

AFRL

NEW MEXICO STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

Star Date: March 2020
Volume XVII, Issue 7



The Rocket Report

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Due to precautionary measures related to the Corona Virus, including school closures, we are implementing changes to our missions and events, including virtual activities that we'll be posting on our website and facebook page.

As the situation evolves, we will provide updates.

Saturdays are Super for STEM



On Saturday, 22 February 2020, AFRL NM Tech Engagement hosted the third annual Super STEM Saturday event at the Albuquerque Convention Center, and wow, was it ever *super!*

We estimate more than 4,000 visitors attended this event, which was free to the public. It featured stage shows by nationally renowned presenter “Science Bob” Pflugfelder and several other STEM enthusiasts from the local community.

AFRL NM STEM Academy provided a display on Why Spin Matters, where visitors got to explore gyroscopic effect, angular momentum, and control moment gyro concepts.

There was even a spinning Hoberman Sphere that would spin *faster* when it was pulled inward on itself, because more mass was near the center of the sphere.

Special guests included Orbit, the Albuquerque Isotopes mascot; and some of the classic characters from the Pre-Disney Era of *Star Wars*. Fun times.

AFRL volunteers for the Why Spin Matters display included: Capt Mark Bateman, Capt Benjamin Fried, Ralph Kelly, Michael Sexauer, and Jason Sullivan.

Other AFRL STEM professionals also set up and manned interactive STEM displays, including:



Dr. Jake Grosek – Wind Tunnel, Dr. Tom Miller – Oudin Coil Bottle Launcher, Liam O’Brien – Maker Lab Express, Dr. Tom Peng – Fuel Cells, and Dr. John Tam – Water Table.

A big thanks to all of the AFRL volunteers who assisted at these and other displays during the Super STEM Saturday 2020 event!

In partnership with:



Collaborator:



Remember, Teachers:

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



Celebrate **WOMEN'S (STEM) HISTORY MONTH**



What's All the Brouhaha?

There's been a lot of brouhaha over Ms. Bruja lately.

Turns out, our very own DoD STARBASE NM Instructor, Ms. Lynn Embick, was just selected to receive the Civil Air Patrol's “New Mexico Wing Aerospace Education Officer of the Year” Award!

Her call sign, Ms. Bruja, means “witch” in Spanish. But she's the “good” kind, like Glinda, the Good Witch of the North. (She used to teach in Salem, MA.)

And she is apparently very good at teaching aerospace concepts to students, because they give this award to “recognize and reward any Civil Air Patrol (CAP) member who is dedicated to promot-

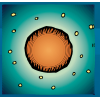
ing and teaching aerospace to the members of CAP, and to spreading the excitement of aerospace to their communities.”

Sounds like Ms. Bruja, all right! Congratulations, Ms. Embick!!!



Ms. “Bruja”





Mission to Mars

For Fifth Graders

Mars Exoplanet Transient Satellite (METS) Mission 2019-2020



Mars Exoplanet Transient Satellite (METS) Mission 2019-2020

Due to precautionary measures related to the Corona Virus, including school closures, the 2020 Mission to Mars is transitioning to online, virtual activities.

Continue to **send in your Crew Registration Forms** so we can print certificates for those who take part in the **virtual Link-Up Day**.

As the situation evolves, we will send updates. Please let us know if you have any questions.

Virtual Days

Welcome to virtual reality. This year, instead of having all the schools report to the Albuquerque Convention Center for Link-Up Day, we are working on converting to a more *virtual* mission.

ExoMars X'ed

Due to the Corona Virus situation, the joint Euro-Russian ExoMars mission, including the *Rosalind Franklin* rover, planned for later this year, has been postponed until August-October 2022.

