AFRL
NEW MEXICO
STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

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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!

Reimagining The Possible

How is it possible? February is the shortest month, but it has so much crammed into its 28 little days...There's Valentines, Presidents, and lots of STEM and chocolate *everywhere!*

DiscoverE's Engineers Week (20 to 26 February) is a time to celebrate engineers and engage the next generation of innovators. This year's theme: *Reimagining the Possible.*

DiscoverE's Girl Day (*Introduce a Girl to Engineering Day*, 24 February) is a worldwide campaign to engage girls in engineering.

Hey! 24 February...thats the date of our *Mission to Mars Mid-Year Meeting!* Well, that's us...we help students "reimagine the possible" all year long.

STARBASE Directors Trained

DoD STARBASE
A Department of Defense Youth Program

On 26 and 27 January, 2022, the national DoD STARBASE program, which our fifth grade DoD STARBASE NM program is a part of, came to *our* facility on Kirtland Air Force Base, to hold the first ever Director's Launch Training for new STARBASE Directors across the nation.

While here, they got to see some of our own STARBASE magic in person.

New STARBASE Directors from all over, including Florida, Hawaii, even Guam!...attended the conference, got a tour of our facility, and saw Sundance Elementary attending their DoD STARBASE NM class as a bonus!

Noms Open

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

Nominations are now open for the 5th Annual NM Excellence in STEM Awards (the "STEMYS").

If you know someone deserving of recognition for their work in science, technology, engineering, or math education, nominate them today.

The Air Force Research Lab Tech Engagement Office created the STEMYS in 2018 to celebrate those individuals and groups that are making a difference in STEM activities and education in New Mexico. Nominations for this year's awards will be accepted through March 4, 2022.

Nominations must be submitted online at: www.afrlnewmexico.com/stemys.

Winners will be honored at a ceremony in June 2022. Some category winners will be eligible for scholarships and monetary awards.

Our New Tesla

No, we didn't buy a new car. Our newest Tesla is Jessica "Tesla" Law, our new STARBASE Educator!

Like the electric car company, her call sign is named for inventor Nicola Tesla. She's been a math and science teacher around NM for years! Let's give her a warm welcome, and remember... Be respectful to her, because anything she disagrees with is automatically against the Law!

Mission to Mars

For Fifth Graders

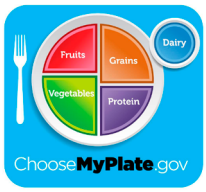
Mars Vast Interferometer Variable Array (VIVA) Mission 2021-2022

Lunch Matters

Ask any astronaut—actually, ask *anyone*: Lunch matters!

So, with that in mind, let's discuss some lunch matters on Mars.

Our Mission to Mars student crews use teamwork, problem-solving, and, yes, *math* to plan and pack a nutritious, space and weight-saving Link-Up Day lunch.



See, in any trip to space, the nutritional value of the food is important...but so is its *mass*.

Mass is defined by the amount of *matter* in an object. The less matter the food has, the less *inertia* it will have at lift-off, which will save on expensive fuel costs.

Space will be limited, too.

So, students plan a nutritious, tasty, four-food-group lunch, but with *mass and volume requirements*.

Include at least *236 mL* (8 fluid oz.) of liquid per crew member; total food and liquid mustn't exceed *568 grams* (20 oz.) per crew member (Teacher's Resource Guide pp. **79-80**). Teachers and adults bring the same lunch as the students. Carry all food in 12 or fewer 1-gallon ziplock bags.

Rosalind Ready

The ExoMars *Rosalind Franklin* Mars Rover has passed its most recent round of tests and is on track for launch as early as 20 September 2022.

It's goal: Search for signs of life on Mars, studying geochemical and potential biological signatures in the area around the landing site.

A wise guy: It will take an instrument called *Water Ice Subsurface Deposits Observation on Mars* (WISDOM), a ground-penetrating radar to look for interesting subsurface places to drill into. See www.space.com.

Uniforms

Uniforms provide groups with a sense of identity, safety, spirit, and purpose. Each Mission to Mars crew designs their uniforms in advance of their journey.

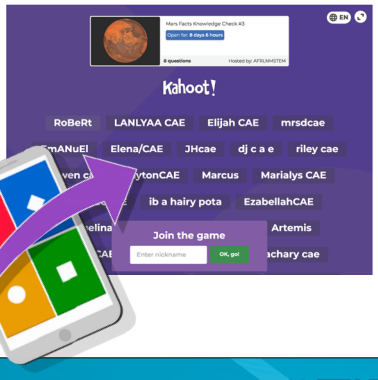
They don't have to be fancy; matching T-shirts and jeans will do. Mission patches, headgear, and other accessories are optional (see pp. **77-78** in the Teacher's Resource Guide.)

Students, teachers, and assisting adults also wear a *nametag,* as part of their uniform, including:

- School, Student, and Teacher Name;
- Colony Habitat Number (the habitat each crew is responsible for building).

Your commitment to this mission is crucial to its success

Kahoot! Kontinues



The Mars Fact Challenge Kahoot! games are continuing. Challenge #3 will be up until 18 February 2022, and then it's on to Challenge #4!

