

AFRL

NEW MEXICO STEM OUTREACH

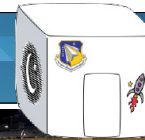
AFRL NM STEM ACADEMY

Inspiring Future Scientists and Engineers

Star Date: May 2023
Volume XX, Issue 9



The Rocket Report



In This Issue...

The Rocket Report	1
Mission to Mars	2
TECH Mission	2
Robotics Challenge	3
STEM Challenge	3
DoD STARBASE New Mexico	3
STEM Bytes	4
Coming Next Issue...	4

METL Accomplished

On 28 April 2023, the Mission to Mars fifth grade students successfully completed the Mars Exploration and Transmission Laser (METL) Mission during the Link-Up Day event at the Albuquerque Convention Center.

Students worked all school year in their classrooms preparing for their

trip to Mars. They:

- Designed uniforms and mission patches;
- Planned and packed nutritious, weight- and space-saving lunches;
- Studied Mars Facts and de-



signed Life Support Systems;

- Wrote and rehearsed a Saga song/dance routine about their journey to Mars;

Continued on page 2

Expo Accomplished

In a world where [robotic puppets](#) can roll little robotic pianos down San Francisco streets singing Vanessa Carlton songs, it's increasingly obvious to today's students need to be familiar with robotics and programming.

Hence, participating middle school student teams from around New Mexico had a number of mechanized challenges to perform at the excellent Robotics Challenge Expo event on 12 May 2023.

With help from some wonderful volunteer judges, they earned colorful lanyard buttons by demonstrating their skills programming



cyber:bot robots, on several challenge courses:

Navigation – No sensors, just coding the robot to “follow the yellow brick road.”

Clear the Debris – Students use a Line-Following Sensor to have the robot sweep a “black hole” and push the wooden blocks out.



Line-Following – Students use a Line-Following Sensor to make the robot cruise the streets, obeying all traffic laws.

Pit and Pendulum – Down — steadily down it crept... certainly, relentlessly down! It vibrated within three inches of my robot! Students use the PING Sonar Sensor to help the “Poe little robot” avoid the fiery-looking pendulum in the Pit of Despair.

Continued on page 3

Super STEM Saturday(s)

We've had some super STEM Saturdays recently!

Super STEM Saturday

On 22 April 2023, we participated in the actual **Super STEM Saturday** event at the Albuquerque Convention Center.

Visitors got to go to Mars with us in a foreshadowing of our Link-Up Day event held six days later!

Those who stopped by made a Mars mission patch, sent an Ozobot to Mars and back, discovered what Mars' lack of air pressure can do, saw a simulated regolith sample, played a Mars Fact Kahoot! game, made a mini-Mars Habitat, and went inside a full-sized Mars Habitat to explore a Gravity Well.



Right next to us, AFRL mentors made light work for them.

Up on the stage, Dr. Oscar, Science Girl, and Kate the Chemist wowed the crowd with all sorts of science

Continued on page 4

In partnership with:



Collaborator:



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





Mission to Mars

For Fifth Graders

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

METL Accomplished

Continued from page 1

- Determined their colony's location on Mars; and
- Made mini-habitats and measured and cut their full-size plastic habitat pieces.

On Link-Up Day, students split into a blue team and a silver team.

Blue team students demonstrated readiness for the mission and received Crew Mission Log points at holding stations that checked the students' life support system models, Mars facts, uniforms, and astronaut lunches.



Meanwhile, silver team students went to their habitat site to begin laying out their pre-fabricated plastic habitat pieces for construction.



Once blue and silver student teams regrouped into crews at their habitat site, they performed their sagas.



Student crews not present at the Convention Center participated virtually, and interacted with teams at the Convention Center, sharing sagas with each other.

Using their 6-mil plastic pieces, grey tape, and a box fan, the student crews built colonies of habitats to simulate what scientists would live and work in on the Red Planet. Including crews participating virtually, students built over 70 habitats this year!



These inflatable habitats are similar to some NASA has considered using for Mars and outer space travel. They're lightweight and compact for transport, but expand to sizable rooms on Mars.

Volunteers from KAFB and other community organizations assisted at the holding stations. *Colony Commanders* at each colony helped keep the Habitat Directors (teachers) and students on track.

During habitat construction, students enjoyed music over the Convention Center loudspeakers to help inspire them. This year, besides sci-fi classic themes like *Star Wars* and *Star Trek*, the music was updated to include some recent sci-fi themes such as *Picard*, the *Battlestar Galactica* remake, and the hit show *The Mandalorian*. Baby Yoda agrees: This is the Way.



