



# AeroSpace FRONTIERS

VOLUME 22 • ISSUE 7 • JULY 2020

**Achieving  
Work-Life Balance**  
Page 4-5

**Unique Material  
for Aircraft**  
Page 6

**Commerical Crew  
Program Success!**  
Page 9

**Tires That Could...  
Go to Mars**  
Pages 2-3







## DIRECTOR'S SAFETY CORNER

### Safety Culture Survey Results

I want to express my sincere thanks to the 2,500 members of the Glenn Research Center community who responded with valuable feedback to the recent survey. Glenn's Safety Culture scores have been trending upward since we started this assessment in 2010. The highest number of comments were attributed to the question, "What is the strength of the Glenn Safety Culture?" Yet, opportunities for improvement in areas such as flexibility, communication and engagement were identified. We will take actions, such as increasing employee opportunities for involvement in safety activities, as we develop an overall action plan to respond to your important feedback.

A strong safety culture is vital to our mission success.

*Mahe*

### AeroSpace Frontiers

is an official publication of Glenn Research Center, National Aeronautics and Space Administration. It is published the second Friday of each month by the Office of Communications in the interest of the Glenn workforce, retirees, government officials, business leaders and the general public.

Submit short articles and calendar items to the editor at [doreen.b.zudell@nasa.gov](mailto:doreen.b.zudell@nasa.gov).

Editor: **Doreen B. Zudell**, ATS,  
216-433-5317

Assistant Editor: **S. Jenise Veris**, ATS

Design: **Rhys Sampson**, ATS

Managing Editor: **Kelly R. DiFrancesco**

Circulation: **Angela Williams**, ATS,  
216-433-8921

# The Little Tires that Could... Go to Mars



GRC-2020-CN-00022

Photos by Colin Creager



### On the Cover:

Left to right: Pathway Interns Kaiser Aguirre and Jack Stewart, assist John Breckenridge and Richard Manco to assemble a prototype Mars Spring Tire. Research and assembly photos were taken in February.

GRC-2020-CN-00021





GRC-2020-CN-00023

It's rocky. It's sandy. It's flat. It's cratered. It's cold. The surface of Mars is a challenging and inhospitable place, especially for rovers. As future missions to Mars become more complex, NASA's robotic wanderers will need new technologies to look deeper into the history of the Red Planet.

One of those technologies is an innovative new tire in development at NASA Glenn using innovative shape memory alloys (SMAs).

Tires made from these shape-shifting materials offer unmatched durability because they flex with the terrain unlike current rigid wheels. They can actually envelop rocks without the risk of puncture. And they can be designed to provide a smoother ride—almost like adding shock absorbers—to minimize potential damage to systems on the rover.

"Glenn began working with the U.S. tire industry years ago to develop a better non-pneumatic, or airless, tire for the Moon," said Vivake Asnani, lead tire engineer, Rotating and Drive Systems Branch.

"This led to an advanced tire known as the Spring Tire, constructed using a network of steel springs, that adapted and contoured to terrain like a traditional rubber tire."

Glenn engineers have since replaced the conventional steel with springs made of SMA to improve a rover's ability to operate in extremely rocky terrain and at the cold temperatures of Mars. This is appealing to mission planners for future use on Mars because of its lighter weight, traction performance and durability.

Engineers are now refining SMA materials processing, working designs and completing environmental testing on a new Mars tire at Glenn's Simulated Lunar Lab.

"We're developing a Mars-grade material that greatly improves SMA capability and makes reversible material deformations possible in the harsh Martian environment without sacrificing performance," said Dr. Santo Padula, lead SMA materials and design engineer, High Temperature and Smart Alloys Branch.

Testing has proven the tire's superior grip meets or exceeds all traction performance demands and will give rover drivers the ability to cross varying terrains. The more capable tires also allow for a rover design using four tires as opposed to the past six-tire configurations. So, in the case of future human exploration or robotic missions, these tires can provide valuable flexibility in the vehicle and spacecraft design.

The next of NASA's Mars exploration missions, Mars 2020 and its Perseverance rover, is scheduled to launch this month.

Meanwhile, engineers at Glenn will continue to mature SMA technologies for applications on Mars and here on Earth, including passenger vehicle, military and aircraft tires. A concept SMA passenger tire has been tested, and could eventually replace conventional air-filled tires, eliminating the risk of punctures and driving under-inflated, while improving fuel efficiency and safety.

