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AFRL
NEW MEXICO STEM OUTREACH
AFRL NM STEM ACADEMY

Inspiring Future Scientists and Engineers

SPECIAL COMMEMERATIVE EDITION
20TH ANNIVERSARY ISSUE

Star Date: Nov 2023
Volume XXI, Issue 3

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!

The first newsletter

Happy Thanksgiving!

WHO's Having an Anniversary?!

Twenty years ago *this month*, way back in November 2003, a monthly newsletter was created especially for what was once known as AFRL TTE, but had *just* changed its name to AF STARBASE® La Luz.

Our name has changed *again* since then—we're **AFRL NM STEM Academy** now—but we *still* have essentially the same goal that AFRL TTE and AF STARBASE® La Luz had:

To encourage and foster students' interest in science, technology, engineering, and math (STEM).

Over the following months and years, we've continued to evolve and improve the newsletter—the current edition of which you are reading right now.

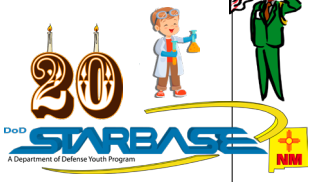
Some of the graphics have changed a little, and we definitely have more STEM activities to discuss these days, but the basic format of the newsletter has held up pretty well over the last 20 years.

We hope it has provided participating teachers with easy access to timely information, and been informative and entertaining for community volunteers and other readers.

If Doctor Who was here, he'd think it was quite splendid this newsletter's 20th anniversary is this month—this *also* happens to be the 60th anniversary month of Dr. Who! If *that* isn't timey-wimey, I don't know *what* is!

And if Abraham Lincoln were here, he'd think we had something extra special to be grateful for this month—it's been exactly 160 years since Honest Abe made Thanksgiving an annual November tradition!

Hey, thanks, Abe!



Of course, this year *also* marks the 30th anniversary of our Mission to Mars program, and the 20th anniversary of our DoD STARBASE NM program! So who *isn't* having an anniversary right now?!

Care for a jelly baby?

The Rocket Report

(for the TECH Mission Rocket Launch)

Launch Time!

Fall TECH Mission Day 2 students were having more fun than a ship full of Cybermen at the TECH Mission Rocket Launch event on 24 October 2023!

Over 300 middle school students from 10 schools, plus home schoolers, launched 30 rockets at the event:

- Baca/Dlo'ay Ahzi Community School
- Christ Lutheran School
- Cleveland MS
- Home School
- Los Alamitos MS
- Mesa View ES
- Peralta ES
- Ruidoso MS
- Tomé ES
- Voz Collegiate Prep Charter School, and
- Washington MS.

Teams gathered at the Albuquerque Rocket Society launch site on the outskirts of Rio Rancho, NM and, with help from staff and volunteers, launched the four-foot rockets they built, more than a *thousand feet in the air*.

The rockets were built beforehand by the students at an earlier visit to AFRL NM STEM Academy, where they also simulated the launch on a computer program called *RockSim*.

Each team gave their rocket a name, much like how NASA is calling their big moon rocket *Artemis*.

Continued on page 2

★30★ Years

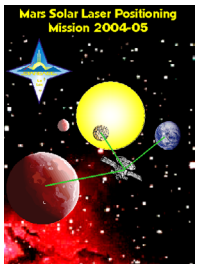
Mission to Mars

For Fifth Graders

Mars Safeguarding Through Asteroid Redirection Spacecraft (STARS) Mission 2023-2024

Many Moons of Mars Missions

We're over the moon about this: Mars has two moons, but Mission to Mars has been going on for many, *many* moons. Thirty *years*' worth, in fact! And in that time, our students have gone on many manned missions to Mars.



We've consulted with the Time Lords on Gallifrey and drawn up a list of as many mission names and graphics as we could find.

