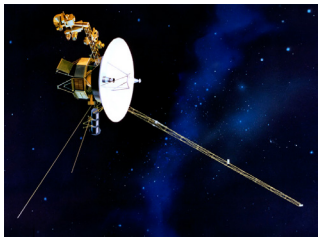
For Fifth Graders

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

Turn, Turn, Turn

Everything's Turning

To everything (turn, turn, turn)
There is a season (turn, turn, turn)
And a time for every mission unto Mars.



Everything's turning in space.

NASA's historic Voyager mission just turned 45. In August and September 1977, two twin probes were launched which have now traveled outside of our solar system!

NASA's *Curiosity* Mars rover mission, which discovered that Mars had a habitable period at least tens of millions of years long, landed on Mars 5 August 2012, and thus just turned 10.

Meanwhile, STEM, and the *Mission to Mars,* are turning students into possible future scientists, engineers, and astronauts!

Page Turners

Mars teachers will want to check out our **Teacher Resource Guide** to understand Base (classroom) Operations. Students will want to check out the updated Mars Student Journal. They're real page-turners, and this year's journal has the most metal cover *ever*!

Where to Turn

For more information about the Mission to Mars, teachers and students can turn to our **website** at www.afrlnm.com/stem/missions/mission-to-mars. There's a button there which links to a form teachers can use to register online.

Questions? Suggestions? Turn to lynn@afrlnewmexico.com for help!

Training

For teachers new to the Mission to Mars, turn to the ***in-person*** training for new teachers at our facility on **Wednesday, 12 October 2022 from 9:00-3:00.**

Returning teachers, *welcome back*! There's a virtual "refresher course," on Zoom, at 3:45 pm on **Tuesday, 27 September 2022.**

Mars Turning

If enough visitors show up, Mars may eventually turn into a *tourist trap!*

The Air Apparent is King

For many, *many* years, Mars has had some air apparent in its atmosphere... but it's thin, mostly made of carbon dioxide, and not very breathable. Mission to Mars *Air Supply* crews can breathe a little easier, though, because that may soon change.

An instrument on the *Perseverance* rover called Moxie, which stands for *Mars Oxygen In-Situ Resource Utilisation Experiment*, has successfully cleaned, compressed, and *electrolysized* the Martian atmosphere, to generate *oxygen*, the King of breathable air! A little patience, and Perseverance, was all it took to become King.

Space researchers are also working on a possible way to get oxygen from *water* using *magnets*.

NASA's Ingenuity helicopter is performing so well, NASA wants to send two *more* helicopters to fly around in all that air and collect rock samples.

China, however, appears to be on track to possibly beat them to the rock sample return game by 2031, a couple years ahead of NASA.

- 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

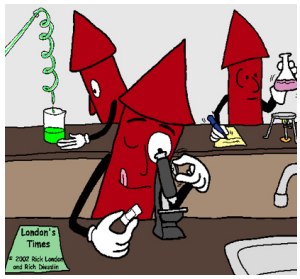
Rocket Science

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 get 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 the flight data.

In Day 1, starting this month, TECH Mission 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, 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 explore global positioning satellite (GPS) rocket tracking, and build *straw rockets*, too.

On Day 2. 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.

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

Why Study Robotics?

What's a robot, 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.

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

They keep coming, too! Website 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?

In the *Robotics Challenge* mission, students explore the basics of systems engineering, computer science, and robotics by assembling and programming small robots to complete tasks.

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

To register as a coach for the Robotics Challenge, go to the www.afrlnm.com/stem/missions/robotics-challenge page, and click the Registration button at the bottom. A Robotics Coach Orientation will be held on 29 September 2022 at 3:30 on Zoom.

Questions? Suggestions? Contact lynn@afrlnewmexico.com for help!

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-conomic problems.

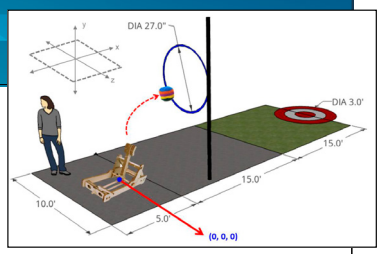
The *Egg-gineering Design Process* provides steps that assist an egg-gineer in clearly understanding a problem and developing a solution to *crack* that problem.

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 challenges: 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. This challenge involves creating a *team name* and designing a *team logo.*

A virtual STEM Challenge Coach Orientation session is scheduled for 28 September 2022 at 3:30 pm on Zoom.

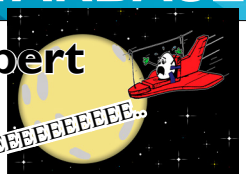


To register as a coach for the STEM Challenge, go to the www.afrlnm.com/stem/missions/stem-challenge page, and click the Registration button at the bottom. This takes you to an online Registration form to fill out.

