



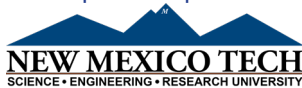
The Rocket Report



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In partnership with:



Collaborator:



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



Just Great

2020's been a *great* year so far, hasn't it? Who knew back in January that scary ol' Halloween was going to be an *all-year event*?

One great thing, though: There's no shortage of *great* costume ideas this year:

ER doctors, Wells Fargo stagecoach robbers (already have the masks!), murder hornets...

...You could even just wear the "2020" glasses from New Year's Eve! Now *that's* scary.



STEM is *always* a great thing here at the Academy, even in the year 2020. We're making kits and starting some *great* virtual internet STEM sessions in our Mission to Mars, STARBASE and 2.0, TECH Mission, and Robotics Mission activities.

Tell Linus: The **great Pumpkin** has arrived! Ms. Hollie "Pumpkin" Pouson (she has red hair) has joined us as our great new STARBASE assistant—the perfect Halloween complement to the great Ms. Bruja the Good Witch!

A math teacher and Air Force spouse, her son attended STARBASE last year and loved it *so much*, she just *had* to patch herself into the action!

Mission to Mars For Fifth Graders

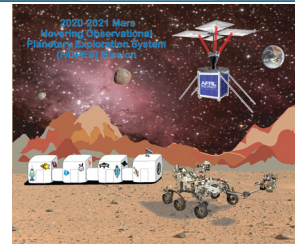
Mars Hovering Observational Planetary Exploration System (HOPES) Mission 2020-2021

High Hopes

Everyone knows an ant can't move a rubber tree plant! But, he has *high hopes*.

Fifth grade student scientists going to Mars, in support of the simulated 2020-2021 **Hovering Observational Planetary Exploration System (HOPES) Mission**, have high hopes for their "ingenius" new directed-energy powered *sailcopter*.

A sidekick to the *Perseverance* Rover, and an improvement over previous Martian 'copters, the sailcopter *hovers over* and *observes* upcoming Martian terrain for potential rover driving conditions and interesting features to explore. Together, the sailcopter-rover duo make a complete *planetary exploration system*.



Instead of dual rotors spinning relatively heavy, brittle metal blades, the new sailcopter uses a single 500-rpm rotor to spin four ultra-lightweight reflective *sailblades*—similar to *solar sails*—overhead. This provides some of the *lift*—because *spin matters*.

The rest of the lift is provided by a lightweight on-board AFRL Directed Energy Directorate high-energy laser infrared system. Four small solar-powered cannons, rotat-

ing in sync with the four rotating sailblades above, shoot a persistent, *persevering* stream of laser and infrared energy up to the sailblades. This provides extra lift and valuable *heat* for the extraterrestrial sailcopter, while using less *power* than earlier Martian helicopters.

Whoops, there goes another Mission to Mars!

Orientation

Mission to Mars teachers attended virtual orientation this year (see our YouTube channel). They learned about the virtual Base Operations, Expert Talks featuring AFRL personnel, and the culminating event scheduled for April 2021.



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



Ant Ex Machina

It may seem *ant-ithetical*, but ants can lift many times their own weight; it is said they can even move a rubber tree plant if they have *high hopes*.

Humans, however, have little hope of matching the ant's prowess...unless we use *machines* to help us do the *work*.

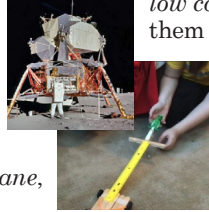
Physics

Work is a *force* acting on an *object* to move it across a *distance* ($W = F \times D$).

A *machine* is a tool designed to make work easier.

Simple machines can magnify, change direction, or increase the speed of a force.

Examples of simple machines include the *lever*, *pulley*, *wheel-and-axle*, *inclined plane*, *wedge*, and *screw*.



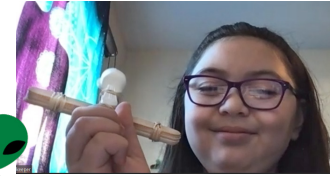
Students in DoD STARBASE Day 1 gave spacefaring marshmallows a soft landing by engineering marshmallow Lunar Landers.

In Day 2, students try their hand at constructing simple

machines such as *marshmallow catapults* (levers) to help them get into the air in the first place.

They also explore another idea with a lot of potential involving the rescue of Astro the Alien. His spaceship broke, stranding him on a deserted planet.

So, students make like Rube Goldberg, who was very good at making simple machines more complicated. They are tasked to make three-step



Rube Goldberg machines that transfer enough energy back and forth between *potential* and *kinetic* to help get Astro off the astroturf.

Archimedes would say: "Give him a lever long enough, and a *fulcrum* on which to place it, and even an *ant* could move the world." But even *without* a fulcrum, ants can still move a *picnic!*

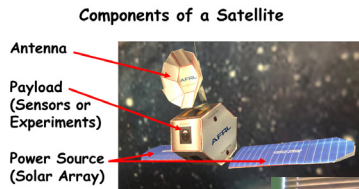


Fold n' Play

*Star light, star bright,
First star I see tonight,
Could be wrong, but think I'm right,
That's no star, that's a satellite.*

A *satellite* is an object that goes around, or *orbits*, a larger object, such as a *planet*. While there are natural satellites like the Moon, hundreds of *man-made* satellites also orbit the Earth.