By Jimi Russell



# How Do You Balance Work, Health and Family?

The *AeroSpace Frontiers* staff asked employees how they are achieving work-life balance in this “new normal” telework environment. Several shared examples of how they are adjusting their daily routines to successfully balance work, health and family.

Compiled by Doreen B. Zudell



*Nikki Welch, Office of Communications, created impressive box gardens in her backyard that bring her great peace and joy.*



*Dr. Howard Pearlman, Low-Gravity Exploration Technology Branch, and his wife have been spending more time with their daughter, including time homeschooling. Here, Pearlman and his daughter, Kallie, play “Marble Run,” a kids version of a Rube Goldberg machine.*



*Yu Hin “Billy” Hau, far right, Diagnostics and Electromagnetics Branch, said mandatory telework opened up an opportunity to set up his office at his childhood home. There he balances work and encourages his parents to stay active.*



*Matt Habebusch, Data and Systems Branch, says it’s all life, so let it mix. Get messy! Experiment! Try working on the floor for a bit! If it’s helping you, it’s probably helping the NASA mission.*





GRC-2020-CN-00029

*Lisa Greeney, LTID Publishing Services, transformed her deck into a (safe) tropical paradise—her 2020 Quarantine Getaway. She enjoys this with her buddy, Boston Terrier, Mario."*



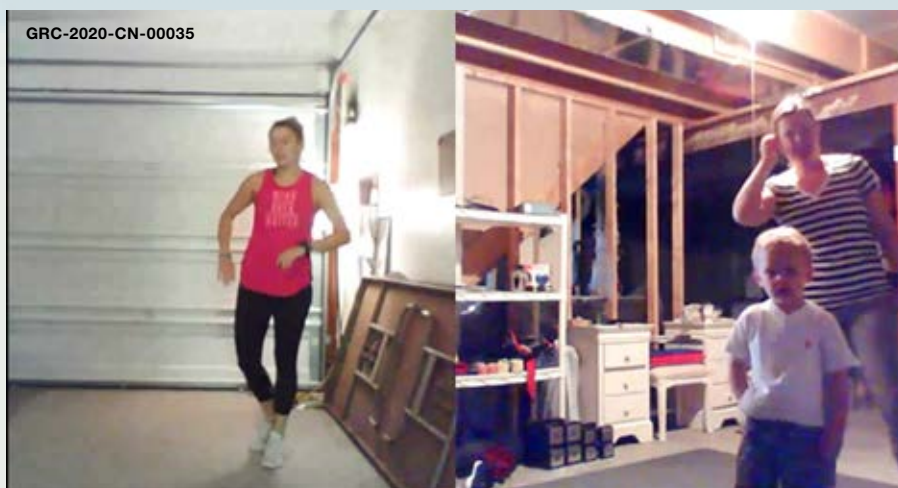
GRC-2020-CN-00031

*Mary Wadel, Aeronautics Directorate deputy, took two online art courses to help relieve stress. One of the classes was the art of Zentangle. This is a picture from her first lesson.*

*Tina Schirmer, Thermal Energy Conversion Branch, finds getting dressed as if she's going into the office, and then changing into casual clothes at the end of her workday, helps separate work from the rest of life. Even when her physical environment doesn't change.*



GRC-2020-CN-00025



GRC-2020-CN-00035

*Jennifer Thomas, right, Environmental Management Office, relieves stress and spends time with her kids through Glenn's Fitness Center Family Class hosted by fitness instructor Heather Mueller, left.*



GRC-2020-CN-00034

*Robin Pertz, Library, History and Records supervisor, finds joy tending her family garden and exercising on the deck her husband recently built.*