Habitat Habitats

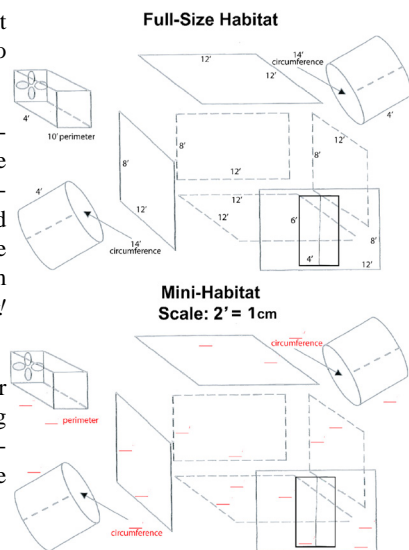
Voilà! Link-Up Day--The Home Version!

Stuck at home, unable to get to the launching pad to go to Mars this year? No problem!

With an ordinary sheet of paper, a pair of scissors, a little scotch tape, and some imagination, your homebound astronauts can make a scale model Martian Habitat from inside their *Earth Habitat!* Here's how:

Have them cut a sheet of paper into pieces as shown. Using scotch tape, join the pieces together as if it was a full-scale habitat.

If you have another sheet or two of paper handy, feel free to cut additional habitats out and tape the connecting tunnels together.



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

Mid-Year Made It

Our Mars Mid-Year Meeting was originally scheduled for 11 February 2020. But they closed the base because of snow that day.



Mid-Month March, schools and field trips started closing due to the Corona Virus situation.

But the Mid-Year Meeting managed to make it in between those times, on 3 March 2020.

Mars teachers made it to the rescheduled meeting. When they got there, they received instructions on how Link-Up Day was *supposed* to go, and how to make scale model Mars habitats. They made *those*, too!



DoD STARBASE NM



For Fifth Graders

Carbon Tracks

Carbon dioxide (CO₂) is used in welding and fire extinguishers; it's a supercritical fluid solvent in the decaffeination of coffee; it makes soft drinks fizzy; and if it's cold enough, it turns solid and makes *dry ice*.

Fifth grade students participating in DoD STARBASE NM Day 2 use CO₂ as *fuel*.

It powers their seltzer-tablet rockets in a *Pop Goes the Fizz* activity. Teams of student chemists, engineers, mathematicians, and recorders investigate how much seltzer-tablet CO₂ fuel is needed to launch a rocket to a minimum height.

Due to precautionary measures related to the Corona Virus, including school closures, the 2020 DoD STARBASE NM mission is transitioning to online, virtual activities.

Visit the www.AFRLNM.com/STEM "STEM 101" page! **All students, not just STARBASE ones, are welcome to check them out!**

Students take a different track, a horizontal one, when they build and race little wooden dragster cars with different amounts of CO₂ canisters in the "trunk." The gas escapes through a tiny hole in the back. Thanks to Newton's Laws of Motion, this makes the cars race down the track quicker than a flash.

Speaking of Newton's Laws, Day 2 students pull the wax paper "rug" out from underneath a

pyramid of cups.

They also use PTC Creo® 3D design software to create satellite stations on a computer.



TARC Status 2.0

STARBASE 2.0 students were getting really good flight times with their rockets, until the virus closures came along!

The American Rocketry Challenge (TARC) Qualification Flights deadline and National Finals are postponed until 2021; however, Marketing, Presentation, and Engineering Notebook competition awards are available. See the TARC website www.rocketcontest.org for details.





TECH Mission For Middle Schoolers

Technology and Engineering Challenges—Fall Rocketry and Spring Satellites Missions

Light is Heavy

A “spectral signature” is not what a ghost writes on the bottom of his checks.

It’s when sensors collect light and other radiation in the electromagnetic spectrum emitted and absorbed by objects. A numeric value can be assigned and the values graphed. This graph, or *spectral signature*, is like a fingerprint identifying the object being sensed.

It’s the kind of thing students in Spring TECH Mission Day 2 look at as they explore concepts includ-

ing light, waves, reflection, refraction, and diffraction, using tools such as lightboxes and lenses.

