AFRL
NEW MEXICO
STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

Star Date: February 2021
Volume XVIII, Issue 6

The Rocket Report

Imagining Tomorrow, Engineering Today

February is the shortest month, but it's long on imagination, engineering, STEM, perseverance, and ingenuity!

DiscoverE's Engineers Week (21 to 27 February) is a time to celebrate engineers and engage the next generation of innovators. This year's theme: Imagining Tomorrow. Girl Day (25 February) is a worldwide campaign to engage girls in engineering.

Registration is *free* for the National Museum of Nuclear Science & History's Discover STEaM Event is 18-20 February. Three virtual days of engaging speakers, electrifying experiments, and entertaining activities that you can experience from the comfort of your own home.

DISCOVER ENGINEERS WEEK
FEBRUARY 21–27, 2021

DISCOVER GIRL DAY
FEBRUARY 25, 2021

The National Museum of Nuclear Science & History

DISCOVER STEaM

But why stay home? *Everybody's* going to Mars this month! NASA, the China National Space Administration (CNSA), and the United Arab Emirates (UAE) *all* have missions that arrive at Mars this month.

And of course, there's us... we just keep STEMrolling ahead with all our activities.

In This Issue...

In partnership with:

NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

Collaborator:

DoD STARBASE
A Department of Defense Youth Program

Reserving school buses for our activities will only be necessary if and when classes resume in our facility on base.

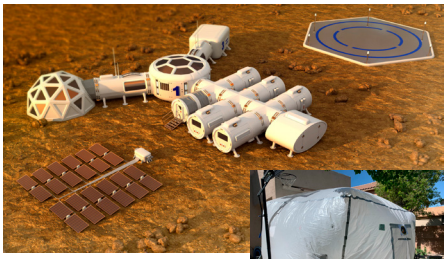
Mission to Mars

For Fifth Graders

Mars Hovering Observational Planetary Exploration System (HOPES) Mission 2020-2021

Habitats Around the Habitat

Everybody's going to Mars these days. Besides Mission to Mars students, NASA (Perseverance), CNSA (Tianwen-1), and UAE (Hope) all have missions arriving at Mars this month (see page 4).



But getting there is only half the battle. Figuring out how to *live* there is the other half.

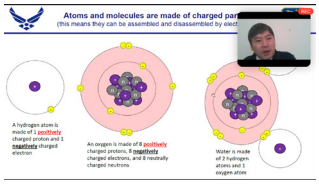
What would your habitat ("house") look like? How would you transport the materials and build it?

One idea is an *inflatable* habitat. The inflatable Bigelow Expandable Activity Module (BEAM) being tested on the ISS right now might be used on Mars someday.

Mission to Mars students can go to the website (https://afrl-nm.com/stem/habitat-design/) and sketch (in their journal) and build their own inflatable scale model habitat.

Students can also sketch and build a scale Mars habitat from objects found around their Earth habitat!

It's Electric

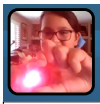


Dr. Thomas L. Peng, AFRL Research Chemist, took us on a party ride during his Expert Talk 9 February 2021. His mission? Teach you, teach you, teach you, to do the electric slide on Mars (boogie oogie oogie.)

Specifically, how Mars astronauts could use batteries to *electrolyze* (separate) water (H_20-) into hydrogen (H_2) and oxygen (O_2). NASA's MOXIE experiment will test electrolyzing CO_2 as well. See afrlnm.com/stem/expert-talks.

Next Expert Talk:
25 Feb.

Your commitment to this mission is crucial to its success



DoD STARBASE NM

For Fifth Graders

Engineering and Marshmallows

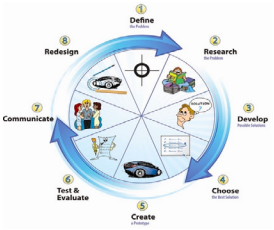
DiscoverE's *Engineering Week* is this month, and several DoD STARBASE NM fifth grade classes recently completed another round of Day 1, focusing on Engineering.

Engineering

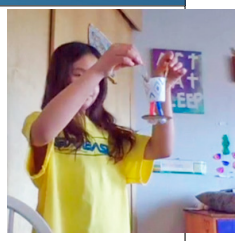
First, students create a *call sign*; a substitute name, or nickname, given to gamers, aviators, astronauts, and even racecar drivers.