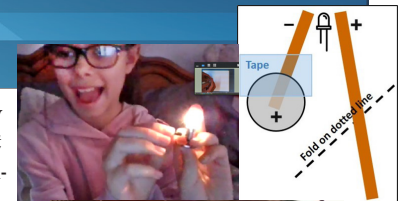
In the past, man-made satellites were always custom-built from scratch each time, an expensive and time-consuming process.



Then AFRL developed a "Plug and Play" satellite construction method. Standardized parts could be attached to cubesats with standard USB ports just like a computer.

Students in TECH Mission Day 1 get to try an even more *recent* satellite construction innovation: *Fold n' Play* technology!

Using a single sheet of paper, *no* tape, *no* glue, and three bendable metal sticky-sticks, students detach, fold, and create their own Hex-Sat, complete with a dual solar panel power supply, a communications antenna, and a *payload* of sensors, GPS up- and downlinks, and cameras.



Day 1 students also fold in some time to make paper circuits like those that would operate the devices on a paper satellite...and, time permitting, examine the *binary numbers* the antenna would be transmitting sensor and picture data with.



The Name of the Game

In the **Robotics Challenge** mission, before students learn to build and program small micro:Maqueen robots to complete tasks and solve problems, they learn a little about *computer programming* first.

The Robotics Challenge consists of 3 modules of tutorials and 12 assignments, found on the **Canvas** online platform. Students complete *one* module before being eligible to receive the materials for the *next* module.

Module 1 helps students develop basic knowledge of a programming language named *Python*. In the first two assignments, *names* are the name of the game.

Assignment 1: Writing With Variables involves naming some variables, such as:

request = "Bring"
name = "Larry"
count = 7, and
food = "pancakes."



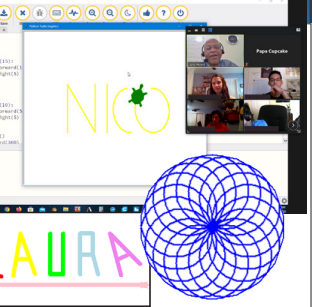
```
1 #Make a sentence with vari
2 count = 7
3 food = "pancakes."
4 name = "Larry"
5 request = "Bring"
6 print(request, name, count, food)
```

Run: make a sentence.py
Bring Larry 7 pancakes.
>>> |

Then you can execute commands such as:

print (*request*, *name*, *count*, *food*).

Assignment 2: Drawing with Code involves students programming computer *turtles* to draw their names on the screen.



The third assignment involves drawing geometric patterns.

To advance to the next (micro:bit) module, students must complete the Python tutorials and at least two of the three assignments.

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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

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

How to Halloween When the Whole Year is Haunted

Australian brush fires, locust swarms, Tiger Kings, murder hornets, endless Zoom meetings, Covid-19...2020 has had the Halloween thing going all year long. It's enough to spook Jack Skellington!



Ironically, now that it's finally here, social distancing and safety restrictions might make Halloween seem a bit... well...hollow.

Standard Halloween activities such as haunted houses, trick-or-treating, and Halloween

parties are, no doubt, frightfully discouraged this year.

So how does one Halloween happily when the whole year is haunted?

Local officials have recommend activities such as pumpkin carvings at home, costume contests over Zoom, and scary movie nights from the safety of your tablet.

But scaring up some STEM with stuff around the house might make the most spooktacular Halloween yet!

For example, with just a

small, hollowed-out pumpkin, some vinegar, liquid dish soap, baking soda, and maybe a little food coloring, you can make a *Pumpkin Volcano!*



Conjure up some corn starch, water, seltzer tablets, a marker, and a few leftover hairspray bottle caps or something similar, and you can make *Ghost Rockets!*



See www.playdoughtoplato.com/20-halloween-science-experiments-kids for more happy home Halloween ideas!

Kitting Around



As pandemic parameters have restricted in-person participation, we've implemented innovative ways to bring the STEM to you...such as assembling STEM activity kits, and making them available to participating teachers, for virtual STEMing!

Quantum Leap



In physics, a *quantum* is the minimum amount of physical entity in an interaction. A photon is a quantum of light.

The White House Office of Science and Technology Policy, with NSF and industry/academic partners, recently launched a new initiative to expand access to K-12 quantum information science (QIS) education.

See <https://q12education.org>.

Space News



Elon Musk's SpaceX plans to launch a satellite on 10 November that can

measure rising sea levels from orbit. Its *Starman* astronaut mannequin "driver," in a Tesla car, meanwhile, recently flew by Mars.



Virgin Galactic is preparing to launch its first spaceflight from

the New Mexico Spaceport sometime this fall.

NASA's OSIRIS-REx just scooped a sample off of the Benu asteroid, and they've selected Nokia to build the first wireless network on the moon. See www.space.com.

Classroom Grant Program



The American Institute of Aeronautics and Astronautics (AIAA) Foundation (www.aiaa.org) is accepting proposals through 15 January 2021 for the K-12 *Classroom Grant Program*.

One of the most significant means to inspire and advance the future of Aerospace is to fund grants to meet the unmet and unfunded educational needs of students. Each school year, AIAA awards grants of

up to \$500 to worthy projects that significantly influence student learning.

A clear connection to science, technology, engineering, or mathematics (STEM) with an emphasis on Aerospace must be included in the grant proposal. Applicant must be a K-12 classroom teacher and a current AIAA Educator Associate member (it's free to [join](http://www.aiaa.org)). Schools are limited to 2 grants per calendar year.

Questions? Sha'Niece Simmons, Sha'NieceS@aiaa.org.

Coming Next Issue...

- STARBASE Technology
- TECH makes waves
- Robot Geometry

Watch for it!