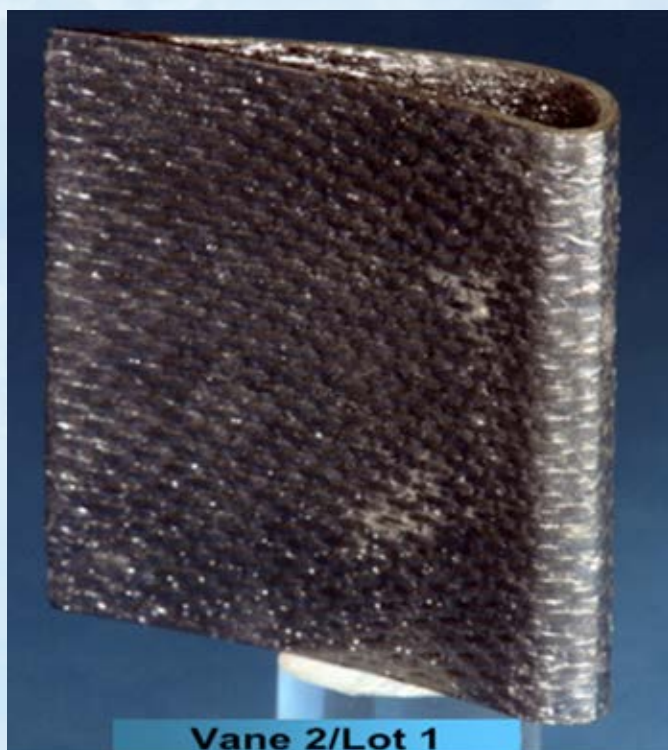


# NASA Develops Unique Materials for the Next Generation of Aircraft

As NASA looks to the future of flight, the agency is investing in technologies aimed at changing the aviation industry as we know it. These developments vary from basic materials to full-scale experimental aircraft, all designed to increase efficiency and reliability, while decreasing weight and cost. One of these materials is silicon carbide (SiC) fiber-reinforced SiC ceramic matrix composites (SiC/SiC CMCs).

Glenn is known for its materials research and development capabilities, and is currently working to bring this SiC fiber material to the commercial aviation market. This lightweight and reusable fiber material is ideal for high-performance machinery, like aircraft engines, operating for extended periods of time in punishing conditions. SiC fibers can withstand up to 2,700 degrees Fahrenheit and are strong enough to last months, or even years, between maintenance cycles.

“Glenn’s materials research is pushing boundaries—creating materials that can withstand intense environments like what is found in advanced gas turbine engines while reducing the weight of these materials,” said Amy Hiltabidel, technology licensing manager at Glenn. “These developments create unique market opportunities, especially for those seeking robust, lightweight structures that can be manufactured using SiC/SiC CMCs.”



GRC-2020-CN-00021

Photo by NASA

*A turbine engine guide vane made with advanced silicon carbide materials.*

Engineers and researchers at Glenn developed a state-of-the-art process for reinforcing the SiC fibers. This technique improves performance and makes the fibers tougher. It also gives engineers expanded design flexibility because the fibers can be shaped for specific applications. These enhancements can be applied to single fibers, multi-fibers or even preform molds without any loss in durability.

“Novel materials such as SiC/SiC CMCs have to be manufacturable and usable to find utility in industry,” said Hiltabidel. “Our materials researchers understand this and employ conventional manufacturing techniques when designing new materials making transition to industry easier.”

After extensive process improvement and testing, NASA opened SiC fibers up for licensing through its Technology Transfer Program. When a company licenses with NASA, the relationship extends far beyond the agency’s brand recognition, it provides U.S. industry with a vast network of subject matter experts, testing facilities and other partners.

“NASA’s SiC technology caught my eye and it was a no-brainer,” said Andrei Evulet, chief technology officer at Jetoptera, an unmanned aerial system (UAS) startup based in Seattle. “I was curious about various enabling technologies that we could license rather than develop ourselves, and frankly, CMCs are really capital-intensive.”

Jetoptera is looking to create a UAS that can augment commerce, deliver humanitarian aid, advance agricultural maintenance systems, replace manned medevacs and more.

Application of this SiC fiber technology extends far beyond aeronautics. It can also be used in land-based gas turbine engines, furnaces and heat exchangers, thermal/fire protection systems, rocket nozzles and even nuclear reactors.

To find out more about how to license available NASA technologies, including Glenn inventions, visit <https://technology.nasa.gov>.

By Lauren Simmers and Jimi Russell



GRC-2020-CN-00020

Photo by Jetoptera, Seattle, Washington

*Jetoptera’s J-55 Unmanned Aerial System uses parts created with NASA Glenn’s silicon carbide materials*



# Step Back in Time

On the morning of May 30, 1985, two student-crewed space shuttle vehicles, (actually reconfigured school buses) embarked on a 4-hour mission that included experiments, data gathering, a vehicle rendezvous and a visit to another planet. The Simulated Shuttle event, sponsored by NASA Lewis (now Glenn), was a tremendous success and an unforgettable day for not only scores of participating students but also the NASA employees and teachers who planned the mission. Learn more about this event, as well as other historic center activities, through Glenn's history features. Step through the portal at <https://www.nasa.gov/centers/glenn/about/history/index.html>.



