AFRL NEW MEXICO TECH ENGAGEMENT OFFICE

STEM OUTREACH

Inspiring Future Scientists and Engineers

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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

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

The Rocket Report

All The Shirts Were POLOs

In the year 2525, will we still look as good as we do at 25?

At this year's annual Link-Up Day event, on 10 May 2019 at the Albuquerque Convention Center, the 25th such event we've held, a variety of colorful and creative uniforms were worn by the fifth grade student teams as they simulated establishing a colony on Mars.

Mission to Mars uniforms typically consist mimimally of some kind of coordinated shirt and pants, and polo shirts are *not* required...in fact, many students were simply wearing colorful T-shirts...even tie-dyed ones...

...yet all the shirts were POLOs anyway.

That's because the students were at the culminating event for this year's POLO (Pressurized Oscillation Laser Observation) Mission.

Purpose of the mission: Shoot a powerful Directed Energy Directorate-developed optical laser into the Martian interior, creating oscillating shockwaves, simulating meteor strikes, while a Space Vehicles Directorate satellite records and transmits the data.

Scientists *did* record the sound of a Martian earthquake recently, was it caused by our Link-Up Day students? See page 2.

Over **1,300** students from **38** schools around New Mexico successfully completed this year's mission to simulate colonizing the Red Planet with **89** habitats.

Participating fifth grade students

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Symposium Was Egg-stra

The STEM Challenge Symposiuim was a little bit egg-stra this year...egg-stra egg-citing, egg-stra egg-stravagant, and egg-stra egg-tacular!

Seventeen STEM Challenge teams completed the STEM Challenge Symposium on 16 April 2019.

Fifty-six 9th-12th grade students representing 17 teams from 3 schools—nine teams from the Albuquerque Institute for Mathematics and Science (AIMS); one team from Gallup, and seven teams from La Academia de Esperanza (LADE) participated.

Four AFRL volunteers (Dr. Daniel Enderich, Steven Fiedler, Lt Rachel Oliver, and Dr. David Simon), plus Ms. Carri Carothers, acted as judges and awarded points for the launching device

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Tours de Force

AFRL NM supported the National Junior Science and Humanities Symposium (NJSHS) at the Marriott Pyramid Hotel in Albuquerque on 24-27 April 2019; 235 high school students from around the US and DoDEA schools participated in this tri-service research competition; more than 20 AFRL volunteers served as judges.

On 25 April 2019, we hosted more than 50 NJSHS students as they toured four AFRL lab areas.

We also hosted a tour for Supercomputing Challenge participants on 29 April 2019 as part of their culminating event.

Mission to Mars

For Fifth Graders

Mars Pressurized Oscillation Laser Observation (POLO) Mission 2018-2019

All The Shirts Were POLOs

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worked all school year in their classrooms preparing for their trip to Mars. They:

- Designed uniforms and mission patches;
- Planned and packed nutritious, minimal-weight and space-saving lunches;
- Studied Mars Facts and designed Life Support Systems based on those facts;
- Wrote and rehearsed a Saga song/dance routine about their journey to Mars;
- Telecommunicated with other schools' crews; and
- Measured and cut their plastic habitat pieces.

On Link-Up Day, students demonstrated readiness for the mission and received Crew Mission Log points at holding stations that checked the students' life support system models, uniforms, and astronaut lunches.

Over **20** volunteers from the Air Force Research Laboratory (AFRL), and **41** middle/high school volunteer students, assisted at the holding stations.

After weighing their lunches and reporting to their habitat site, student crews performed their Sagas. Using their 6-mil plastic pieces, grey tape, and a box fan, they built colonies of habitats to simulate what scientists would live and work in on the Red Planet.

These habitats, incidentally, are similar in concept to some that NASA has actually considered using for Mars and outer space travel.

Colony Commanders at each colony helped keep the Habitat Directors (teachers) and students on track. This year, the Colony Commanders included Lt Col Alex Carothers (USAF, Retired), Lt Simeon Hanks, Ms. Carri Carothers, Lt Jason Kirkendall, Dr. Ted Ortiz, Capt Chris Rocker, and Dr. Jake Grosek.

The students ate their prepared astronaut lunch inside the habitats, weighed the lunch waste, and then cut the sealed *connecting tunnels* for colony neighborhood exploration.

Linking the habitats together in this way, forming a connected neighbood within the colony, is how Link-Up Day got its name!

Guest Returns

Hi! See, I see the Hi-SEAS! Mr. Zak

Wilson, a mechanical and composites engineer, and former member of NASA's real-world manned "long-duration Mars analog simulation" called Hawaii Space Exploration Analog and Simulation (Hi-SEAS), joined us at Link-Up Day again this year (www.hi-seas.org.)