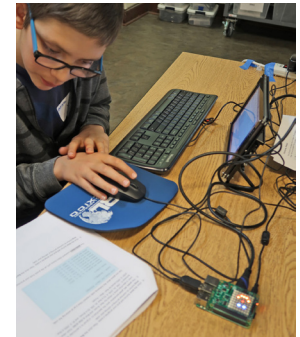
Students also work on the code to light up a sense hat on a Raspberry Pi computer, using a combination of red, green, and blue (RGB) light to set the color of each pixel on the little screen.

Each color requires three byte-sized values between 0 and 255; one for each RGB color, if that makes any sense. If it doesn’t, check to make sure you’re wearing your sense hat!

That’s right, the STEM is pretty *heavy* in TECH Mission Day 2, even if it is a bit *light*!

Due to precautionary measures related to the Corona Virus, including school closures, the scheduled 2020 TECH mission classes have been cancelled.

We’re working on creating some new virtual STEM activities that will be on our website in April.



Robotics Challenge For Middle Schoolers

5...4...3...2...WAIT!

We were eagerly counting down the weeks until the Robotics Expo, scheduled for 20 March 2020, because we knew it was going to be spectacular.

The robots, the sensors, the courses, the 3-D courses, the performance demonstrations, the Robotics Pageant, the Quiz Bowl...

But just when we were making final preparations for the event, life threw a Corona Virus event of its own in our path.

Unfortunately, we have cancelled the Expo for this year.

We will recognize the teams that qualified for the Expo on our website.

In the meantime, here’s a couple of activities you might be able to try.

Home-Based Binary Cards

1. Get out eight index cards, or cut out eight index-card sized rectangles of paper, about 3” x 5” in size.
2. With a marker, or whatever you have handy, write a “1” on one side, and a “0” on the other side, of each card.
3. Lay them all out in a row, “0” side up.
4. Think of a number from 1-255.



Due to precautionary measures related to the Corona Virus, including school closures, the 2020 Robotics Challenge is finished for the school year.

We’re working on creating some new virtual STEM activities that will be on our website in April.

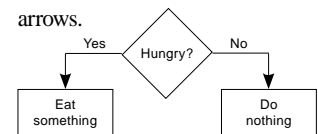
5. Using a Base 2 sequence (their values are 1, 2, 4, 8, 16, 32, 64, and 128, right to left), flip enough cards over to “1” so that their values add up to your number.

Flowcharting Practice

One thing that helps programmers write the code to operate something as intricate as a robot is to diagram it out in a *flowchart* first. Practice your flowcharting skills at home by mak-

ing a flowchart for a simple process you might do around the house.

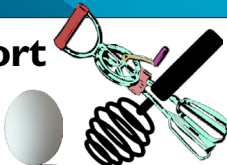
Baking a cake, for example, or doing the laundry. Something like that. Yes/No decisions are diamonds, actions are boxes. Connect them with arrows.



STEM Challenge For High Schoolers

Final Report

Suggested Timeline:
March/April



There we were, just *whisking* along, *beating* a path to the STEM Challenge Symposium.

And then, all of a sudden, the world just kind of *egg-sploded*.

Teams normally would have submitted a **final report** on CourseSites, before the Symposium, which *had* been scheduled for 7 April 2020. Teams would be preparing about now for the **Presentation** portion of

the Symposium using the report as a framework.

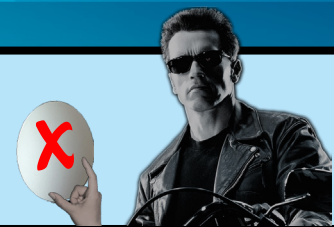
Well, the current school closures and social isolation guidelines make it rather difficult to hold a normal Symposium.

Although we *did* have a bit of social distancing built in to the Symposium already...

You had to be a certain “social distance” away from the launcher before you flung your eggs.

Teams can continue using CourseSites to complete their assignments, but since the

Due to precautionary measures related to the Corona Virus, the 2020 STEM Challenge Symposium has been eggs-terminated.



deadlines have passed, they won’t be graded.

