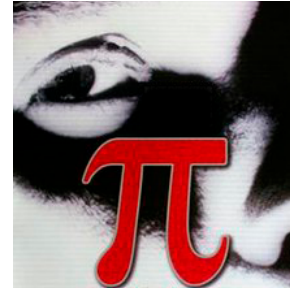




# The Rocket Report

## March Math-ness



from the word *al-Jabr* in the title of his book on mathematics. He was a real mathematical *pi*-oneer! What would STEM be without math, and what would math be without pi?

### In This Issue...

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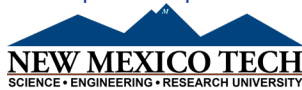
March is full of math-ness. Pi Day (3.14, March 14) also happens to be the birthday of Albert Einstein and astronaut Frank Borman, both of whom used math to get where they were going.

Pi ( $\pi$ ), the ratio of a circle's circumference to its diameter, a fundamental mathematical constant, has been studied and calculated since ancient times. There was even a movie called Pi in 1998.

Pi has now been calculated to over 62.8 (double 31.4) trillion digits, some of which *may* be overkill. If you drew a circle around the entire known universe, you'd only need 39 decimal places of pi to compute the circle's circumference to within the radius of a hydrogen atom.

Mathematician Al-Khwarizmi, whose name gave us the word *algorithm*, calculated pi to four digits: 3.1416. The word *algebra* comes

In partnership with:



Collaborator:



### Remember, Teachers:

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

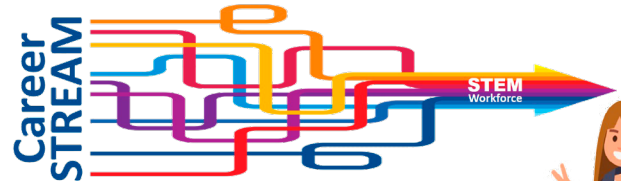


## Career STREAM

Do you know a high school junior or senior who has an interest in STEM, likes to tinker, fix things, bring things to life, or has shown innovative ways to solve problems in or out of the classroom?

One who may not have decided yet whether STEM is for them? One who perhaps doesn't have access to explore opportunities in STEM content and careers?

Career STREAM is a paid sum-



mer apprenticeship program for high school populations underrepresented in STEM.

STREAM stands for STEM Trajectories: Research Engagement for Apprentices and Mentors.

**Applications are being accepted now through 31 March 2022!**

All required materials and equipment will be provided to each apprentice.

For more info, or to apply, visit our website at <https://afrlnm.com/stem/stem-opportunities/#career-stream>.



## Mid-Year Meeting Met

The week of 20-26 February 2022 was known as DiscoverE's Engineers Week. This year's theme was "Reimagining the Possible."

Thursday of that week, 24 February 2022, was "Girl Day" (Introduce a Girl to Engineering Day).

It might be nearly *impossible* to imagine the odds, but by an amazing coincidence, that was also the day that Mission to Mars teachers happened to meet at the Mid-Year Meeting this year!

Dozens of fifth grade Mission to Mars teachers came to our facility to attend the training.

### Plastic and LUD Info

When they first arrived, they discovered a truck passing out plastic and duct tape. These materials will come in handy back in their classrooms, when they help their students assemble the plastic habitat

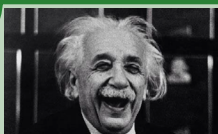


pieces they will need to bring with them on Link-Up Day.


Inside, teachers received a run-down 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 19 April 2022.

*Continued on page 2*




**Albert Einstein says:**  
**HAPPY 94TH BIRTHDAY**  
to oldest living astronaut **FRANK BORMAN**



**Commander of Apollo 8,**  
first mission to orbit the Moon!

**$\pi$**   
Born on  
**PI DAY.**  
3/14/1928





# Mission to Mars

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

## MidYear 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 at first on the Red Planet.



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

### Build Practice

Teachers also got to practice building a scale model of their habitat at the meeting.