Mr. Wilson brought back some of his Hi-SEAS projects, including his 3-D printer and 3-D printed objects, and an air pressure vaccum jar that demonstrates the need for pressurized astronaut suits in space, and discussed them with visitors.

Thanks, Everyone!

We'd like to thank Mr. Zak Wilson, all our AFRL volunteers, the Leadership students, the wonderful Albuquerque Convention Center staff, the parents, teachers, and, of course, the over **1,300** fabulous fifth grade Mission to Mars student participants who helped us construct and link **89** habitats around the Red Planet in one day.

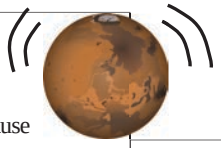
Thanks to you, the 2018-19 Mars Pressurized Oscillation Laser Observation (POLO) Mission Link-Up Day event was something even Marco Polo would have been proud of.

We'll see you during the *next* 25!

Shakes On a Plain

Scientists are trembling with joy: Martian seismology is now a thing!

On 6 April 2019, after 128 sols on the plains of the Elysium Planitia, the Mars *Insight* lander recorded the faint rumbling sound of what scientists believe is a *Marsquake*—like an earthquake, but on Mars.



Quakes on the Red Planet are less intense and harder to detect than on Earth, because Mars lacks tectonic plates.

Did the stomping feet of all those POLO Mission astronauts running around cause the quake? Oh, dear, we hope not!

Feel the vibe at www.space.com.

Link-Up Day Date/Site

	Date	Site	Habitats
✓	10 May 2019	Albuquerque Conv. Ctr.	89

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

DoD STARBASE New Mexico

For Fifth Graders

Plop, Plop, Fizz, Fizz, Flying STEM, Gee, Whiz!

Fifth grade students participating in DoD STARBASE NM Day 4 use PTC Creo® 3D design software to create satellite stations on a computer, without having to fly out to low earth orbit.

But then, things *really* get moving. Students explore Physics and Sir Issac Newton's Three Laws of Motion with activities like *Pop Goes the Fizz*. Student teams of chemists, engineers, mathematicians, and recorders investigate how much Alka-Seltzer fuel is necessary to launch a rocket to a minimum height.

Students force the issue when they build and race CO_2 *Dragster Cars* that have different amounts of carbon dioxide-powered force behind them.

If you could be a fly on the ceiling in Day 5, you might be buzzed seeing students learning about *Cartesian Coordinates.* Students study *fluid dynamics* and use Bernoulli's Principle to help them inflate some *Bernoulli Bags.* Flight enthusiasts discuss STEM careers with students, bringing props such as flight helmets and other gear, and help students practice the fluid dynamics of taking off, flying, and landing airplanes on *flight simulators.*

TECH Mission

For Middle Schoolers

Technology and Engineering Challenges—Fall Rocketry and Spring Satellites Missions

They're Only Human

In TECH Mission Day 3, students turn themselves into a *human gyroscope*, sitting on a rotating stool while holding a spinning tire. The *angular momentum* of the wheel spins the student around, too.

Students also turn themselves into human *lightning rods* when they touch a Van de Graaff Generator. It's a hair-raising tale!

Students take various electronic components, including six resistors, four capacitors, two 555 timers, a battery clip, a power button, and three LED lights, and *solder* (metallically fuse) them all in the correct places on a *printed circuit board* (PCB).

The diodes light up and blink. The message at the bottom of the badge reads, "I've Got the Power," and it's true! The TECH students now have the power to solder working LED badges.

With so much hands-on STEM going on, the students can't help but have fun.

After all, they're only human!

Robotics Challenge

For Middle Schoolers

Robotic Wrap-Up

All the excellent teachers and mentors participating in the very successful Robotics Challenge and Expo this year helped us show participating students that robotics can be fun, useful, and educational...

And we thank you for that. We hope to see you again next year!

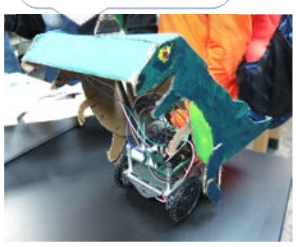
Teachers, please be sure to send in your Student Post Surveys, and your Teacher Survey, if you haven't already done so, to:

Larry@AFRLNewMexico.com.

Also, don't forget we're looking for *new* middle school teachers who want to involve their students in next year's Robotics Challenge.

Not to worry, we have online training available for participating teachers, before implementing this activity with your students. Contact Mr. Larry Heard for more information.

