AFRL
NEW MEXICO
STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

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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

Rockets Up to Bat

We didn't need extra innings to know that the 2022 TECH Mission Rocket Launch was a (Kirtland Air Force) *base hit!*

On their way to winning the World Series, in Game 4, on Wednesday, 2 November 2022, playing against the Philadelphia Phillies, the Houston Astros made history by pitching the World Series' first *combined no-hitter.*

On Tuesday, 18 October 2022, TECH Mission middle schoolers proved that the value of students studying science, engineering, technology, and math (STEM), hands-on, is a *combined no-brainer.*

The Phillies may not have hit any home runs in Game 4, but the TECH Mission students were hitting nothing but homers all day at the TECH Mission Rocket Launch event!

Students from seven middle schools participated in the event:

- Eagle Ridge MS,
- Holy Ghost Catholic,
- Cleveland MS,
- Int'l School at Mesa Del Sol,
- Menaul School,
- Ruidoso MS, and
- Washington MS...

...gathered at a field on the outskirts of Rio Rancho, NM and, with help from staff and mentors, launched the 22 four-foot rockets they had built, about a *thousand feet in the air.* That's an out-of-the-park home run right there!

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.*

Continued on page 2

Pluto is a *Person*

For some years now, the debate has been swirling: Is Pluto a planet, a dwarf planet, or a dog? Now we know: Pluto is a *person.*

Caitlin "Pluto" Everhart, our newest STEM Outreach Specialist, was born and raised 20 minutes from Disneyland, and loves astronomy!

She's studied Physics, has a passion for teaching, and spent *seven years* working for science museums.

Investigation and Construction

Suggested Timeline: Nov/Dec

Gotta use *something* to sling those eggs through the air.

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

If they go with our in-house version, they have plenty of help!

First, we have an instruction 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.

In addition, *this* year students came to our classroom facility and used some of our tools, such as drill presses, to help them create their own catapult kit.

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Sunny Destiny

Call it fate, fortune, luck, or kismet, but our destiny is looking *brighter* and *brighter.*

Please give a *warm* welcome to our newest DoD STARBASE NM classroom assistant, Destiny "Sunshine" White. She hails from sunny California, and enjoys helping our students learn STEM and achieve challenging accomplishments.

Mission to Mars For Fifth Graders

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

Full-Sized Training

First time Mission to Mars teachers attended a full-sized in-person New Teacher Training session on 12 October 2022.

The training included Mission to Mars activities such as designing a life support system and a riddle about one of its Mars Facts, writing a saga, and constructing a full-size model of the inflatable habitat the students will build on Link-Up Day.

Read The Manual

The Mission to Mars **Teacher Resource Guide** (TRG) provides step-by-step instructions and forms for the activities students will work on in their classroom during the "Base Operations" portion of the Mission to Mars.

There's even some quiz questions to check your understanding.

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. But be sure your class completes the activities prior to the **Link-Up Day event, 28 April 2023!**
- Have students learn "Mars Facts," and work on sagas and mission patches
- Sing really loud whenever you're alone in the car and your favorite holiday tune comes on the radio

Busywork

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

You can also make a little 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 design a separate section of the life support system model, based on that Fact.

Whatever works best for *your* class.

Poster Session

Some of the cool posters Mars teachers got as prizes during the New Teacher Training event are FREE for download from NASA and JPL: https://mars.nasa.gov/multimedia/resources/mars-posters-explorers-wanted/ and https://mars.nasa.gov/resources/7701/travel-posters-from-nasajpl/.

TECH Mission For Middle Schoolers

Technology and Engineering Challenges—Rocketry and Satellites Missions

Launch Time!

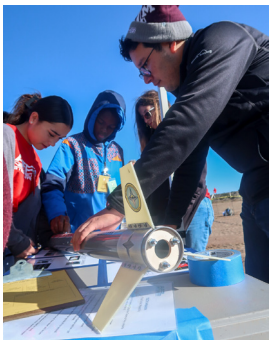
Continued from page 1

The students divided up into teams, much like a real world rocket crew would, to prep and launch their rockets.

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

This year, six teams picked *Phoenix*; three each picked *Apollo, Saturn,* or *Spirit*; two each picked *Atlas, Gemini,* or *Opportunity*, and one team picked *Mercury*.

