AFRL
NEW MEXICO
STEM OUTREACH

AFRL NM STEM Academy

Inspiring Future Scientists and Engineers

Remember, STEM Challenge Teachers: The STEM Challenge Symposium is coming up on **4 April 2023!**

Star Date: Mar 2023
Volume XX, Issue 7

AFRL
THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

In This Issue...

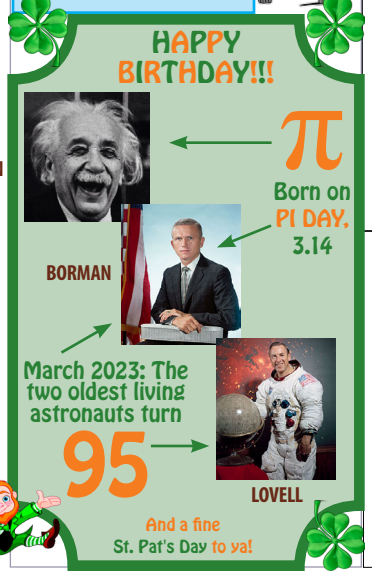
In partnership with:

NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

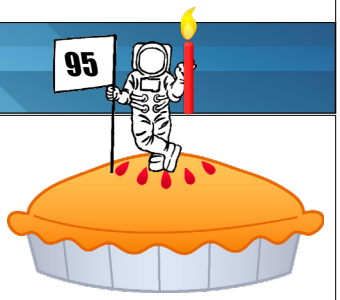
Collaborator:

DoD STARBASE
A Department of Defense Youth Program

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

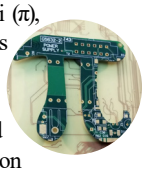


The Rocket Report

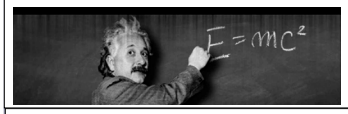


Happy Birthday!

March madness! Pi (π), the ratio of a circle's circumference to its diameter (π = c/d), usually abbreviated to 3.14, is celebrated on **March 14 (3/14)**.



That date also happens to be the late physicist **Albert Einstein's birthday**. Einstein developed the *theory of relativity*, but he also made contributions to *quantum mechanics* theory. His mass–energy equivalence formula, **E = mc²**, may be the *world's most famous equation*.



This month, **"Pi Day"** *also* happens to be the **95th birthday** of the world's *oldest living astronaut*.

Frank Borman is a retired USAF colonel, aeronautical engineer, test pilot, businessman, and NASA astronaut.

In 1966, as commander of *Gemini 7*, he set a 14-day spaceflight endurance record. He was commander of Apollo 8, the first mission to fly around the Moon, with crewmates Jim Lovell and William Anders.

Speaking of 95th birthdays...

25 March 2023 marks the **95th birthday** of the *second* oldest living astronaut, **Jim Lovell**.

Barely *11 days younger* than Borman, who he flew with on Gemini 7 and Apollo 8, Lovell was also commander on what may be called NASA's most "successful failure," *Apollo 13*. If you saw the *movie* Apollo 13, he was the one played by Tom Hanks.

Mid-Year Meeting Met

Dozens of fifth grade Mission to Mars teachers came to our facility on 23 February 2023 to attend the Mid-Year Meeting training.

LUD Info and Plastic

Mars teachers received a rundown of the procedures for this year's Link-Up Day event, the culminating event of the Mission to Mars, which will be held this year at the Albuquerque Convention Center on Friday, 28 April 2023.

After listening to the presentation outlining Link-Up Day procedures and information, the teachers received their 6-mil plastic and duct tape for helping their students make the unassembled portions of their habitat(s).

Mars students will bring these plastic habitat pieces with them on Link-Up Day to be assembled and linked to other habitats.

Continued on page 2

Tour

On 3 March 2023, Regional Junior Science & Humanities Symposium (JSHS) students toured AFRL's Thermal and Robotics Labs, and the Makerspace. STEM Academy staff escorted the visitors on the tour.

