AFRL
NEW MEXICO STEM OUTREACH

Inspiring Future Scientists and Engineers

AFRL NM STEM ACADEMY

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The Rocket Report

Leaping Lizards, Lots of STEM

We like to think of a *year*, the time it takes Earth to orbit the sun, as exactly 365 days, but that's not entirely accurate. It's actually more like 365.24 days. Every four years, we're off by just about a day.

That's why this year is a *leap year*. Even though February is the shortest month, it's a little longer this year because of an additional *leap day* on February 29, to even things out a bit.

Which makes us *leap for joy*, because there's lots of STEM to jump into this month.

DISCOVER ENGINEERS WEEK
FEBRUARY 16–22, 2020

- DiscoverE's **National Engineers' Week** (16-22 February) sparks organizations and volunteers to engage students in the profession of engineering.

- **Introduce a Girl to Engineering Day (Girl Day)** inspires girls to learn they have a place in engineering a better world (20 February).

Super STEM SATURDAY

- 22 February is the annual **Super STEM Saturday** event at the Albuquerue Convention Center. **FREE** and open to the public! Can you come? Super!

The National Museum of NUCLEAR SCIENCE & HISTORY

- **Discover STEM Week** (24-28 February) is an annual celebration of all things STEM at the Nuclear Science Museum, grades 4-8.

We *were* going to have a **Mars Mid-Year Meeting** on 11 February, but inclement weather triggered a reschedule. **The new date is 3 March 2020.** Hey, Martian weather can be tricky sometimes!

STEM Demo Goes Viral

Daniel Bernoulli (1700-1782) contributed more to science than just the *Bernoulli's Principle* that helps explain how airplane wings attain enough lift to make planes fly.

In 1766, Bernoulli came up with the earliest mathematical model of how diseases spread.

On 31 January 2020, AFRL's Dr. Jake Grosek used a more hands-on, visual approach to demonstrate how diseases are spread, and what students can do to stop it.

Over two sessions, all 434 K-5 students at SY Jackson Elementary attended the demo. Dr. Grosek had students hypothesize how to stop the spread of disease.

Using "healthy" cups of water, and one "sick" cup of vinegar, students shared the contents of their cups with each other, and then added an indicator dye to see if their cup was a "healthy" purple or a "sick" pink. They also explored how a "vaccinated" cup (containing baking soda to neutralize the vinegar) impacted the results.

In This Issue...

In partnership with:

NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

Collaborator:

DoD STARBASE
A Department of Defense Youth Program

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

Mission to Mars

For Fifth Graders

Mars Exoplanet Transient Satellite (METS) Mission 2019-2020

Crew Registration Forms are due at the Mid-Year Meeting. Print legibly; we'll use them to generate student certificates.

Due to inclement weather, the **Mid-Year Meeting** was rescheduled. **The new date is 3 March 2020.**

That's No Martian Habitat; It's a Space Station

NASA has agreed to allow a company called Axiom Space to install a commercial habitation module on the International Space Station (ISS) by 2024.

When the ISS retires, the module will get its own power pack and become a space station of its own. See www.space.com.

Uniform Informed

Don't be uninformed about uniforms! *Uniforms* are clothing of a distinctive design worn by members of a group, as a means of identification *with* that group.

Astronauts; armed forces; police; emergency services personnel; security guards; retail, bank, post office, and healthcare workers...

Many schools even require their students to wear *school uniforms*. Show up to school out of uniform, and the principal might sit you down and inform you of the rules!

On Link-Up Day, Mission to Mars crews score Mission Log points by wearing uniforms. They don't have to be fancy; matching T-shirts and jeans will do. Mission patches, headgear, and other accessories are optional (see pp. **97-99** in the handbook.)

Students, teachers, and assisting adults also wear a *nametag*, as part of their uniform, including:

- School, Student, and Teacher Name;
- Colony Habitat Number (the habitat each crew is responsible for building).

ABC Elementary School

Student Name: Clair Enet
Teacher: Mrs. Smith
Colony Habitat #: 12

Vitamins, Nutrition, and Math

UMass Amherst food scientists recently published, in the journal *Food Chemistry*, the results of a nearly $1 million NASA-funded study.