The Assembly Team verified that the *bats* weren't *corked*...no, wait, that



was at the World Series! At the *rocket launch*, the Assembly Team added a *parachute,* an *altimeter,* and a *motor* to the rocket. No cork needed.

The Range Safety Officer students checked with Meteorology students to make sure the Big Game wasn't going to get delayed due to wind, checked with the Spotter Team that skies were clear of aviation and flying baseballs, and counted down the launch.

The Launch Control Officer student pushed the Launch button, and the rocket took off....*whoosh!* An onboard altimeter tracked how high the rocket flew.

Spotter Teams tracked the rocket's flight...it's a high fly ball to left center field...it's going, going, *gone!* Then they directed the Recovery Teams to where it 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).

Later, on Day 3, students will compare this data to their *RockSim* simulations to figure out why real-life launch data differs from predicted computer model results. You know... kinda like *baseball stats*.

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

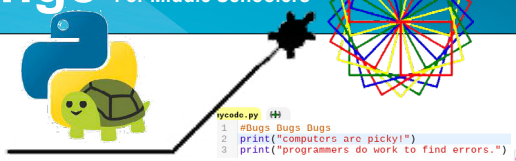
Intro to Programming

We have over 100 teams registered for the Robotics Challenge Competition this year! Wow!

Not all teams were able to start at the same time, however; some are still getting their bearings.

So, we have decided to **extend** the **Module 1 deadline** (originally 11 November) to **16 December 2022** to give everyone a chance to get a good start to the Challenge.

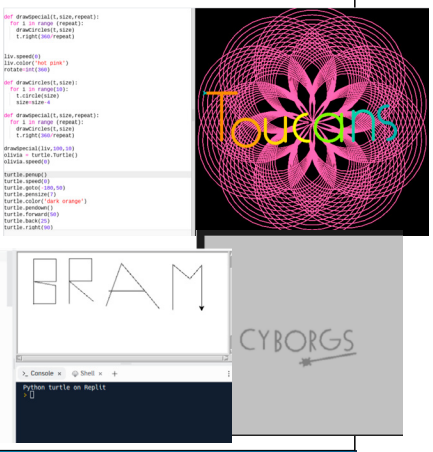
Which is a good thing, because there's a lot going on in Robotics Challenge Module 1, *Intro to Programming*. It gives students the skills to program, or *code*, in the computer language *Python*.



It starts with familiarizing students with binary numbers. Then it gets into programming functions and variables in the code...even getting Python to do some math! Not to mention students do some good old-fashioned *debugging*. Bugs, bugs, bugs. Computers are picky! Programmers do work to find errors.

Next, students learn how to draw using Python's Turtle graphics module. Student teams get good at this, they can draw their team's name using the turtle!

Adding another trick to their arsenal, students can also use For-Next loops in their drawing code... turning a simple oval into a virtual spirograph! Some teams have already started turtling around in Python, drawing some pretty cool names and spirograph patterns, as you can see here.



Questions? Suggestions? Don't just sit there like a turtle! Contact lynn@afrlnewmexico.com!

STEM Challenge For High Schoolers

Investigation and Construction

Continued from page 1

Whatever launching device type the students choose, once they have assembled it, it's time for the next step:

Launching Device Performance Characterization Data Collection.

Now it's time to explore how the launching device works. The team coach has a hackysack that can be used as a payload to test the device.

It's about the same mass as the raw hen's egg the teams will be flinging, so it's a great way to test the device without getting any egg on your face.

DoD STARBASE NM For Fifth Graders

Now Rolling Great

In DoD STARBASE NM Day 3 Technology, students are rolling right along. Actually, they're Now Rolling Great, or NRG.

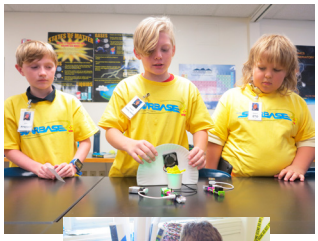
See, "technology" is anything man-made that solves problems and makes life easier. But there's a catch: Technology requires some form of NRG... I mean, *energy*.

There's lots of *types* of energy: It can be *potential* or *kinetic*, and it can assume many different forms, such as *heat*, *light*, or *electricity*, to name a few.