GRC-1985-C-04538

*Students line up to board a bus converted into a space shuttle vehicle.*

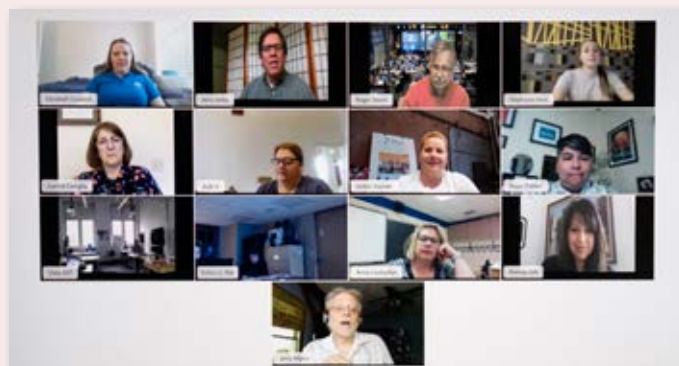
## OSTEM Specialists Host Virtual “Make it NASA” Activity

Twenty-nine formal/informal educators trained to be facilitators of an exciting new STEM making activity during Glenn's Office of STEM Engagement (OSTEM) first virtual “Make it NASA” workshop, held May 27 and 28. An OSTEM team of education specialists, led by Gerald Voltz, demonstrated the level of rigor and support that facilitators should employ to aid students in the NASA design activity.

Dr. Jerry Myers, a project scientist working with Glenn's Human Research Program Cross-Cutting Computational Modeling Project, inspired the activity based on his work. In the activity, titled “Save Your Breath,” students build and test a data-collection system consisting of a sensor, microcontroller, and transmitter that could be used during lunar exploration. They employ computational thinking practices to modify their system to detect carbon dioxide in simulated spacesuit helmets and signal an alert if CO<sub>2</sub> exceeds acceptable levels.

Participants were selected based on proposals for a solicitation that included the identical activity kits used during the workshop in advance of engaging students at their respective organizations. Based on feedback, the workshop goals were met. “I’m not technical at all,” confessed Rebecca Rak, a workshop participant representing Lodi Family Center in Lodi, Ohio, “but I enjoyed the challenge and felt very empowered to be able to work with my kids. I’m already trying to raise money for a mock clean room and additional kits to expose more than the 20 students I projected in my initial proposal.”