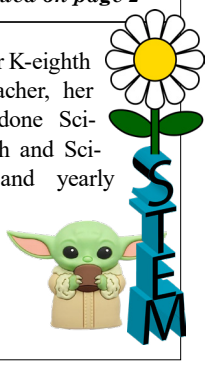
Coming Up Daisies

Give a flowery welcome to our likable STARBASE educator, Lika "Daisy" Begnell.

Simple, durable, like a Daisy. She attended the same high school as Mark Hamill, which, like Rey, makes her like a Skywalker.

A retired 25-year K-eighth participating teacher, her students have done Science Fairs, Math and Science Nights, and yearly Egg Drops.

Eggbert is one of her favorite activities!



Mission to Mars

For Fifth Graders

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

Mid Year Meeting Met (con't.)

Continued from page 1

Virtual Visits

For teachers wishing to participate virtually rather than in-person, an outline of a planned 3-hour virtual Link-Up Day, held concurrently with the in-person version, was included in the briefing.

Teachers learned we'll strive to create a virtual experience that approximates the in-person version of the event. Crews will virtually present Technical Briefings and Sagas, inflate a habitat along with their colony, and make their own arrangements for habitat visitation.

Blue and Silver on Red

To keep things moving, teachers learned, in-person crews will be split into Blue and Silver Teams when they first arrive on the Red Planet.

Blue Teams will report to the Technical Briefing Station, Silver Teams will stay with their Habitat Director, mass their astronaut lunches, and lay out the plastic pieces they prepared, at their Habitat site.

Build Practice

Teachers who wished to stick around a little longer after the presentation also got to practice building a full-sized model of their habitat at the meeting.

Your commitment to this mission is crucial to its success

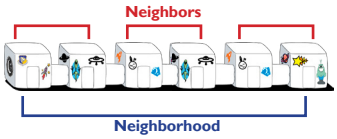
Construction Instruction

With dedication, determination, and duct tape, student crews will construct habitats on Link-Up Day.

If the walls of the habitat don't line up perfectly, duct tape is the students' best friend. The crew tapes/joins the connecting tunnels on *both* sides of the habitat together, except for the ones at either end of the neighborhood that have only one tunnel.

After Link-Up Day, Habitat Directors take completed habitats **with** them to reuse/recycle when they "get back" to Earth.

Howdy, Neighbor!



After lunch, student crews weigh their lunch waste and return to their habitat. Habitat Directors have the student crews cut the opening to their next-door *neighbor* habitat.

When the Colony Commander announces it is time for Colony Exploration, student crews cut the remaining openings in the whole connected colony *neighborhood*, *linking* all of the habitats in the neighborhood together.

And *that's* why the event is called Link-Up Day!

Pre-Fab Prep

Pre-fab *before* Link-Up Day!

Silver Teams will have to scramble to finish incomplete pre-fab on Link-Up Day! Why rush?

Base Operations crews should attach the door panel and fan/connecting tunnels to the appropriate walls before Link-Up Day.

Students tape the **door panel** on the inside front wall of the habitat.

The **fan tunnel** goes in the middle of the back wall *near the ground, taped* and *flanged*, and *cut open*.

Connect the **connecting tunnel** to the habitat, *as close to the floor as possible*. Think *short* and *fat* tunnels.

Kahoot! Kontinues

The Mars Fact Challenge Kahoot! games continue!

Kahoot challenges #4 and #5 will be up this month, and #6 starts on 7 April 2023 (https://afrlnm.com/stem/2023-mars-metl-mission/).

TECH Mission

For Middle Schoolers

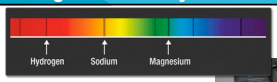
Technology and Engineering Challenges—Rocketry and Satellites Missions

Spectral Spectacle

Spring TECH Mission Day 2 makes a spectacular STEM satellite spectacle of itself!

See, satellites scanning space and stuff rely on sensitive STEM sensors to leverage certain special, specific aspects of the *elecromagnetic spectrum*. Stupendous!