Gemini, *Bruja*, *Pebbles*, *Pumpkin*, and *Sunflower* are examples of call signs.

Then students dive into the world of *engineering*—using science and math to solve problems and improve the world around us.



The *Engineering Design Process* (EDP) they use looks like a wheel that goes around and around.

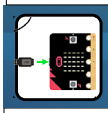


It's a marshmallow world in the winter! Students select from a list of materials such as tape, plastic straws, paper cups, and cardboard to create a small *lunar lander* to protect a marshmallow pilot.

Using the EDP, students design, build, test, and redesign lunar landers capable of absorbing the landing shock when dropped from above.

This year's Engineering Week theme is *Imagining Tomorrow*.

If students want to imagine being an engineer, there are many career paths to choose from, in many different fields. Some require a college degree, but not all of them!



TECH Mission

For Middle Schoolers

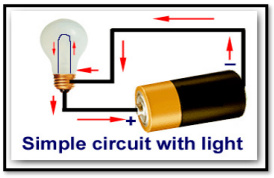
Technology and Engineering Challenges—Satellites Mission

Paper Chase

Students participating in the TECH Mission portion of our little STEM circuit have flat-out found a way to make electrons chase each other around a piece of *paper*!

Using flat copper tape for wire, students make various circuits on a sheet of paper, connecting a battery power source to light emitting diodes (LEDs).

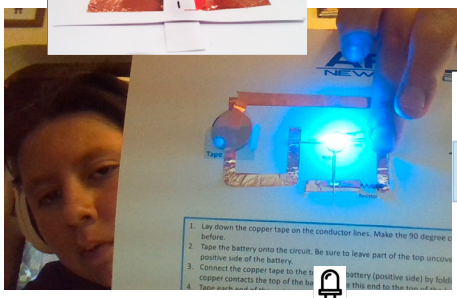
Students construct circuits where lights are connected

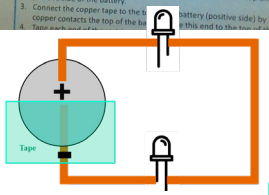


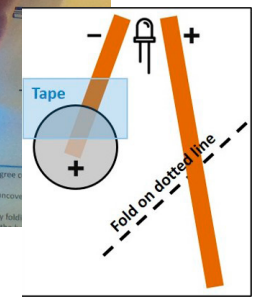
in *series*; the current has only one path to travel on. But, if one light goes out, they *all* do. Just ask Clark W. Griswold!

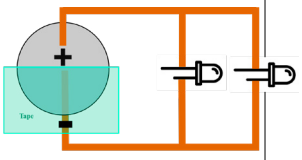
Students also construct *parallel* circuits, where the current has multiple paths to follow, each with its own LED.

Red and yellow LEDs don't need as much voltage, so students add *resistors* before those colors, saving power for other, more "needy" colors, like blue, green, or white.









Robotics Challenge

For Middle Schoolers

Maqueen: Motorized Micro:bit

The BBC micro:bit is quite the amazing little pocket-sized computer. It has an LED light display, buttons, sensors and many input/output features that can be programmed and physically interacted with.

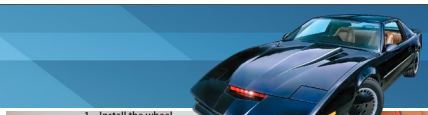
But there's one thing it *doesn't* have: *Wheels!*

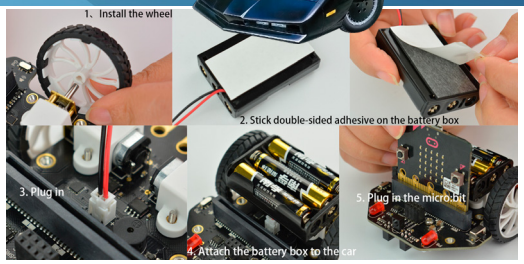
Robotics Challenge students who make it to **Module 3** build themselves a **Maqueen** robot. When they plug the micro:bit in

for its brains, they've practically got themselves a miniature KITT from Knight Rider! All it needs is a Turbo Boost button.

Once they figure out how to code the servomotors to move the way they want them to, students can tackle Assignments 8 and 9.