There's far too many graphics to show them all in this newsletter, but here's a list of all the known mission names:

Year	LUD Name
1994-98	N/A
1998-99	Mars Reconnaissance Mission (MRM)
1999-00	Mars Millennium Colonization Mission (MMCM)
2000-01	Mars Odyssey Mission (MOM)
2001-02	Mars Asteroid Defense Mission (MADM)
2002-03	Mars Critical Response Mission (MCRM)
2003-04	Mars On-site Laser Development (MOLD) Mission
2004-05	Mars Solar Laser Positioning (SLP) Mission
2005-06	Mars Membrane Mirror (M^3) Mission
2006-07	Mars Metamaterial Research Mission (M^2RM)
2007-08	Mars Reconfigurable Research Robot (MR^3) Mission
2008-09	Mars Miniaturized Optics Probe (MOP) Mission
2009-10	Mars On-site Lakebed Excavation (MOLE) Mission
2010-11	Mars Cave Skylight Investigation (CSI) Mission
2011-12	Mars Microprobe Evaluation of Lava and Titanium (MELT) Mission
2012-13	Mars Microbial Asteroid Research Survey ($MARS)^2$ Mission
2013-14	Mars Survey of Topsoil for Extremophile Microbes (STEM) Mission
2014-15	Mars Manufacturing Components and Capabilities (MC^2) Mission
2015-16	Mars Asteroid Redirection Employing Satellites (ARES) Mission
2016-17	Mars Harvesting Hydrogen and Oxygen (H_2O) Mission
2017-18	Mars Scan, Evaluate, and Excavate (SEE) Mission
2018-19	Mars Pressurized Oscillation Laser Observation (POLO) Mission
2019-20	Mars Expolanet Transient Satellite (METS) Mission
2020-21	Mars Hovering Observational Planetary Exploration System (HOPES) Mission
2021-22	Mars Vast Interferometer Variable Array (VIVA) Mission
2022-23	Mars Exploration and Transmission Laser (METL) Mission
2023-24	Mars Safeguarding Through Asteroid Redirection Spacecraft (STARS) Mission

Visit the Mission to Mars post on our Facebook page to see all the known Mars Mission graphics and mission descriptions to date.

Many Suns of Curiosity

Mission to Mars may have been going on for many moons, but the Curiosity rover, on Mars, has been going on for many *suns*! (Or *sols*, one Mars day, as the locals call it.)

Since landing on Mars' Gale Crater way back in August 2012, Curiosity has now seen over *4,000 sols*. That's a lot of suns... and many moons! And a *lot* of curiosity! How's the cat?

Your commitment to this mission is crucial to its success

The Next Step...

November/December is a good time to...

- Study the **timeline** on page 8 of your TRG; adjust as necessary to fit your curriculum and scheduling needs. Be sure your class completes the activities prior to the **Link-Up Day event, 25 April 2024!**
- Have students learn "Mars Facts," and work on sagas and mission patches
- Eat some turkey! MMMM!

Multitasking

Teachers: During Base Operations, every student doesn't have to work on every single activity. For example, one group could work on the lyrics for the saga, while another group designs the mission patch.

You can also make a contest out of activities. For example, have several groups design a mission patch, and then have the class, or the school, vote for their favorite.

Another option is to assign one Mars Fact to each group, which would then design a separate section of the life support system model, based on that fact.

Have students remember: Unlike a TARDIS, a habitat is the *same* size inside and out—make sure the model can fit through the airlock door!

Poster Session

Some of the cool posters Mars teachers won during the New Teacher Training event are FREE for download from the NASA and JPL websites, in case any teachers want more.

TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Rocketry and Satellites Missions

Launch Time!

Continued from page 1

This year, 10 teams picked *Phoenix*; 6 picked *Apollo,* 5 picked *Atlas,* 3 picked *Opportunity*, and 2 teams each picked *Gemini, Saturn,* or *Spirit*.

At the launch event, the Assembly Team added a *parachute,* an *altimeter,* and a *motor* to the rocket.

The Range Safety Officer students checked with Data Quality and Inspection students to make sure the winds weren't too strong, checked with the Spotter Team that skies were clear of aircraft, and counted down the launch. The Launch Control Officer student pushed the Launch button...