See https://afrlnm.com/stem/2022-mars-viva-mission.

Mark Your Mobile

It's almost here! Mars teachers, Mark Your Mobile, specifically the calendar app in it, for the mandatory Mid-Year Meeting coming up on 24 February 2022.

Head there, and we'll hand you some habitat plastic for Martian home-building.

DoD STARBASE NM

For Fifth Graders

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.

Massive STEM Education

In DoD STARBASE NM Day 1, students get a massive STEM education when they explore *mass*, the amount of matter in an object. Mass can be measured in *grams* using a Triple Beam Balance.

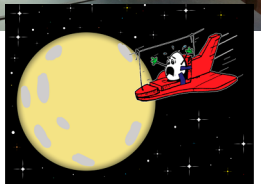
Students use the Triple Beam Balance to mass different cubes, representing different metals, to determine the composition of each cube.

Knowing how to determine the mass of objects comes in handy when the students design a restraint system to save Eggbert the Space Shuttle Pilot as he crashes on the "moon."

The students, just like real-world engineers, have certain parameters to follow. They can choose from a variety of different materials to build their restraint system, but each has a price tag and a certain mass.

Student teams are allowed a budget of only 450 "dollars" to build their device, and the mass of the device and the lander cannot exceed 350 grams.

They also explore 3D CAD software PTC Onshape to help a character named Bunsen search a computer aviation model for hidden objects in a virtual *scavenger hunt.*



Fortunately, they don't have to *mass* the objects they find... It would be hard to get them onto the Triple Beam Balance!

TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Rocketry and Satellites Missions

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.

Power, Programming, and Pixels

The TECH Mission Spring semester has started, and the classes all orbit around one thing: Satellites!

Meanwhile, the satellites are all orbiting around something *else*, like the Sun or the Earth. Because that's what satellites *do*, regardless of whether they're natural, like planets and moons, or man-made, like the GPS satellites that help your phone figure out where it is.

The Air Force Research Laboratory knows all about satellites, because they have a whole Directorate on Kirtland Air Force Base working on satellites and satellite technology, such as their *Roll-Out Satellite Array* (ROSA), a flexible, roll-up solar panel for satellites.

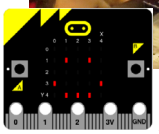
NASA knows about satellites, too... They just put the James Webb Space Telescope satellite into its "L2" orbiting point around the sun.

TECH Mission Day 1 students explore various aspects of man-made satellites, such as *power, programming*, and *pixels*.

Every man-made satellite has various electronic components on it, like cameras, sensors, and antennas. But all those components require electrical *power*, which flows in *circuits*.

So, TECH Mission Day 1 students explore making their own electrical circuts using *snap circuit boards*.

Those components need to be programmed how to function, so students explore *programming* with a Python computer language editor, to program a *micro:bit microcontroller*.

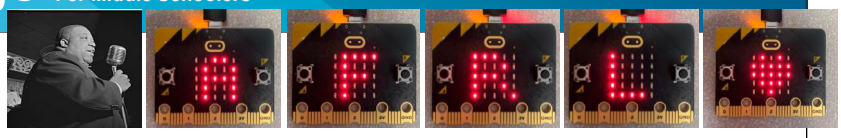


Even though they measure only about 4x5 cm, these micro:bits are packed with features, including a 5X5 grid of tiny LED lights that can be programmed to display images such as smiley faces.

Each LED in the grid represents one pixel, or *picture element*, and it's always either on (1) or off (0). Satellites can transmit images and other data to ground receivers using only ones and zeros.

Robotics Challenge

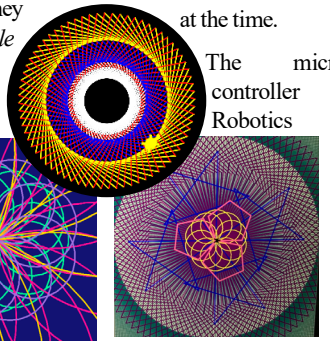
For Middle Schoolers



Mr. Five By Five

Robotics Challenge Module 1, *Intro to Programming*, has closed, culminating in students submitting Spirograph-like *mosaics* they programmed the computer's *turtle module* to draw.

A gallery of their mosaics can be found on the Robotics Challenge section of our website at https://afrlnm.com/stem/turtle-mosaics-gallery/.



A popular song written in 1942 called "Mr. Five by Five," was about a man named Mr. Jimmy Rushing, the featured vocalist for the Count Basie Orchestra at the time.

The micro:bit controller the Robotics Challenge students explore this month in Module 2, *Using the Micro:bit*, never had the chance to sing in the Count Basie Orchestra—but it *also* could be called "Mr. Five by Five."

In between all the other little buttons and sensors on the mirco:bit, there's a 5X5 grid of LED lights, which the students program to make flashing and scrolling images with.

Students learn how to program the micro:bit to play a "Rock, Paper, Scissors" game, but they'll have to check with Sheldon from *The Big Bang Theory* on how to add Lizard and Spock.

