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...



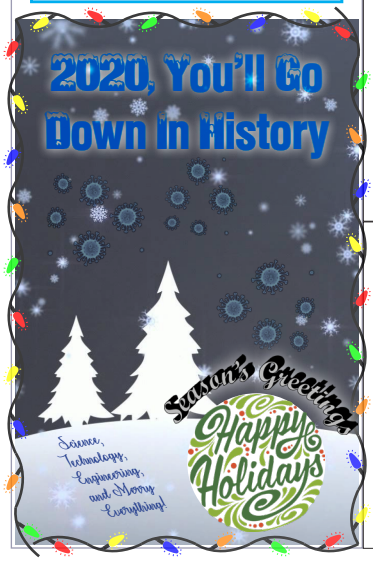
In partnership with:

NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

Collaborator:

DoD STARBASE
A Department of Defense Youth Program

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




# The Rocket Report

## Hour, Week, Month, and Year Time

We made it! December is finally here. As the song goes, 2020, "you'll go down in history."

Computers, and the programs running on them, have helped us get through this year's challenges. Many of us have probably done more online shopping and learned more about video teleconferencing software this year than we ever dreamed.

7-13 December 2020 is the Hour of Code and National Computer Science Education Week, in recognition of the

9 December birthday of Admiral Grace Murray Hopper. She went down in history as a *computer pioneer*.

Admiral Hopper worked with early computers such as the Harvard Mark I, also called the IBM *Automatic Sequence Controlled Calculator*.

She wrote the world's first computing manual, and developed FLOW-MATIC, the first programming language to express operations using English sounding statements. This eventually led to COBOL, a programming language still used today. She also popularized the term "debugging" a computer.

Hour of Code has high and low-tech coding activities and videos available on their website (www.hourofcode.com) and YouTube channel.

HOUR OF CODE

We're posting some computer science-related activities on our Facebook page during the week. Try your hand at some!

2020 will soon be history, but computer, coding, and STEM skills will last a *long* time!

# Mission to Mars

**For Fifth Graders**

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

## Patches and Facts

**Mission Patches** visually symbolize the Martian crew and their mission. For example, *this* one, submitted by a student from Cielo Azul Elementary School.

Red for Mars, orange for the sky above Mars, blue for Cielo Azul.

The raven? School mascot.

The first flag represents ideas, the second represents observing, the last one represents solving and mathematics.

**Mars Facts:** Do you know what the planet Mars is named after? Do you know if the air is breathable on Mars?

Fact is, there's 19 Facts and a Mars Riddle to investigate in the Mars Facts section of the website (afrlnm.com/stem/mars-facts/).

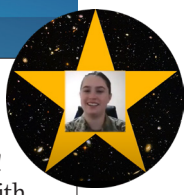
## SAGA Special Guests

The Mars Saga tells the story, sung or spoken, of the crew's adventures during their journey from Earth to Mars.

In the Mission to Mars section of our website (afrlnm.com/stem/saga/), you'll find a link to special guests Commander

Andromeda and Papa Cupcake singing sample Sagas!

## Packing Heat



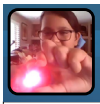
As thermal engineers go, she packed some heat! She conducted herself with a lot of conviction, and radiated warmth and knowledge.

Next Expert Talks: 12 and 26 Jan.

AFRL expert Lt Mary Albrecht talked to Mission to Mars students virtually on 1 December 2020, and discussed thermal control in space. The hot and cold of it: Imagine moving your smartphone from the freezer to the stove! Martian colonists will need to plan ahead.

If you're trying to find the video using the Mars Expert Talks button in the Mission to Mars section of our website (afrlnm.com/stem/expert-talks/), you're getting warmer!

Your commitment to this mission is crucial to its success



# DoD STARBASE NM

For Fifth Graders

## Fruit Compound

Matter of fact, *atoms* are the physical building blocks of all *matter*. *Elementary*, yes? But this is *compounded* by the fact that combining one or more types of atoms creates *molecules*.

### Chemistry

The focus of DoD STARBASE NM Day 4 is *chemistry*—the study of matter and the changes matter undergoes when interacting with other matter and energy.

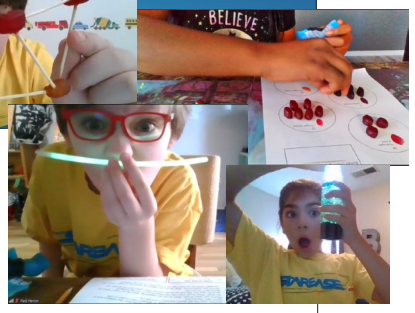
Students build their own molecules using atomic fruit-flavored snacks, and bonding them together with ionic or covalent toothpicks. If all the fruit snacks are the same flavor, it's an *element*. If they're different flavors, it's a *compound*.

Faster than you can say, "No, silly! *Real* molecules are much *smaller* than fruit snacks," students have built tasty models of oxygen, water, and other molecules.

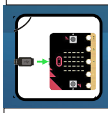
You should see the students' reactions when they explore some chemical reactions. Their faces glow brighter than the *glow sticks* that light up due to a chemical reaction.

When students pour salt into a glass of water, the salt disappears! Where did it go? Students solve the puzzle when they realize the salt is *solulable*—it dissolves in water. The salt is still there, it just *physically changed* from a solid to a liquid.

It's a gas when they try the same thing with a seltzer tablet in water. This time, the change is more fizz-ical than physical; it's actually a *chemical change*.