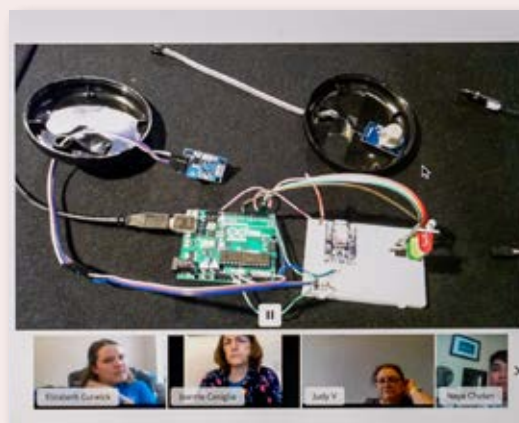
By S. Jenise Veris



GRC-2020-C-01652

Photos by Jef Janis

*Workshop participants join in an online discussion.*



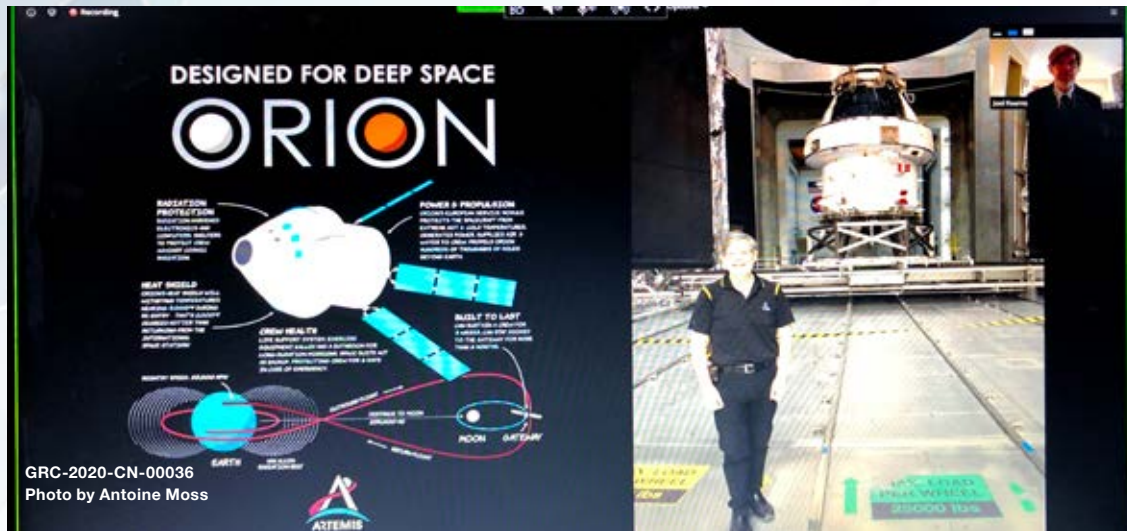
GRC-2020-C-01785

*A visual of wiring the sensor as participants observe.*

# Dr. Kearns Conducts Virtual Presentation for Leaders

As part of The Cleveland Leadership Center's "The Way Forward Leader Lunch Breaks," Glenn's Director of Facilities, Test and Manufacturing Directorate Dr. Joel Kearns engaged virtual viewers in NASA's plans to return to the Moon in 2024. The

Way Forward Leader Lunch Breaks are a series of virtual (via Zoom) discussion workshops on topics to help you move forward in our new and uncertain world.



## NEWS AND EVENTS

### Feeling Homesick for Glenn? Visit Through Virtual Tours

While the need for social distancing has resulted in closures of businesses, museums and attractions throughout the country, many of Glenn's research facilities are still open—virtually. Thanks to the efforts of Glenn's Digital Communications and Imaging Technology Center teams, employees and the public can stay connected to Glenn. A total of 11 facilities—at Lewis Field and Plum Brook Station—can be visited through 360-degree visual tours. Enter through <https://www.nasa.gov/glennvirtualtours>.

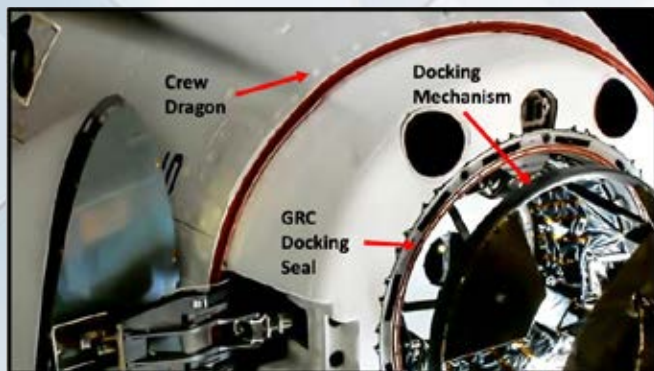


Photo by Jordan Salkin

*Take a seat in the NASA's T-34 plane in Glenn's hangar.*



# Glenn Celebrates Role in Return to Spaceflight From American Soil



GRC-2019-CN-00041

Photo by Bruce Steinetz

*Crew Dragon docking seal developed by Glenn*

On May 30, people across the globe viewed the launch of SpaceX Crew Dragon Demonstration Mission 2 (Demo-2), the first crewed mission of NASA's Commercial Crew Program. NASA Glenn test facilities and workforce expertise contributed to the successful performance of a commercially built and operated spacecraft launched from American soil, after nearly a decade hiatus.

In 2018, SpaceX representatives completed thermal vacuum and acoustic tests at Plum Brook Station on its Crew Dragon spacecraft for Demo-1, an uncrewed test flight in March 2019 to the International Space Station.

Plum Brook's one-of-a-kind, multifaceted capabilities for testing hardware under simulated launch and spaceflight conditions have made it a destination for NASA and commercial partners alike.

Crew Dragon underwent analysis in two different testing arenas. First, in the In-Space Propulsion (ISP) Facility, the world's only facility capable of testing a full-scale upper-stage launch vehicle, to determine if it could withstand the extreme temperatures and vacuum of space during its trip to the space station. The spacecraft then moved to the Space Environments Complex to determine the acoustics effects of launch.

Glenn also worked with a number of local partners (University of Akron, University of Toledo, the Ohio Aerospace Institute, Vantage Partners and Parker Hannifin) to develop spacecraft docking seals for the NASA Docking System (NDS). Many of the NDS components, including the Glenn-developed seals, are used on Crew Dragon to help it connect to the space station, keeping breathable oxygen inside so the astronauts can safely transfer themselves and cargo.