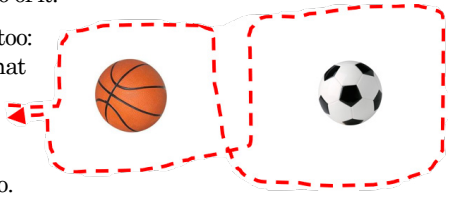
Assignment 8 is 8, and it's great: Write a program that will make your robot move





forward and then around two obstacles in a "figure 8" pattern. Record a video of it.

Assignment 9 is fine, too: Write a program that will make your robot move in the pattern of a letter "S." Record a video of it, too.



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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

HOPES: Mars Hovering Observational Planetary Exploration System 2020-2021

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!

STEM Challenge For High Schoolers

MiniPax, MiniTrue, and MiniSTEM

In George Orwell's book *1984*, *Minipax* was the government's Ministry of War, and *MiniTrue* was the Ministry of Propaganda.

In real life, in 2021, it's not propaganda; regular classes and field trips just haven't quite gotten back to normal yet.

So we're having a "MiniSTEM" Challenge Mission.

Four participating teams from La Academia de Esperanza (LADE) have already created team names and logos, and that's the MiniTruth. The four teams are:

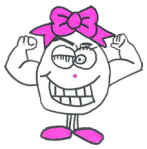
Team 1: Eggstraveggent
Team 2: Team Lightning
Team 3: Los Huevos
Team 4: The Unbreakable Shelly

It's a bright, cold day in February; is the clock striking 13 yet?

Team 1:
Eggstraveggent

Team 2:
Team Lightning

Team 3:
Los Huevos


Team 4:
The Unbreakable Shelly

STEM Bytes

Mars Madness

Arriving in February

It's Mars Madness in Feburary! *Three* missions to Mars arrive this month!

A *fourth* mission, the European Space Agency (ESA)'s ExoMars rover, for a time scheduled to launch in 2020, would have landed next month, March 2021, but technical issues delayed that launch until 2022.

UAE's Hope Orbiter mission entered Martian orbit on 9 February 2021, giving hope that the other missions will be as successful. It plans to study Martian weather patterns and how gasses in the planet's atmosphere escape to space.

China's Tianwen-1 Orbiter/Lander/Rover mission's orbiter entered orbit 10 February 2021. The mission will, among other things, search for evidence of current and past Martian life, produce surface maps, and study the soil and atmosphere. The lander portion is scheduled to land in May 2021 and release the rover.

NASA's Perseverence Rover/Ingenuity Helicopter are scheduled to touch down on Mars on 18 February 2021.

"Percy" plans to search for evidence of current and past Martian life, plus collect samples and test oxygen production from the Martian atmosphere.

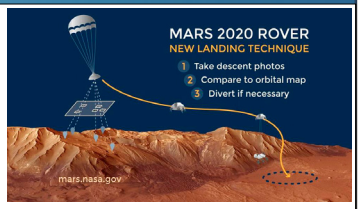
Ingenuity will test the ability of Martian helicopters to scout targets of interest on Mars.

See www.space.com.

About That Landing

When "Percy" lands, it will attempt to use a new technique, taking pictures and correcting itself on the way down.

At www.mars.nasa.gov, under "More Resources," you can download a Perseverance sticker, to encourage the rover to stick the landing!



You can also download 3D model files of Perseverance and Ingenuity.

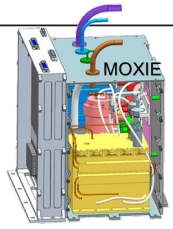
Congratulations

Congratulations to AFRL NM STEM Outreach. We have been informed we won *two* awards for our *Satellites: Velocity Victors!* presentation at the recent Big Brothers Big Sisters STEAM Discovery Festival: The *WOW! Factor* and *Kid's Choice* Awards. Wow!

It's Got MOXIE

"Moxie," meaning courage, daring, determination, *perseverance*...started out as a carbonated soft drink brand.

The Mars Oxygen ISRU Experiment (MOXIE) on the Perseverance rover will attempt to produce a small amount of oxygen (O_2) from Martian atmospheric carbon dioxide (CO_2) using *solid oxide electrolysis.*



Coming Next Issue...

- Lunch on Mars
- Paper Satellites
- The Luck of the Irish

Watch for it!