Oil and water don't mix, but things get really groovy when the students mix oil, colored water, and more seltzer tablets to make *lava lamps!* Bell bottom pants not included.



# TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Satellites Mission

## Bugs and Bits

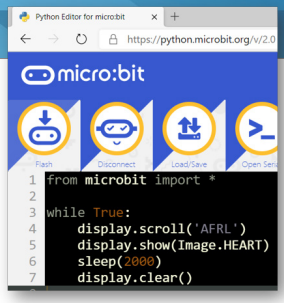
As we mentioned on the front page, this is the birthday month of computing pioneer Admiral Grace Hopper, and one thing she was famous for was popularizing the phrase "debugging" a computer or software program.

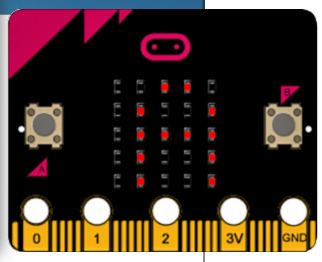
It seems a moth was having a ball and got into the relay system of an early computer she was working on called a Harvard Mark II. To fix the computer, they literally had to "debug" it.

Students in the TECH Mission get to practice modern-day debugging as they learn the Python programming language.

Entering program code provides many opportunities for errors. A simple typo or missing punctuation mark among all the *variables*, *strings*, and *loops* in a program can confuse the computer until it doesn't understand what you want it to do.

But once the program is sufficiantly debugged, the program should run correctly.

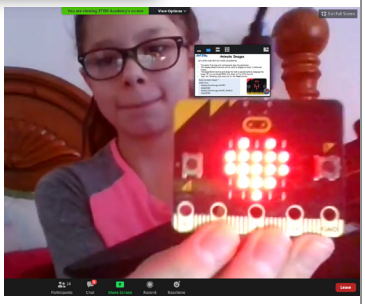



Which is good, because then students can hook up and program a micro:bit microcontroller!

The micro:bit has a little 5x5 LED display screen. Students can program the micro:bit to put on a happy face, animate a beating heart or a clock face, and even scroll messages!

Later, they investigate micro:bit *sensors*.



# Robotics Challenge

For Middle Schoolers

## Micro Sized, Macro Uses

When Robotics Challenge students are ready to move on to Module 2, they discover the only thing "micro" about micro:bit is its size!

A micro:bit is a type of computer called a *microcontroller*. The micro:bit was created to help teach computer science.

Smaller than a saltine, but "size matters not," right, Baby Yoda? This thing packs cool features like radio and bluetooth antennas, a temperature sensor, a compass, and an accelerometer into its micro-sized frame.

It can be used in a variety of different projects, like experiments, games, robots, musical instruments, and more.

Now that students have gotten the hang of Python programming in Module 1, they button down on pins and needles ready to apply those skills to micro:bit. Starting with exploring micro:bit's *buttons* and *pins*.

Micro:bit has two little buttons on it that can be programmed to perform various functions. Students code one button to display a happy face, and the other to display a sad face on the little 5x5 LED screen, for example.

They hook up *alligator clips*...or is it *crocodile clips*?...to the pins to create electronic *circuits* which can be connected to devices, such as an external LED diode, to make it light up.

**SCIENCE TIP**

You can distinguish an alligator from a crocodile by paying attention to whether the animal sees you later or in a while.

Next, students tackle using the light sensor, so the micro:bit doesn't get scared of the dark.

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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 Bytes

**For the 2020-2021 school year, we are putting the STEM Challenge Mission on hold for fall semester. We are working on alternate activities for high school students and will continue to monitor conditions to determine whether we can offer this Mission beginning in the spring.**

## Camps and Competitions

The New Mexico Academy of Science (NMAS) sponsors a written **Science Research Paper Competition** with oral PowerPoint presentations for all students from public, private or those home-schooled in grades 6-12. Albuquerque Region accepts group projects with 3 or less students. Students must complete research, but Science Fair participation is NOT required.

The deadline is 16 February 2021 for the 4-5 March 2021 virtual competition. See www.nmas.org for details.


Applications are being accepted for the 2021 **National Youth Science Camp** (NYSC) sponsored by the National Youth Science Foundation.

The program is open to high school seniors who have demonstrated accomplishments in STEM. Two seniors will be selected to represent New Mexico at the 2021 Camp.

Two students from each state, Washington, D.C, and select countries will attend the all-expenses-paid program, **which will be held virtually** from 28 June through 21 July 2021.

This camp is offered to selected participants at NO COST.

See www.nyscamp.org.



## Scholar Place


The AFRL Scholars Program is an internship program to provide upper-level high school, undergraduate, and graduate students, and professional educators, with opportunities to pursue research interests and develop professional skills while increasing the diversity of the STEM workforce.

Applications for summer 2021 internships are being accepted through 12 January 2021.

See https://afrlscholars.usra.edu/.

## Space News

Dr. Larry Crumpler of NM was recently named one of NASA's team of 13 scientists for the Mars 2020 Perseverance Rover mission, scheduled to land 18 Feb 2021.

AF Brig Gen Chuck Yeager, first person to break the sound barrier, recently passed at age 97.

Chang'e 5, third Chinese spacecraft to land on the moon, lifted back off recently, carrying the first lunar samples since 1976.

See www.space.com.

## Coming Next Issue...

- Telecommunications
- Robotic Sensors
- A virtually Happy New Year