DoD STARBASE NM

For Fifth Graders

E is For Eggbert



S is for STEM, and STEM stands for Science, Technology, Engineering, and Math.

S is also for Students. How do your students feel about STEM?

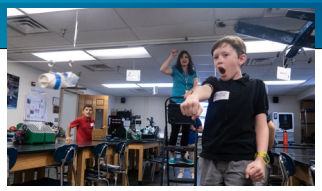
Do they enjoy learning about STEM? Do they think it's *fun?* When they grow up, do they want to *work* in STEM, with other STEM professionals? Do they see themselves as a "STEM person?"

If not, we may have the cure: Nothing beats hands-on STEM for motivation, and that's what the five-day non-consecutive DoD STARBASE NM mission is all about.

On Day 1, the E in STEM stands for Engineering. It also stands for Eggbert, a very brave egghead of a shuttle pilot, 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 for Eggbert, using the Engineering Design Process.

What if the suit had too much mass? Students learn how to measure mass like scientists, on a *triple beam balance.*



To help engineer and 3-D-print new prototypes for potential future additional testing, students familiarize themselves with a computer-aided design program called Onshape, by going on a virtual scavenger hunt in space!

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www.afrlnm.com/stem

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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

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

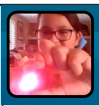
STEM: Science, Technology, Engineering, and Math

TECH: Technology and Engineering Challenges

USAF: United States Air Force

USSF: United States Space Force

Remember, Teachers:
Get those EPA Modification forms in!



DoD STARBASE NM

For Fifth Graders (continued)

And Then There Were Three

Last year, we had two schools participating in our STARBASE 2.0 program: Albuquerque Institute of Math and Science (AIMS), and Albuquerque School of Excellence (ASE).

This year, we've added a *third* school: Del Norte High School (DNHS)—or more specifically, their Junior ROTC program. And yes, they're in ***STARBASE 3.0!***

The "2.0" in "STARBASE 2.0" refers to the fact that, unlike the fifth grade STARBASE program, STARBASE 2.0 is aimed at *middle school students*.

But Del Norte's JROTC program isn't made up of middle school students; they're *high school* students. And *that's* why they get the designation "STARBASE 3.0."

Same concept, though. It's an after-school or extracurricular way for schools to extend the impact of DoD STARBASE through a team mentoring approach in which teams of 4-5 students, working with a STEM mentor, meet for multiple sessions to build and test

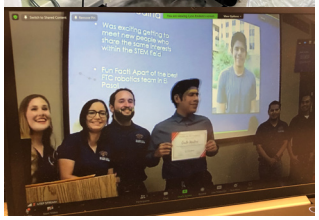
two different model rockets, before attempting to qualify for The American Rocketry Challenge (TARC) https://rocketcontest.org/.

They already had a Mentor Orientation session on 10 August 2022, and 2.0/3.0 teams are already busy building their first rockets!

STEM Bytes

More Fun in the Sun

STREAM Teams



Career STREAM, the paid summer internship where high school students work with college mentors to solve problems in STEM, had teams making final presentations at *three* schools during July: NM Tech, UNM, and UTEP!

NM Science Fiesta

Lazy summer days? Not likely... we put light to *work* at the NM Science Fiesta on 18 June 2022. Visitors to our booth used lasers to draw on light-sensitive material, examined the color spectrum of laser light, tried to aim a mild laser at a rotating target, and bounced lasers through a little mirror maze.

STEMYS Awarded

This year's winners of the New Mexico Excellence in STEM Awards, aka the STEMYS, which celebrate those individuals and groups making a difference in STEM activities and education in New Mexico, were honored at a ceremony on Thursday, 9 June 2022.

Lifetime Achievement this year went to former research chemist, and retired local middle and high school STEM teacher, **Ms. Ellen Loehman.**

Described as the "glue that holds the local STEM community together," in 1997, she created one of the original local science teacher mailing lists, which still exists as a Google Group today. You can see a YouTube video about her here.

For more information about this year's *other* award recipients, visit www.afrlnewmexico.com/stemys.

Career Café

Eagle Ridge MS in Rio Rancho is looking for STEM professionals to visit with students during lunch period and discuss their work.

For more information, contact Elesha.Fetrow@RRPS.net.

STEM Grants

1. AFA STEM/Aerospace Education grants, up to $500, apply by 15 December, www.afa.org/grants. CAP and JROTC $250 STEM grants also available, apply by 31 Dec/10 Oct.

2. APS STEM Grants, $500-$5,000, apply by 5 October, www.aps.edu/education-foundation/impact/classroom-grade-level-learning.

Coming Next Issue...

- The most metal Mars Mission *ever!*
- TECH Rocket Launch Prep; if you build them, they will zoom.

Watch for it!