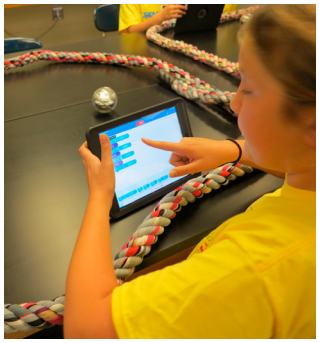
The total energy of the universe is *constant*. It cannot be created or destroyed...but it *can* be *transferred*.

The students are already full of energy, so in Day 3, they transfer some to each other...in a *human circuit!*

Students also transfer some of that energy into creatively building a little bit of technology using littleBits, electronic components used to construct little techno-gadgets.



Students then transfer some of their energy into programming some little rolling Sphero robots to move and navigate around and help Astro the Space Puppy find his toys. Now they're Rolling Great.



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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

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!

Recertified Level III

AFRL's Ms. Joanne Perkins recently published a very nice article about our DoD STARBASE NM program recently being recertified at STARBASE's highest level, Level III.

An excerpt from the article is below.

"The Air Force Research Laboratory's Department of Defense STARBASE NM program, managed through the AFRL STEM Academy, Kirtland Air Force Base, New Mexico, received accolades and certification to the highest level, for its work with fifth graders in science, technology, engineering and math, or STEM.

The National DOD STARBASE Program, managed by the Office of the Assistant Secretary of Defense for Manpower and Reserve Affairs, inspects individual programs for class size, the number of topics presented per classroom, financial accountability, equipment, program management, personnel, outreach requirements and management of volunteers, as well as conducts interviews with staff, students, teachers and principals.

"We say, 'hands-on, minds-on' because young people learn and get excited about projects they can touch," said Esti Gutierrez, program director. "We introduce concepts and describe potential career paths in the disciplines of engineering, math, physics, chemistry and technology. It's important that students explore STEM in context so they can connect what they are learning to the world around them."

The AFRL STEM Academy staff prepared many months for the certification inspections.

"The certification to a level III program is an arduous process," Gutierrez explained. "After many months of preparation, followed by an on-site inspection, we not only passed the inspection, but several of our efforts were recognized as best practices."

Only five of the 75 DOD STARBASE programs nationwide carry a level III, or high performing, designation, indicating they have achieved both level I and II status, and have made significant advances in the STARBASE vision and mission...

...The Academy added STARBASE 2.0 for middle school students in 2015, and is now piloting a STARBASE 3.0 program, with Junior ROTC at Del Norte High School in Albuquerque, New Mexico."

Thanks, Joanne! To see the full article, visit https://www.afrl.af.mil/News/Article-Display/Article/3199821/afrl-stem-unit-receives-dod-starbases-highest-level-award/.

STEM Bytes

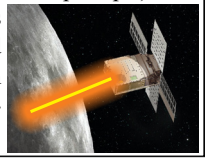
STEM News

- Upper level high school students: **AFRL Scholars** at Kirtland AFB is accepting Summer 2023 **applications now through 10 January 2023**. See https://afrlscholars.usra.edu/apply/ for more information.
- DiscoverE's **Engineering Week** (19-25 February 2023) theme is "Creating the Future." See https://discovere.org/.
- Hey, buddy, can you spare an hour? **Hour of Code** (https://hourofcode.com/us) is coming during Computer Science Education Week, 5-11 December 2022.
- See NM Tech's STEM Outreach website at www.nmt.edu/stem/ for information on Science Olympiad, the NM Science and Engineering Fair, Combat Robot tournaments, and more!

Space News

See www.space.com:

- *Artemis 1* , NASA's moon rocket, may try a test flight launch as early as 11:04 pm MST, 15 November 2022.
- The results are in: DART, the *Double Asteroid Redirection Test* probe, was successful at redirecting the path of the asteroid it impacted.
- On 24 December 2021, the Insight lander detected a large quake shaking Mars to its core. The crater from the meteorite that hit it was photographed by the Mars Reconnaissance Orbiter.
- The *Lunar Flashlight*, a cubesat that uses a laser to search deep lunar craters (and potentially Martian craters perhaps!) for water ice is scheduled to launch 22 November 2022.



Coming Next Issue...

- MM Patches, Facts, and Sagas
- TECH Flight Day 3
- News, Info, Fun… and Holidays!

Watch for it!