**Your commitment to this mission is crucial to its success**

## Construction and Pre-Fab

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.

### Pre-fab before attending Link-Up Day!

Silver Teams will have to scramble to finish incomplete pre-fab on Link-Up Day! Better to finish it in advance.

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.*

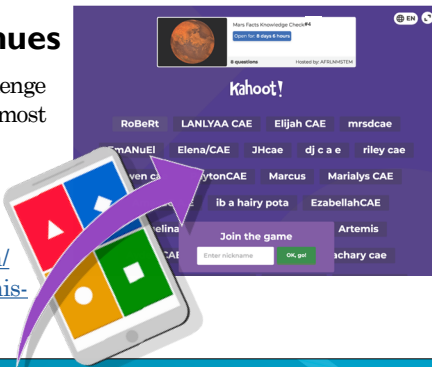
The **connecting tunnels** should be connected to the habitat, *as close to the floor as possible.* Think *short and fat* tunnels.

## Kahoot! Kontinues

The Mars Fact Challenge Kahoot! games are almost done.

Only two to go: #5, and #6!

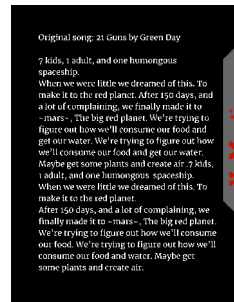
See <https://afrlnm.com/stem/2022-mars-viva-mission>.



## Cool Creations

Students continue to create some pretty cool stuff.

Like sagas and mission patches, for example!



## DoD STARBASE NM

For Fifth Graders

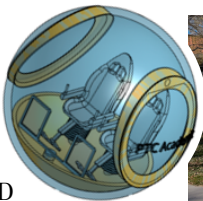
By the Tuesday of the week before the first class in the series, session, or semester, we will ask you for the name, driver's license number/state of issue, date of birth, and the FULL Social Security Number, of every adult coming through the base gate for that series of classes.

## Fizzics

Besides making something called a Gyrosphere in PTC Onshape CAD software, In DoD STARBASE NM Day 2, Physics, it's not quizzical when students get fizzical.

Students get into the motion of CO<sub>2</sub> fizz force with activities such as Pop Goes the Fizz, and making and racing little CO<sub>2</sub> dragster cars.

Sir Issac Newton was apparently a whiz at fizz!



## No Snow, So Go, 2.0!

Some days, it just forgets to snow, so Albuquerque School of Excellence (ASE) and Albuquerque Institute of Math and Science (AIMS) STARBASE 2.0 students have been launching rockets at Isleta Amphitheater during March 2022.

They're preparing to enter The American Rocketry Challenge national competition, and qualifying-launch time is less than a month away!





# TECH Mission For Middle Schoolers

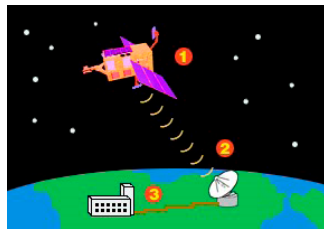
Technology and Engineering Challenges—Rocketry and Satellites Missions

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.

## Satellites, Sensors, and Micro:bits

Satellites use many different types of sensors and instruments to perform all sorts of tasks. For example, satellites use sensors to:

- See weather,
- Map Earth,
- Detect the health of the environment,
- Tell if something has been removed or added to the environment,
- Track migration patterns of animals, and even
- Take pictures of the ground from high overhead.



Sensors must be programmed to communicate with computers to obtain and send data.

Most satellites send and receive data with Earth using radio waves carrying long strings of numbers, in binary (0 and 1) digits. For example, to transmit a picture the satellite took, it sends informa-

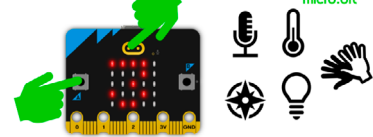
tion about the brightness of millions of image "pixels" recorded by the satellite's camera sensors.