Students also work with the micro:bit's light, temperature, and motion sensors, and even transmit images to other microbits like a digital walkie-talkie!

Interested in participating as a coach or an Expo judge? Contact Lynn@afrlnewmexico.com for more info.

STEM Challenge

For High Schoolers

Inte-Great!

Timeline: February/March

Don't mean to sound like an *ingrate*, but if STEM Challenge teams would *integrate* (combine) and *test* their payload protection and launching devices, rather than *grate* their egg payloads, that would be *great*.

Teams place a 3' target 30' away from the launching device, select a launch configuration (arm stop setting, tension setting, arm length, number of rubber bands, etc.), and launch a raw hen's egg at least three times. Teams must photo or video at least one of the launches.

Once they get fairly consistent results from each launch, teams record/analyze five launches. Does it pass the test? Is the device providing enough range? How far does the payload travel after initial impact? Does the egg survive? Great!

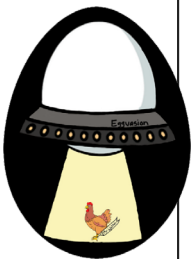
Great Logos!

We're getting some great logo submissions!

Remember—Teams must complete **Assignment #1—Team Identity** to be registered in the STEM Challenge Symposium!

The **Symposium** is scheduled for **5 April 2022**, less than two weeks before Easter Egg time!

Team 06--ATM Catapult



Team 12--Eggvasion

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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

STEM: Science, Technology, Engineering, and Math

TECH: Technology and Engineering Challenges

USAF: United States Air Force

USSF: United States Space Force

VIVA: Mars Vast Interferometer Variable Array Mission 2021-2022

Remember, Teachers:
Get those EPA Modification forms in!

STEM Bytes

Space News

Moon Water

China's *Chang'E 5* lunar lander recently became the first to find water on the moon in *real time*, using a *lunar mineralogical spectrometer*. Up to 180 parts per million in one boulder! See www.space.com.

Ever wanted to go swimming in the moonlight? Now's your chance!

Student Rover First

The *Iris* lunar rover, built by Carnegie Mellon University students, is on track to launch later this year with Astrobotic's Peregrine lunar lander mission.

It aims to be the first *American*, first *student-made*, and *smallest* uncrewed lunar rover.

See www.therobotreport.com.

Play Nerdle!

1	1	+	1	1	=	2	2
2	3	+	-	4	=	1	9
2	*	5	+	3	=	1	3
2	0	-	+	4	=	1	6
2	/	2	+	9	=	1	0
2	+	8	+	7	=	1	7

First, there was Mastermind: Deduce the pattern of colored pegs. Then, there was Wordle: Deduce the letters in the secret word.

Now, there's Nerdle: Deduce the characters in the *math equation!*

Play free at https://nerdlegame.com.

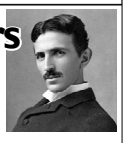
Teen Pilot Solo

Nineteen-year-old pilot Zara Rutherford recently became the youngest woman to fly solo around the world.

On 20 January 2022, she landed in Belgium after an around-the-world solo flight that started last August. In so doing, she also became first woman to circumnavigate the world in a microlight aircraft.

You listening to this, Gabe? The gauntlet has been thrown!

Tesla Honors



In honor of our newest STARBASE Educator, Jessica "Tesla" Law, we thought we'd mention some of the honors the Tesla name has gotten over the years.

Her call sign comes from inventor, electrical and mechanical engineer, and futurist Nikola Tesla (Никола Тесла), 10 July 1856 – 7 January 1943. Tesla is probably best remembered for his contributions to electricity, specifically Alternating Current, the "AC" in "AC/DC."

SpaceX owner Elon Musk also owns the Tesla electric automotive company, also named for the famed inventor. Four years ago this month, SpaceX launched *Starman*, an astronaut mannequin in a red Tesla Roadster, into space to orbit the Sun, trackable here: www.whereisroadster.com.

The *tesla* (symbol: T) is a derived unit of magnetic flux density.

Tuskegee Honors

Did you know? Annually during the summer, we support the General Lloyd W. "Fig" Newton Chapter Tuskegee Airmen, Inc.'s week-long Aviation Camp. It's an intensive week where students get an in-depth look into the world of flying aircraft, culminating in their taking the controls of a real Cessna, with a Civil Air Patrol co-pilot seated nearby.

The Tuskegee Airmen were an elite and groundbreaking squad of African-American combat fighter pilots and support staff in WWII.

Charles McGee, 102, one of the last surviving Tuskegee Airmen, recently passed away. He had been given an honorary promotion to Brigadier General by President Trump in 2020.

The 332nd Fighter Group, better known as the "Tuskegee Airmen," quietly made history in 1949 when they were declared winners of the first "Top Gun" contest, formally known as the Air Force's *First Aerial Gunnery Competition.*

This impressive award was not well-publicized...until last month, on 11 January 2022, when they were formally commemorated with a plaque at Nellis Air Force Base.

Coming Next Issue...

- Habitat Construction
- DoD STARBASE Day 2
- STEM Challenge Final Report

Watch for it!