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

Include relevant photos, diagrams, and graphs (software like

PowerPoint helps). See the handbook on CourseSites for suggestions.

Hey, it may seem cracked up to not get together and fling eggs through hoops like a normal Symposium...

But at least we’re not making you do one outside in the rain this year!



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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

METS: Mars Exoplanet Transient Satellite (METS) Mission 2019-2020

MM: Mission to Mars

PRS: Phillips Research Site

S&Es: Scientists and Engineers

STEM: Science, Technology, Engineering, and Math

TECH: Technology and Engineering Challenges

USAF: United States Air Force

Remember, Teachers:
Get those EPA
Modification forms in!



No Strings Attached

High School teachers, are you all strung out wondering how you're going to teach your students STEM during and after the Corona Virus event? Well, here's a plucky idea:

The National Science Foundation **STEM Guitar Project** (www.guitarbuilding.org) offers five-day hands-on summer teacher grant workshops teaching high school *teachers* how to teach their *students* the engineering involved in making a guitar—*no strings attached*.

With any luck, some of the current isolation restrictions will be lifted enough by then to participate.



If not, they also have online training videos and resources available.

They say that when students make guitars, they learn the math and science, but also the importance of mechanical precision, the design process, and basic manufacturing skills, which are central to what engineers do.

For example, as they go through the different steps of building a guitar, they learn about the underlying *physics*.



Electric guitars all have *pickups*, small devices that use something called electromagnetic induction to make sound, so they learn something about physics in these classes.

And those little metal wires that go across the neck of a guitar, the *frets*, have to be arranged in a specific way. The way you figure out that arrangement requires, gulp, *algebra*.

Check out their website for more information.

Not a high school teacher? What other musical instruments could you engineer using materials around your house? I hear upside-down pots and pans make a great drum kit!

Women in (STEM) History Month

In honor of Women in History month, here are three Latina women making history in STEM, per Raquel Reichard of www.remez-cla.com. (She lists seven more, too.) One is an Albuquerque, NM native!

Sabrina González Pasterski

The world's "next Albert Einstein," as she has been called, studied high energy physics at Harvard. She studied black holes and spacetime, particularly trying to explain gravity within the context of quantum mechanics.



Laura I. Gomez

At the age of 17, she took an internship with Hewlett-Packard, then went on to work as one of the only Latinas at Google and YouTube, and became one of the founding members of Twitter's international team, where she led *Twitter en Español*.



She became founder and CEO of *Atipica* in 2015, a recruiting software start-up that uses artificial and human intelligence to help companies make bias-free decisions when hiring employees.

Alissa Chavez

When Alissa Chavez was 17 years old, she patented her invention, a device called "The Hot Seat," that helps prevent babies and children who've been left alone in cars from dying from heat strokes. It includes a pad placed inside a car seat or booster seat, an alarm, a keychain, and an app that are activated as the heat of the pad rises.



The idea came to the Albuquerque, NM native when she was in middle school, and landed her a "Good Samaritan" award from then Mayor Richard Berry.

STEM News

Women in STEM Posters



Check out www.amightygirl.com!

They have free Women in STEM posters available for download.

Gladys West, Tu Youyou, Rosalind Franklin, Dr. Cynthia Breazeal, and more!

Happy Birthday

Happy 270th birthday to astronomer Ms. Caroline Herschel (16 March 1750–9 January 1848). She would have turned 270 this month.



A German astronomer, she was the younger sister of astronomer William Herschel, with whom she worked throughout her career. She discovered several comets, including her namesake 35P/Herschel-Rigollet. She was the first woman to receive a salary as a scientist, and the first to be awarded the Gold Medal of the Royal Astronomical Society (in 1828).

Not So Hidden Tribute

NASA mathematician and "Hidden Figure" Katherine Johnson, whose calculations helped America's first human spaceflight in 1961, died recently at the age of 101. Thank you for not staying hidden, Ms. Johnson!



Coming Next Issue...

- Virtually everything we know about conducting STEM activities such as ours with your students virtually.

Watch for it!