Visible light that our human eyes can see represents only a small portion of the full electromagnetic spectrum. For example, our eyes can't see infrared (heat) waves, but a *Forward-Looking Infrared* (FLIR) camera on a satellite can...and it can see *through* obstacles, like planets, in ways that visible light cannot!



TECH Mission Day 2 students see themselves through a FLIR camera the same way a satellite might.

Different elements have different *spectral signatures*, so, satellites, and the scientists who work with them, also study objects on Earth and in space using *spectral analysis* to study the electromagnetic signatures they emit.

Day 2 students use a *spectrometer* to study the spectral signatures of several gases, and record the pattern in their student logs.

Things get even hotter when students (carefully) take turns burning various chemical elements, and identifying the element based on the color of the flame.

Students also explore light, lenses, color, and the various sensors on a *micro:bit microcontroller*...

...but that's a story for another day.

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.

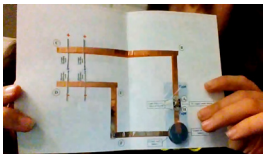
Robotics Challenge

For Middle Schoolers

Robots!

So far, the students have worked on learning Python and programming micro:bit microcontrollers. But if we're going to call this thing the Robotics Challenge, you'd think there'd be some actual robots involved.

Well, we made it! **Module 3. Building and Controlling Robots,** wraps up this month.

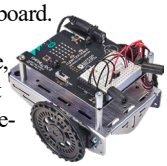


After designing an electronic circuit, using flat copper tape for the wires, students get down to brass tacks:

Building and programming a Cyber:bot robot!

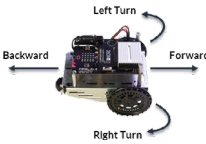
First thing on the list: Assembling the robot, which includes attaching a piezospeaker, wheels, attaching and centering the servomotors that turn the wheels, a battery pack, and the microbit "brains" to the robot's frame and circuit board.

When they're done, they have a robot that looks something like this:



Next step: The robot is too cute not to have a name, so they give it one!

Then they figure out the code to *navigate*, or move, the little guy around: Forwards and backwards different distances, and different types of turns, at different angles.



They can make the robot move in a pentagon shape, for example, and after tying a pen to it with a pipe cleaner, they can make it *draw!*

Next, students attach various sensors to the robot, such as line-following or ultrasonic "Ping" sensors, and explore writing code to get the robot to follow lines and avoid obstacles (or at least push them out of the way).

Now they're almost ready for the main event: The Robotics Expo on 12 May 2023!

Questions? Suggestions? Don't just spin in place! Contact lynn@afrlnewmexico.com!

STEM Challenge

For High Schoolers

Reports and Interviews

Timeline: March

The STEM Challenge Symposium is early next month, 4 April 2023!

This month, STEM Challenge teams should start summarizing their work into a **final report**. Completed *before* the Symposium, it makes an egg-cellent tool to help teams prepare for the **Interview** portion of the Symposium.

Reports include an Introduction, Launching and Payload Protection Device Details, Competition Point Scoring Strategy (to maximize score), and Lessons Learned.

The final report includes relevant photos, diagrams, and graphs (software like PowerPoint helps). The student handbook has additional details.

Logos!

Team 12—Warwolves

Team 51—Viking Batallion

Team 31—Shooting Stars

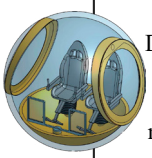
Team 52—Super Talented Egg Masters

DoD STARBASE NM

For Fifth Graders

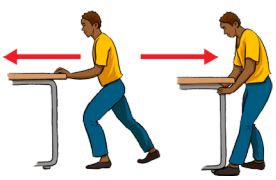
STEM is the Action

STEM is the action, and learning is the reaction, in DoD STARBASE NM Day 2, Physics.



Day 2 students explore 3D CAD software PTC *Onshape* to construct a 3-D Gyrosphere modular transportation cockpit.

That Newton, he was a pretty smart guy. He said that objects in motion or rest tend to *stay* that way unless acted on by an unbalanced force.