Using computer code, students in Spring TECH Mission Day 2 explore some of the sensors on a *micro:bit* microcontroller.

Though only about as big as a wristwatch, these things are packed full of sensors and controls, capable of reading temperature, light levels, orientation of the device, and detecting sounds!

For example, students use the *accelerometer* to detect and count how many times the micro:bit was shaken, tilted, or dropped.

### micro:bit sensors



They also use the *temperature* and *light* sensors to detect the temperature and light levels in the room!



## Robotics Challenge For Middle Schoolers

### Domo Arigato, Mr. Roboto

*You're wondering who I am (Secret, secret; I've got a secret) Machine or mannequin (Secret, secret; I've got a secret)*

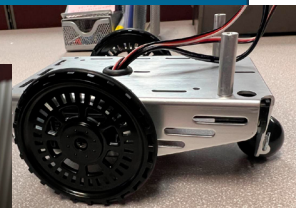
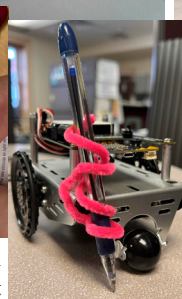
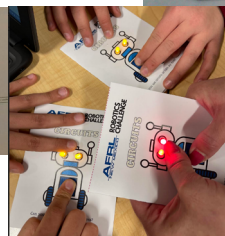
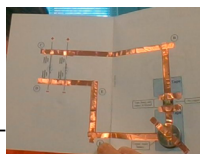
Well, the secret's out...I'm neither machine *nor* mannequin! I'm a *paper circuit robot*, and I'm the first thing the Robotics Challenge students make this month as they explore Module 3--Building and Programming the Robot.

Challenge 15, Module 3, has students lay down copper tape, LED

lights, and a flat-cell battery in a particular fashion to make a paper circuit robot with eyes that light up when you push the button.

It helps the students become familiar with electric circuits, preparing them for the later challenges of building, naming, and programming a wheeled Parallax robot to navigate, follow lines, clear debris, and avoid obstacles.

Along the way, they learn how to



predict the code they'll need to move and turn the robot different amounts, and how to move the robot in particular patterns, such as in a big hexagon.

Module 3 is due at the end of March. It's all part of the students' journey preparing them to com-

pete in the Robotics Expo, coming up on 6 May, 2022.

Interested in participating as a coach or an Expo judge? Contact [Lynn@afrl-newmexico.com](mailto:Lynn@afrl-newmexico.com) for more info.

Thank you very much, O Mister Roboto. I'm Kilroy! How do you do?



## STEM Challenge For High Schoolers

### Report Report

#### Timeline: March

Even the Joker knew: You can't make an omelette without breaking a few eggs.

Teams will start summarizing their work; not into an omelette, but into a **final report**. Completed *before* the Symposium, it makes an egg-cellent tool to help teams prepare for the **Presentation** 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.

There's only one more omelette to make...the **STEM Challenge Symposium, on 5 April 2022!**

### Eggcellent!

Teams must complete **Assignment #1—Team Identity** to be registered in the **STEM Challenge Symposium...**and judging from all the egg-cellent logos being submitted, this Symposium should be egg-stravagant!

Dozen that sound egg-citing?

#### SHANGHAI

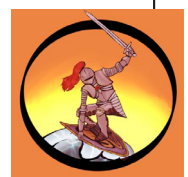


#### KAOS

Team 13--  
Shanghai Kaos



Team 14--  
Scorpii



Team 15--  
Serf's Up

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Albuquerque, NM 87119  
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[www.afrlnm.com/stem](http://www.afrlnm.com/stem)

YouTube Channel:  
<https://www.youtube.com/channel/UC-QuOSd1XTkYuXPONZwAIHQ/videos>

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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