GRC-2018-CN-00040

Photo by Space X

*SpaceX's Crew Dragon in the ISP*

The success of Demo-2 serves as a precursor to fully operational crew rotation missions under NASA's Commercial Crew Program and the anticipated growth of America's commercial space industry. NASA Glenn stands ready to support in any way possible.



## PROMOTIONS



Abadie

**Marc Abadie** has been selected deputy program manager in the Radioisotope Power Systems Program Office, Space Flight Systems Directorate. Abadie formerly served as the Orion Propulsion Functional Area manager and, more recently, acting chief of the directorate's Exploration Systems Office.



Robinson

**Calvin Robinson** has been selected data system architect in the Office for the Data Architect position within the Information and Applications Office, Office of Chief Information Officer. Robinson most recently led the Data and Information Management Solutions project and supported the Scientific Computing and Visualization Team.



Varouh

**Taylor K. Varouh** has been selected facility management engineer in the Test Facility Management Branch of the Management Integration Division, Facilities, Test and Manufacturing Directorate. She previously served in the Space Environments Test Branch as lead mechanical test engineer for the Vacuum Facility 5.

## MORE THAN A MEMORY



Kalis

**Poppy Kalis**, 88, a 1992 retiree with 21 years of federal service, died May 28. Kalis joined the NASA workforce in 1981 providing clerical/administrative assistance in the Library. She transitioned to the Space Propulsion Technology Division in 1983, where she remained throughout her career supporting various branches of the organization. Kalis earned a 1987 Lewis Secretarial Award and a 1991 NASA Group Achievement Award for support to the Solid Surface Combustion Experiment. Her husband, Leo, is also a 1992 NASA retiree.

## Trending with Tech Transfer Enabling Weight Control

Glenn's Technology Transfer Office has signed a nonexclusive evaluation license with Breathefit, LCC, in Palm Desert, California. Breathefit will investigate the use of LEW-17945-1, Portable Unit for Metabolic Analysis (PUMA), for a new concept in weight-loss management. The PUMA technology is a perfect fit for Breathefit's device, which will measure the amount of carbon exhaled at rest and while exercising, and combine those numbers in an app to determine personal carbon exhaustion as it relates to total daily weight loss in pounds. This will aid in enabling weight control, thus reducing obesity and other diseases caused by weight issues. The device would be marketed to sporting goods retailers, medical/rehab/physical fitness facilities and weight loss manufacturers.

For more information on NASA Glenn's technologies available for licensing, visit <https://technology.grc.nasa.gov>.



## Coming on Tuesday, Aug. 18 GRC's Virtual Center Picnic!

Watch Today@Glenn for more details on when and how to virtually experience this year's event. Retirees—for details on how to participate, contact Dorothy Viancourt at 216-433-2532 or [dorothy.e.viancourt@nasa.gov](mailto:dorothy.e.viancourt@nasa.gov).



# NASA Recognizes Glenn's Photography, Videography Excellence

Two Alcyon Technical Services employees in Glenn's Imaging Technology Center earned top honors during NASA's 2019 Photographer and Videographer of the Year competition.

Jordan Salkin's photo of Timothy Bencic from her "Inventor Portrait Series" took first place for outstanding achievement in the Portrait category. View the series on Glenn's Flickr site at <https://www.flickr.com/photos/nasaglen/albums>.

Jim Zunt's videography of Tonya Mitchell for the NASA's "Women's History Month" series took second place in the Production category. View the video at <https://www.youtube.com/watch?v=cZqKWXu1Yyw>.

The NASA Imaging Experts Group conducts an annual program that recognizes the Photographer and Videographer of the Year via submissions from all NASA centers. Submissions for Photography were categorized as Documentation, Portrait, People or Places. Submissions for Videography were categorized as Documentation or Production. A panel of judges selected a first, second, and third place winner for each category. The awards were given during a virtual agency livestream event in June.



GRC-2019-C-01079

Photo by Jordan Salkin

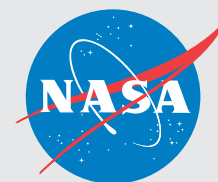
*Salkin's first-place photograph featuring Tim Bencic and his technology.*



GRC-2019-C-13323

Photo by Jim Zunt

*Zunt's second-place videography entry featuring Tonya Mitchell.*



## OUTDOOR SIREN TESTING

The Emergency Management Office staff will conduct an audible siren test on the "lockdown" tone on Saturday, Aug. 1 at Lewis Field. They will conduct a mass notification noise test at bldg. 6 on Wednesday, Aug. 5.