He also said that for every action there is an equal and opposite reaction, and that force = mass * acceleration. What did this guy eat for breakfast?!

Day 2 students put Newton to the test when they get fizz-ical with CO_2 rocket launches and racecars.

Have you ever eaten too much pizza and thought, "Man! If only I had some Alka-Seltzer®, I could launch a *rocket!*" That's kind of what it's like in the *Pop Goes the Fizz* activity. Student teams of chemists, engineers, mathematicians, and recorders investigate how much Alka-Seltzer® fuel does it take to get a film caninster rocket to fly a certain height up a launch tube.

Students also use *rocket dragsters* to determine what effect a 4g vs. 8g CO_2 cartridge has, if the mass of the two cars is the same.

AFRL NEW MEXICO STEM OUTREACH

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-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 (continued)

Prepare to Qualify

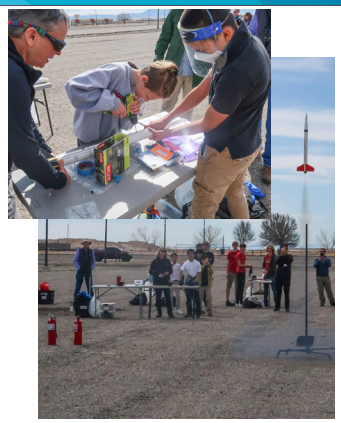
Popular 1980's arcade car-racing video game *Pole Position* used to say: *"Prepare to Qualify."*

Well, that's where we're at. Our STARBASE 2.0/3.0 student teams are preparing their rockets for their official qualifying launches.

The American Rocketry Challenge (TARC)'s qualification flight score submissions are due 3 April 2023.

This year's goals include: Launch a two-section rocket, containing a large (55-61 gram) hen's egg and an altimeter in one section, and the motor in the other, to an altitude of 850 feet, landing between 42 and 45 seconds later, egg intact. Man! To qualify in Pole Position, you just had to drive faster than the other cars!

The best 100 scoring teams nationwide will compete for a share of a $100,000 prize package in a national competition in May 2023.



STEM Bytes

Nominate a STEMY

Nominations for the 2023 STEMY Awards are now open!

The *New Mexico Excellence in STEM Awards*, aka the STEMYS, celebrates those individuals and groups making a difference in STEM activities and education in New Mexico.

Categories you can nominate STEMYS in include:

- Student K-8
- Student K-12
- Educator K-8
- Educator K-12
- School
- District
- Business
- Non-profit
- Higher Ed program
- Mentor
- Advisor or Coach

STEMYS Excellence in STEM Awards
presented by AFRL New Mexico Tech Engagement Office

Winners will be honored at a ceremony in June 2023. Some category winners will be eligible for scholarships and monetary awards.

To nominate someone, visit www.superstemevents.com/stemys-1.

Saturday is Super STEMMY

Super STEM Saturday is *back*, Jack, and that's a fact!

Super STEM Saturday is a super-fun STEM day featuring live STEM shows and STEM booths with hands-on fun for kids of all ages. Be dazzled, amazed, and learn something new! Mark your calendars *now*!

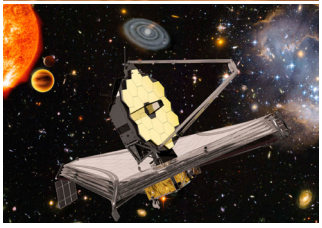
22 April 2023, 10 am-4 pm
Shows start **11 am and 2 pm**

See www.superstemevents.com/super-stem-showcase.

Sheer Genius

The Mars helicopter *Ingenuity* recently aced its 43rd and longest flight in over a year. Meanwhile, The James Webb Space Telescope (JWST) recently discovered a new but very ancient galaxy.

Did you know the solar panels for both of these were made by an Albuquerque company called SolAero (now owned by Rocket Labs)? Good ol' Albuquerque ingenuity! See www.space.com.



Coming Next Issue...

- Mars and Robots coming; LUD things to know, bring, and Neighbors
- STARBASE Days 3 and 4
- Symposium Symposed

Watch for it!