**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

## Tech Pioneers

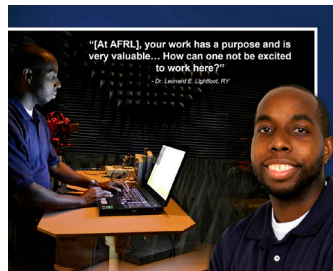
The Washington Post ([www.thewashingtonpost.com](http://www.thewashingtonpost.com)) recently had an article highlighting some African American technology pioneers:

- In the 1880s, Jan Matzeliger invented a machine that could sole shoes faster.
- In the 1980s, Patricia Bath invented an improved device for laser cataract surgery.
- George Carruthers led a team that sent a telescope to the moon on Apollo 16 in 1972.
- Electrical engineer Sandra K. Johnson helped develop an early version of IBM's "Deep Blue" chess computer.



- Among other things, inventor Garrett Morgan invented early versions of the traffic signal and gas masks.
- Gladys West led a geodesy (ge-ODD-es-see) satellite survey of the Earth's surface...the basis for the Global Positioning System (GPS). She still reportedly prefers paper maps, though—probably because she knows how to fold the darn things back up!

## AFRL's Lightfoot Wins STEM Award



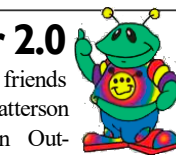
Congratulations to AFRL's Dr. Leonard Lightfoot, nominated by AFRL's Sensors Directorate, who recently received the 2022 Black Engineer of the Year Award in STEM for Professional Achievement.

Dr. Lightfoot encourages young STEM-oriented minds to take advantage of opportunities (such as AFRL NM STEM Academy!) when they present themselves.

## Another 2.0

Shout-out to our friends at Wright-Patterson AFB Education Outreach, who have their own version of STARBASE 2.0 going—complete with electric circuitry, sound/vibration, and robotics projects.

Oh, hi-oh, Wright Patt!

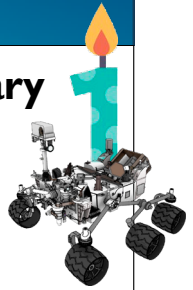


## Percyversary

On 18 February 2022, the Mars Perseverance rover reached its one-year Percyversary of being on Mars.

It celebrated by performing its first multiple-sol drive (a sol is a Martian day). It broke the record for longest-single-sol distance by any Mars rover (319.79 meters), and the longest distance of any Mars rover in a single plan without ground intervention (509.75 meters).

See [www.space.com](http://www.space.com).



## Student Reaches for Five Stars

Anna Brusoe, a 16-year-old home-schooled high school junior from Morgantown, West Virginia, was so inspired by the thought of women in STEM that she recently wrote an entire book about it!



The 40 page book, which she wrote and illustrated herself, called *Reaching for the Stars: 5 Influential Women Scientists Who Changed The World*, profiles the lives of five female STEM pioneers.

Geared to elementary school-aged students, the book even includes a glossary of terms and a punctuation guide.

Among the inspirational female STEM pioneers she highlights are:

- Mathematician Katherine Johnson, featured in the movie "Hidden Figures," one of the first African American women to work as a NASA scientist.



As a "human computer," she calculated orbital mechanics for the Project Mercury, Apollo, and Space Shuttle programs.

• Vietnamese-born Dr. Jane Luu (Luu Lê Hằng), an astronomer and defense systems engineer. She co-discovered the Kuiper Belt, the icy orbital ring past Neptune where comets and asteroids are formed.



• Oklahoma Cherokee Mary Golda Ross, first known Native American female engineer, and first female engineer in the history of Lockheed Corporation, who helped design and improve P-38 fighter planes in WWII.



In a few years, we may even have to add Anna Brusoe to her own book!

Schools and organizations interested in receiving electronic copies of Anna Brusoe's book, email [reachingforthestars.projectnews@gmail.com](mailto:reachingforthestars.projectnews@gmail.com) for more information.

## Coming Next Issue...

- LUD Things to know and bring
- Symposium Time
- Expo Coming
- Tours and Events

**Watch for it!**