They used teamwork, problem-solving, and math to develop a user-friendly mathematical model that helps ensure astronauts' food remains rich in nutrients during extended missions to destinations such as Mars.

The study showed how *thiamine* (vitamin B1) degrades over two years in potential astronaut meals such as brown rice, split pea soup, and beef brisket. The model predicted vitamin degradation with high precision. NASA believes obtaining nutrition from *food* is preferable to taking vitamin supplement pills.

Our Mission to Mars student crews also use teamwork, problem-solving, and, yes, *math* to plan and pack a nutritious, space and weight-saving Link-Up Day lunch...with *food*.

Include 8 oz. of fluid per crew member; total food and liquid mustn't exceed 20 oz./crew member (pp. **95-97**). Teachers and adults bring the same lunch as the students.

Carry all food in ten or fewer 1-gallon ziplock bags, to save space in space.

Check out the **Mission to Mars** event page on our Facebook!

Your commitment to this mission is crucial to its success

DoD STARBASE NM

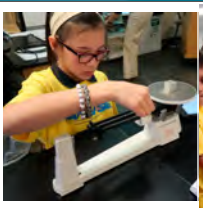
For Fifth Graders

STEM x 3, By Design

DoD STARBASE NM Day 1 students get triple the STEM, by design.

After choosing a call sign...even Papa Cupcake has one...and taking a quick pre-test, students create a safety restraint for Eggbert, who is crash-landing his shuttle on the Moon.

It's a three-step process: They *design* a restraint system within budget and mass constraints, *test and analyze* performance data of their system, and then *redesign* it based on the results of their analysis.



Speaking of mass, students use a Triple Balance Beam to measure and compare the *mass* of cube-shaped objects during a measuring activity.

STEM scores a triple play when students explore 3D CAD software PTC Creo to search a 3D aviation model for hidden objects such as trumpets, trucks, and *Batman* logos. Wait till Papa Cupcake hears about this!

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.

Don't forget to turn in your Media Release forms!

TARC Redesign

STARBASE 2.0 students are also doing the redesign triple play. Having already designed and tested their TARC-class rockets, AIMS students are *redesigning* them for improved performance. See how well they fly *now*!

TECH Mission For Middle Schoolers

Technology and Engineering Challenges—Fall Rocketry and Spring Satellites Missions

Plug n' Play

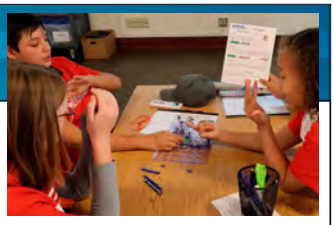
The Spring semester of TECH Mission is all about satellite technology. Here at Kirtland Air Force Base, the Space Vehicles (RV) Directorate is all about satellilte technology, too.

One satellite innovation that RV is known for is the "plug and play" concept.

In the old days, companies and organizations would come to RV for assistance designing and building a satellite from scratch. It was a long process; it could take weeks or even months to design a satellite that met all of their specifications. When it came time to change the satellite, they started all over again.

So, the AFRL engineers came up with a solution. By using panels with ports similar to home computer USB ports, they could custom-build satellites in any number of configurations; a camera here, a sensor there...in days or hours instead of weeks or months. They call it "plug and play" technology.

TECH Day 1 students are experimenting hands-on with similar techniques when they design satellites using LEGO bricks, and complete circuits to



build simple electronic devices using Snap Circuits.

Students work with binary numbers, 1's and 0's, much like computers do, and code using Raspberry Pi computers, as well.

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.

Robotics Challenge For Middle Schoolers

10, 20, 30

Robotics Challenge teams, let's count by 10's! Ready?

Assignment 10: (Last assignment!) Project due **21 February 2020**

Prepare a document that describes a robotics project you would like to create, such as using a particular sensor, a robotic arm, maneuvering a Rube Goldberg device, or playing a game.

Remember: *The last day to receive points for the Robotics Challenge*, for Assignment 10 or any of the other assignments, is **21 February 2020.**

Teams will be chosen for the Expo soon after that. Tutorials and assignments will continue to be available online on CourseSites for the rest of the semester, for participating schools to learn about robotics.

Teams have already worked on robotics assignments such as turn signals, IR sensors, and push blocks.