Students ate their prepared space lunches inside the habitats, weighed the lunch waste, and cut the sealed *connecting tunnels* for colony neighborhood exploration.

Linking the habitats together in this way, forming a connected neighborhood within the colony, is how Link-Up Day got its name!

During all this, Marvin the Martian (AFRL's very own Dr. Diana Loree), was walking around taking pictures with the students, and listening for Earth-shattering *kabooms*. Marvin was led around by visiting guest

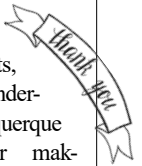


Dr. Nicole Yemothy, an Albert Einstein Fellow on loan to Air Force STEM this year.

Interesting footnote: Marvin the Martin turned out to be a little bigger than we thought he was; Bugs Bunny must be *huge*. That's what's up, doc!

We'd like to thank all the volunteers, the staff, the teachers, the students, and of course, our wonderful friends at the Albuquerque Convention Center for making the 2022-2023 Mission to Mars METL Mission the most metal mission *ever*; and such a huge, Bugs Bunny-sized success!

Sign up for next year's Mission to Mars at www.afrlnm.com/stem/missions/mission-to-mars.



TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Rocketry and Satellites Missions

A Moment of Inertia; A Lifetime of STEM

TECH Mission Day 3 students get a STEM lesson they can carry with them for a lifetime. They learn how to solder electronic components, like resistors, timers, capacitors, LEDs, battery clips, and power switches, to a printed circuit board (PCB).

When they're done, they have a badge depicting an orbiting satellite with blinking red and yellow LED lights, which reads "I've got the power!" And now they have the power, and know-how, to solder.

Some moments later, after learning how solar weather can damage the electronics in space satellites, students take a moment to explore *angular momentum* and the *moment of inertia*.

As mass spins around an axis, it has an angular momentum that helps it resist spinning in any other plane. Very handy on a satellite!



But how close or far the mass is from the axis affects its moment of inertia. For example, a spinning ice skater puts their arms out wide and spins slowly. When they pull their arms in, they suddenly spin faster.

Students explore these concepts



with hand-held gyroscopes, and by sitting on a spinning stool with weights in their hands to make a *human gyroscope*.

Middle School/Home School application forms for next year's TECH mission can be found here:

www.afrlnm.com/stem/missions/tech-mission.

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



Expo Accomplished

Continued from page 1

Escape the Maze – Students use the PING Sonar Sensor to navigate their robot through a maze.

Dance Your Circuits Off – Students use saved code, music, and props to get their robot dancing, complete with sound, lights, motion, and creativity.

from the Manzano Teen Tech Center, and WALL-E.

Flashy Chassis Pageant Winner: Team 02, RoboEagles2

Integrity Award: Team 61, The Cyborgs

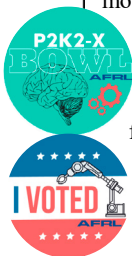
2023 Robotics Expo Champions: Team 15, Pain-Em

STEM winner: Everyone!

Thanks to all the staff, volunteer judges, schools, students, robots, and robotic exhibitors who helped make this year's 2023 Robotics Challenge Expo a success!

Register for next year's Robotics Challenge at www.afrlnm.com/stem/missions/robotics-challenge.

Robotic guests included Cozmo (the cutest little robot you'll ever meet), several teams and robots



P2K2-X Quiz Bowl – Students test their robotic knowledge in a game-show-like format.

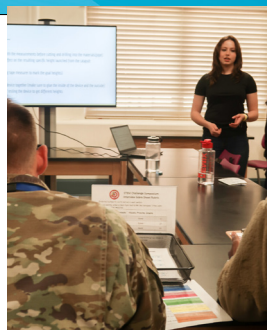
Flashy Chassis Pageant – The Best-Dressed Robot competition.

STEM Challenge For High Schoolers

Symposium Egg-tacular

More egg-celent pictures from the STEM Challenge Symposium on 4 April 2023!

Registration for the 2023-2024 STEM Challenge can be found on our website at www.afrlnm.com/stem/missions/stem-challenge.



DoD STARBASE NM For Fifth Graders

First Time Pilot? That's OK, No Pressure

The fifth grade students in DoD STARBASE NM Day 5 typically don't even have *driver's licenses* yet. But that's OK, we let them fly the airplanes anyway! No pressure.

That's because first we help them explore how to use air pressure and Bernoulli's Principle (faster moving air creates less pressure than slower air) to accomplish some amazing things.

For example, in a Tornado Tube (sort of a colored-water-filled hourglass), students can turn the bottles upside down, and the fluid in the upper bottle won't pour down into the lower one!

That's because the air in the lower bottle has nowhere to go to get out of the way, and the air pressure is strong enough to hold up the water.