Turn in your surveys! Roar!



STEM Challenge

For High Schoolers

Symposium Was Egg-stra

Continued from page 1

performance and project presentation portions of the event.

Student teams all got out their eggs and started flinging them through vertically suspended hula hoops towards a target 30 feet away, with the egg-stra condition that the egg shouldn't break.

In addition to scrambling to get their eggs through the hoop during the Performance section, students also presented a project report to the judges, for Presentation points.

Student teams also tested their knowledge in a Quiz Bowl, sort of like Jeopardy, egg-cept that even if Ken Jennings *and* James Holzhauer were on the team, the most they could hope to win would be some egg-stra Quiz Bowl points.

Congratulations to AIMS for winning the top Performance Excellence and Presentation Excellence awards, and to LADE for winning the Project Excellence award!

Thanks to all the students, teachers, and volunteers that helped make this year's STEM Challenge and the Symposium so egg-cellent.

But most of all, thanks to the dozens of eggs who made the egg-stra sacrifice for STEM.

Teachers, don't forget to turn in your STEM Challenge Surveys!

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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

MM: Mission to Mars

POLO: Mars Pressurized Oscillation Laser Observation (POLO) Mission 2018-2019

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

STEM Signing Day

High school athetes typically have a "Signing Day" in which they sign a binding "Letter of Intent" to attend their chosen NCAA college. But why should athletes have all the fun?

On 1 May 2019, The STEM Employers Network and AFRL NM hosted a "STEM Signing Day" at Hotel Albuquerque. Area high school seniors signed letters of intent to attend their chosen STEM field and college.

Space Year

Christina Koch is scheduled to spend 328 straight days on the ISS; a new record for female astronauts (Peggy Watson's curent record is 288 days.) NASA hopes to gather data on how humans respond to longer spaceflights such as to the moon and Mars.

Toshiba STEM Grants

STEM: Science, technology, engineering, and *money*; money is good.

K-5 teachers can apply online for a $1,000 Toshiba America Foundation grant to bring an innovative hands-on STEM project into their classroom. Deadline: 1 October each year.

Grade 6-12 STEM education grant requests under $5,000 are accepted throughout the year; deadlines for grant request applications of more than $5,000 are 1 November and 1 May.

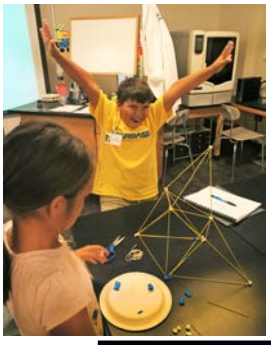
Applications must be for project based learning. They do not consider requests for computers, laptops or tablets! See www.toshiba.com/taf/ for more information.

Summer STEM Camps

As we said on page 1, school's out for summer, but STEM is *forever*!

Besides manning a booth at the New Mexico Science Fiesta Expo on 22 June 2019, we have a number of summer STEM camps for children of Kirtland AFB families and teacher-recommended students:

- From 3-7 June, we will host the annual Tuskegee Airmen, Inc. Aviation Camp.
- From 10-14 June, we have a DoD STARBASE NM Camp for rising 5th-6th graders.
- From 17-21 June, we will have a Space Camp for rising 3rd-4th graders, *and* a Mid-High Robotics Camp!



Soft Robots, Blue Moons

NASA interns are investigating using "soft robots" to help with mobility, linking to other robots (to provide a large temporary shelter, perhaps), leveling the ground under a habitat, or strengthening materials like dust shields, in space places like the Moon and Mars.

To help us get there, Blue Origins recently unveiled the design for a "Blue Moon" lunar lander. Squish over to www.space.com.

Fluid Power Grant

The *Fluid Power Action Challenge* is a competition that challenges middle or high school students to solve an engineering problem using *fluid* (*hydraulic* and *pneumatic*) power.

Middle and high schools may apply annually for grants of up to $500 for fluid power kits for classroom use or for participation in the *Fluid Power Action Challenge* event. Check out www.nfpa.com/home/workforce/Fluid-Power-Technicians/Action-Challenge.htm for more information.

For additional STEM grants, check out:

Apply Yourself

Applications are being sent out for our DoD STARBASE New Mexico and TECH Mission programs for the 2019-20 school year.

We will be recruiting for our other missions in August 2019.

Please contact us for more info.

Coming Next Issue...

To spare some trees, we're going **green!** Our primary newsletter delivery method is now **electronic** (we'll email you a .pdf version).

Want a hard copy instead of, or in addition to, the electronic version? Let us know and we'll make sure you're on the hard copy list!