20 March 2020

The Robotics Challenge Expo will be here on 20 March, 2020.

Participating teams will compete for top scores on various courses, including blue, black, and 3-D courses, plus a robotics performance demonstration, a robotics Quiz Bowl, and other surprises.

30 Qualifying Teams

The **top 30 qualifying teams** will be eligible to attend the Robotics Challenge Expo.

Let the Countdown Begin!

The Expo is almost here! 10...9...8...

Homeschool robot pushing a block

STEM Challenge For High Schoolers

Testing, Testing, 1,2,3...

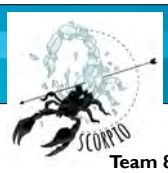
Suggested Timeline: February/March

Check, check. Is this thing on? OK. This is it; the big test! Don't worry, you and your students won't have to stay up the night before cramming for *this* test.

However, don't lay an egg and forget to do it, or you'll get a big fat *goose egg* for the asssignment, and that might be too big to fit into your launching device!

Have your teams *integrate* (combine) and *test* their payload protection and launching devices.

Have teams place a 3' target 30' away from the launching device, select a launch configuration (arm stop setting, tension setting, arm length, number of rubber bands, etc.), and launch a raw hen's egg at least three times. Have them photo or video at least one of the launches; making adjustments as needed.



Team 8 Scorpio

Team 28 We're So Egg-streme

Once they get fairly consistent results from each launch, have them record and analyze data on five launches. Does it pass the test? Is the device providing enough range? How far does the payload travel after initial impact? Does the egg survive?

Team 29 Los Super Huevos (NOT Eggs-ecutors!)

Remember—Teams must complete **Assignment 1—Team Identity** to be registered in the STEM Challenge! The **Symposium** is scheduled for **7 April 2020.**

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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!

Tuskegee Airmen, Inc.
Giving History a Future!

Tuskegee Airman Honored

Did you see the Tuskegee on the TV? Every summer, we support the Tuskegee Aviation Camp as they give students a deep dive into the world of aviation, including flying an actual Civil Air Patrol Cessna.

Tuskegee Airmen "Red Tails" were the first African American Army Air Corps WWII aviator squadron; phenomenal and highly respected.

Charles McGee, one of the last surviving Tuskegee Airmen, turned 100 years old last December, and was given an honorary promotion to Brigadier General by President Trump.

You may have also seen him on television this month; The centenarian was a participant at the Coin Toss event at the Super Bowl, and he was publicly recognized (again) by the President, at this year's State of the Union Address.

BGen McGee's "Four P's" for students: **Perceive.** Dream your dreams. **Prepare**. Getting a good education is key. **Perform**. Let excellence be your goal in everything you do. **Persevere**: "We could have gone, 'Oh, they called me names, they don't like me' and done nothing for our country. Don't let circumstances like that be an excuse for not achieving."

Space News

The Dog Was Very Excited

Christina' Koch's dog, LBD ("little brown dog") was very excited to see her when she returned home. Nothing spectacular about that; *lots* of dogs get excited when their owner comes home.

Except Ms. Koch is an astronaut, and she had just returned home from spending a record *328 days in space* aboard the International Space Station (ISS), more consecutive days in space than any other woman.

While up there, she also completed the first all-female spacewalk with fellow astronaut Jessica Meir.

Voyager 2 Fixed

Scientists were able to get space probe *Voyager 2* up and running again, from *11 billion miles away*, after a malfunction shut down its instruments. And *you* thought waiting for the cable guy was tough!

Walking On the Sun

Cool hi-res pic of the sun from the world's largest solar telescope, Daniel K. Inouye (DKIST). But why does it look like unpopped popcorn? See www.space.com.

Fair Weather STEM

This spring, the Nuclear Science Museum will host one-day "Science is Everywhere" Spring Day Camp 2020 sessions for Pre-K to 7th graders, 30 March to 3 April 2020. Call (505) 245-2137, ext. 101, with questions.

UNM School of Engineering summer programs for high schoolers include a Summer Academy, with weekly stipend, 8 June through 3 July 2020, and other programs.

See https://ess.unm.edu/programs/ for details.

Coming Next Issue...

- STARBASE Day 2
- Habitat construction
- STEM Challenge final report

Watch for it!