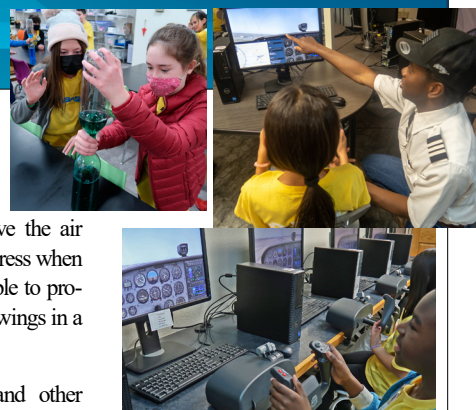
To break the impasse, students swirl the bottle and generate their own mini-tornado in the tube! Weather Modification at its finest.

Students leverage Bernoulli's Principle to recruit extra air, besides what's in their lungs, to fill a Bernoulli Bag. They can also blow on the top of a ping-pong ball in a cup and make it hop into another cup, which could be handy if the students ever get into Jedi

Ping-Pong Cup Hockey.

But the students really give the air pressure issue a full court press when they use Bernoulli's Principle to provide *lift* under their virtual wings in a flight simulator airplane.

Kirtland AFB mentors and other flight enthusiasts often stop by to assist, regaling the students with tales of real-world flight experiences. Pictured here in the white shirt, Gabe Carothers, age 17, is currently the youngest pilot in New Mexico, and the youngest African-American pilot in NM history.



If they fly through all of *that*, students can use Onshape CAD software to design a new Martian science outpost.

Fifth grade schools/homeschools can register for next year's DoD STARBASE NM at www.afrlnm.com/stem/missions/dod-starbase-nm.

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>

No copyrighted material belonging to others is knowingly used in this publication without permission. If any is inadvertently used without permission, contact:

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!

STEM Bytes

Super STEM Saturday(s)

Continued from page 1

demonstrations! It was a Super STEM Saturday, all right!



STEM Educators Workshop

The day after the Link-Up Day event, Saturday, 29 April 2023, K-12 teachers came to our facility for a super Saturday hands-on **STEM Educators Workshop**, held by Albert Einstein Fellow Dr. Nicole Yemothy, on loan to AF STEM this year.

Participating teachers made hot air balloons, pop rockets, hydraulic tilt-a-marble games, and pretty much everything in between.



The only downside: Dr. Yemothy, who attended our Link-Up Day event a mere 24 hours earlier, didn't bring Marvin the Martian with her!

Free Money \$\$\$



AFA's *Educator Grant* program promotes K-12 classroom aerospace education with up to \$500 grants. Applications accepted 1 September–15 December 2022.

AFA also offers \$250 grants twice a year to Civil Air Patrol (CAP) and Air Force JROTC units for STEM and aerospace education.

See www.afa.org for more information on AFA grants and programs.



The New Mexico Out-Of-School Time Network (NMOST) will be awarding \$500, \$750, and \$1000 **Advancing Young Women in STEM Scholarships** to assist and encourage young women to pursue a STEM career.

Applications are open through **30 May, 2023.**

To apply, see www.nmost.org/most-aywistem-scholarships.

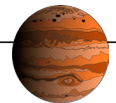
STEM 4th



Fashioned after athletic signing days, high school seniors signed "letters of intent" to their chosen STEM field and school on "May the Fourth Be With You Day" (4 May 2023).

See www.superstemevents.com/stem-signing-day.

Space News



Psyche, the orbiter mission to explore the origin of planetary cores by studying a metallic asteroid, is now scheduled to launch 5 October 2023.

Meanwhile, Jupiter's JUICE mission launched 14 April, and SpaceX's giant Starship rocket successfully "launched and exploded" on 20 April 2023.

See www.space.com.

Women in STEM

Mattel released a special line of Barbie dolls for International Women's Day on 8 March 2023. The dolls immortalize seven minority women in STEM, including Maggie Aderin-Pocock, a space scientist, and Katya "Kat" Echazarreta, a NASA engineer and the first Mexican-born woman to fly into space.



Sorry, the dolls are not available for sale to the public. See www.shop-mattel.com/pages/barbie-role-models.

Mars News



UAE's *Hope* craft recently got a good picture of Mars' moon Deimos.



Link-Up Day? In June, four astronauts will stay in *Mars Dune Alpha*, the CHAPEA real-world Mars simulation's unique 3D printed habitat.

Star Trek's William Shatner will host a celebrity Mars survival simulation show called *Stars on Mars* starting this June on Fox.

See www.space.com.

Coming Next Issue...

- A whole new year of STEM!

Watch for it!