...And, faster than you can say, "Hey! That TARDIS looks just like a police box!" *Whoosh!* The rockets took off! The on-board altimeter tracked how high the rocket flew.

Spotter Teams tracked the rocket's flight and directed the Recovery Teams to where the rockets landed. Some rockets were easier to find than others!

Data was collected from the rocket, which was then disassembled to retrieve reusable parts (like parachutes and altimeters).

On Day 3, students return to our classroom facility and compare this data to their *RockSim* predictions to analyze how the real-life launch data compares with the computer model results.

"I learned how to launch a rocket. I had *fun.* I learned how to take rocket launch *data.*"

2023–24 TECH Mission student

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

Only a Little Bit

Robotics Challenge Module 2 is now open, and that means: *Micro:bits!*

The micro:bit is a tiny programmable device. But have you *seen* one of these things? It's no bigger than a wide postage stamp, yet this thing has sensors, input buttons, an LED screen, a compass, an accelerometer, antennas, a speaker, a microphone, and a USB port?!

Maybe *this* thing is the TARDIS; it has *way* more stuff *inside* it than it has room for *outside*! Add a *chameleon circuit,* and it could be a *police box!*

Students communicate with the micro:bit using an online Python editor. Python is a computer language—and it's also a snake.

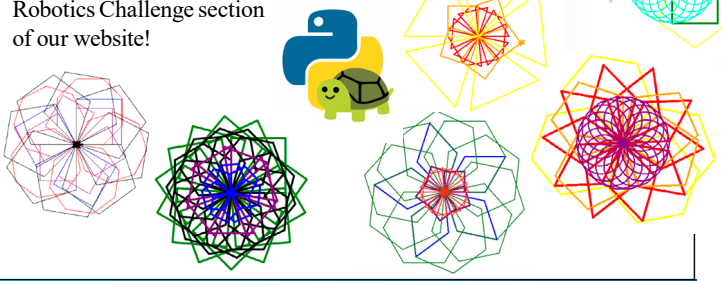
But this snake only bites a little. Maybe that's why they call it a *micro:bit.*

Module 2 students program the microbit to flash images, scroll text, and even play games! Questions? Suggestions? Contact caitlin@afrlnewmexico.com!

Fast Turtles

They say turtles are slow, but the turtle mosaics the students are programming in Module 1 are coming in *fast!*

We've already got some posted in the Turtle Mosaics page in the Robotics Challenge section of our website!



STEM Challenge

For High Schoolers

Invest-egg-ate!

Suggested Timeline: Nov/Dec

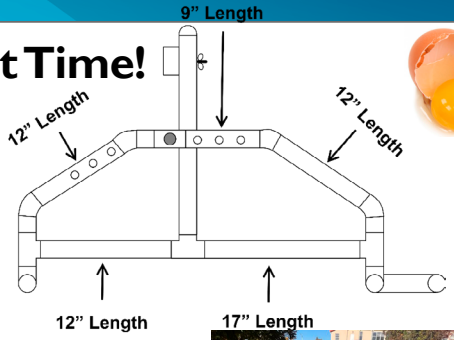
As STEM Challenge high school student teams initiate their **Launching Device** investigation (600 points), they choose whether to design their *own* device to launch eggs through space, such as a *trebuchet*, or use our provided "in-house" catapult design, adapted from Paul Carreiro's *Statistical Catapult Plans.*

You *could* call it an EARDIS—an Egg and Relative Dimensions in Space device.

If they go with our in-house version, they have plenty of help! We have an instructional guide that teaches students how to build, step-by-step, a catapult using PVC pipes. It includes everything from where to drill the holes in the PVC pipe, to how to assemble all those pipes and "tee joints" together.

You can almost hear the Daleks screeching, *"Invest-egg-ate!"*

Catapult Time!



Students can come to our classroom facility and use our tools, such as drill presses, to help them create their own catapult kit.