POC: Allen Turner, 3-6826

## AEROSPACE TOASTMASTERS MEET

Improve communications and leadership skills through Aerospace Toastmasters. The group meets on Microsoft Teams on Thursdays from 12:05 p.m. to 12:50 p.m. Contact john.wang-1@nasa.gov, extension 3-3613, for more information. <https://aerospace.toastmastersclubs.org/>.

Stay tuned to Today@Glenn for updates on these activities

Deadline for next calendar section is **July 24, noon**. News and feature stories require additional time.

## Correction

The AeroSpace Frontiers unintentionally omitted the title "Dr." in front of Dr. Jamesa Stokes' name in the caption on page 8 of the June issue. The error has been corrected on the online version.



Salkin

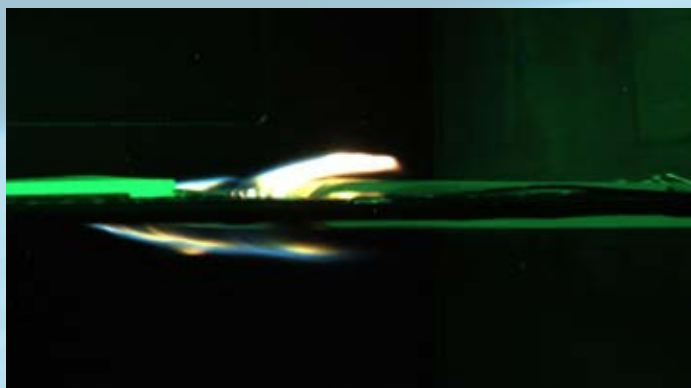


Zunt





# The Flame of Discovery Grows as Saffire Sets New Fires in Space



GRC-2020-CN-00042

Photo by NASA

*An edge-on view of spacecraft material set on fire in space as part of NASA's Saffire IV experiment.*

In May, NASA ignited another set of space fire experiments when Saffire IV lit a number of longer, stronger flames inside Northrop Grumman's Cygnus cargo spacecraft. Saffire, NASA's Spacecraft Fire Safety Demonstration Project, is a series of six experiments that investigate how fires grow and spread in space, especially aboard future spacecraft bound for the Moon and Mars.

Just like Saffires I, II and III, the researchers began the experiment in Cygnus after it completed its primary International Space Station resupply mission and departed to a safe distance away from the station.

One of the unique features of Saffire IV is that after two material burns, a carbon dioxide scrubber and smoke eater were used to remove particulate and carbon monoxide. The instrument to monitor combustion gases and the smoke eater filter are prototypes of what will be used on the Orion spacecraft.

"We want to take what we learned from the first three Saffire experiments and see how flames spread and grow in other spacecraft conditions," said Saffire Program Manager, Gary Ruff, Exploration Systems Office. "We also loaded Saffire IV with more diagnostic equipment to see how effectively we can detect fires, measure combustion products and evaluate future fire response and clean up technologies."

Saffire, built by Zin Technologies Inc. in Cleveland, is equipped with numerous sensors that detect oxygen and carbon dioxide levels, smoke concentration and diameter, and temperatures at different places in the Cygnus vehicle. Four cameras were mounted inside to show the size and spread of the flame.

The first three Saffire experiments had limited-sized fires and examined ignition and spread over similar materials. Results showed that flames spread quickly and achieved a steady size and burn rate, unlike here on Earth where flames tend to continue to grow. Scientists also learned that the size of the spacecraft had more effect on the fire than anticipated.

Saffire's most important goal is to understand fire behavior in space so safety measures can be developed to deal with fire emergencies, when astronauts do not have the option to exit spacecraft or quickly return to Earth. Imagery and data returned from the Saffire investigations will be important for Artemis missions to the Moon and future missions to Mars.

Two additional Saffire experiments are scheduled for October and March of 2021, as NASA continues to develop safer ways to operate future crewed exploration missions.

By Nancy Smith Kilkenny

## Emergency and Inclement Weather Lines

Lewis Field: 216-433-9328 (WEAT)

Plum Brook Station: 419-621-3333

## Connect With Glenn