Whatever launching device type the students choose, once it's assembled, they can test it out using a hacky sack. Don't want to "eggs-terminate" those eggs too soon!

DoD STARBASE NM

For Fifth Graders

Rolling Robots and Space Pets

The third day of the 20th anniversary year of DoD STARBASE NM has really gone to the dogs. The space dogs, that is. And the hamsters, and the bunnies, and the cats...

Day 3 is all about **technology**, which is everywhere you look!

Students use Onshape 3D CAD software to design a *gyrosphere.*

They *code the road* with color codes, so a rolling Ozobot robot can help Darwin the Space Dog find his friends, space pets Hertz the Hamster, Bernoulli the Bunny, and Curie the Cat.

Students use metric math to help the animals get the right amount of drinking water, too.

Then students use iPads to program non-mechanoid rolling Lego robots to help find Astro, the space dog who is lost in space.

Rolling Robots and Space Dogs... Come along, K-9, you happen to be both! *Yes, mawstah!*

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.

AFRL NEW MEXICO STEM OUTREACH

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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

MM: Mission to Mars

S&Es: Scientists and Engineers

STARS: Mars Safeguarding Through Asteroid Redirection Spacecraft Mission 2023-2024

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)

Advanced Prototypes Launched

STARBASE Advanced teams are advancing on their way to the qualifying launches for the American Rocketry Challenge (ARC).

They're already launching smaller, prototype rockets, and advancing to ARC-class ones.

STEM Bytes

Meet Judith Love Cohen

Judith Love Cohen (16 August 1933–25 July 2016) was an American aerospace engineer.

She worked on the Minuteman missile, the science ground station for the Hubble Space Telescope, and the Tracking and Data Relay Satellite.

She also worked for the Apollo Space Program.

If you've ever seen the movie *Apollo 13,* you're aware of the difficulties that mission had.

Well, her Abort-Guidance System is credited with helping rescue the Apollo 13 astronauts.

When she went into labor, she took a printout of an Apollo 13 mission problem she was working on with her to the hospital.

When she'd figured out the solution, she called her boss... from her hospital bed...said she finished the problem...

...and then gave birth...

...to actor Jack Black.

Upcoming Deadlines

AFRL SCHOLARS PROGRAM — MILLION GIRLS MOONSHOT

- AFRL Scholars Summer 2024 applications open through **10 January 2024**
- Applications for the Million Girls Moonshot Flight Crew are due **1 December 2023**

AI Dance Party

Computer Science Education Week (the week of 4 December 2023) is almost here...

...and that means it's time for an Hour of Code, a free introduction to computer science for learners of all skill levels.

This year, Hour of Code features an Artificial Intelligence (AI) Dance Party! Use code to make a variety of colorful characters bust a move.

Space News

- Oldest living US Astronaut Frank Borman, and Apollo 13 astronaut Ken Mattingly, recently passed away.

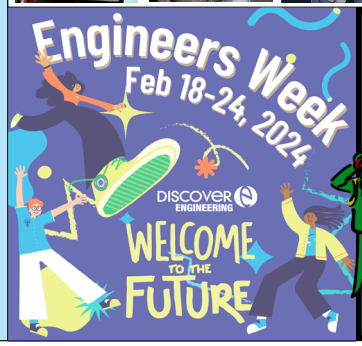
- NASA's "First Woman" Graphic Novel Issue #2, *Expanding Our Universe*, is now available.

SPACE...is not the FINAL frontier...
KNOWLEDGE is!

Teacher Feature

Teachers: Need help with the Mission to Mars, Robotics Challenge, or STEM Challenge missions?

There's Zoom "office hours" with our staff every Thursday (excluding holidays) from 4:00 – 5:00 pm. Email caitlin@afrlnewmexico.com.



This issue is dedicated to:

- Astronauts Frank Borman and Ken Mattingly
- All the teachers, volunteers, and other loyal readers of this newsletter over the last 20 years

Coming Next Issue…

- Mission Patch, Life Support System, and Saga information
- News, Info, Fun… and Holidays!

Watch for it!