



# AeroSpace FRONTIERS

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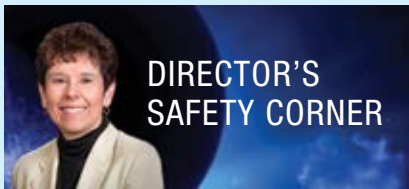
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**Growing Plants  
in Space**

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## Supporting One Another

At the Center Update Town Hall last month, we celebrated our key accomplishments over the past quarter across the space and aeronautics missions, the institution, and our partnerships and collaborations. While I am truly proud of your hard work, I am aware that many of you continue to experience hardships during this enduring pandemic. May is Mental Health Awareness Month, and I encourage you to stay connected with your family, friends, supervisor, and co-workers for support. Please do not hesitate to reach out to the Employee Assistance Program (EAP) resources, if needed, <https://www.grc.nasa.gov/smad/employee-assistance/>.

## 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).

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# Project Examines How To *Water* Plants in Space

Ensuring that plants receive the nourishment they need through proper irrigation is an age-old challenge for farmers here on Earth. It is also a challenge in space. NASA is one step closer to determining the most effective way to provide adequate hydration and aeration for plants to grow in space after completing Glenn's Plant Water Management (PWM) project.

"In the past, NASA has shown that plant growth in space is feasible as a food source," said PWM Project Scientist Tyler Hatch, Low-Gravity Exploration Technology Branch. "From a gardening perspective, it's possible."

In prior projects, researchers found that providing adequate hydration and aeration to the root zone of the plant in zero gravity is an issue. Roots grow differently in space compared to on Earth due to the difference in gravity. That's where the PWM project came in.

The team consists of Hatch; Project Manager Kelly Bailey, ISS and Human Health Office; Principal Investigator and former Glenn employee Dr. Mark Weislogel from Portland State University; and engineers from ZIN Technologies, Inc. They worked with plant biologists at NASA's Kennedy Space Center to determine the needs of plants and issues that arise when attempting to grow vegetation on the International Space Station.

"The goal was to discover how to get the right amount of water to the roots of the plants," said Bailey.

PWM concentrated on the delivery of water throughout the entire life cycle of the plant. The team looked at two main ways water can reach the plant's root zone. The first focused on the traditional manner with the use of soil. The second method involved the use of hydroponics. In this method, no soil is present, and the plant sits directly in water.

The team developed artificial, or simulated, plants for use during the project. Using live plants would pose a challenge, mostly for shelf-life purposes. They used felt, foam, and sponges to develop simulated plants that closely resemble real plants. The goal was to create a simulated plant that mirrored the root system and evaporation rate of a live plant, among other physical

### ***On the Cover:***

*Astronaut Michael Hopkins works with Glenn's Plant Water Management hydroponics test cell on the International Space Station.*



Photo by NASA  
iss064e030009



characteristics. This way, the team did not have to match the biology of working with a real plant.

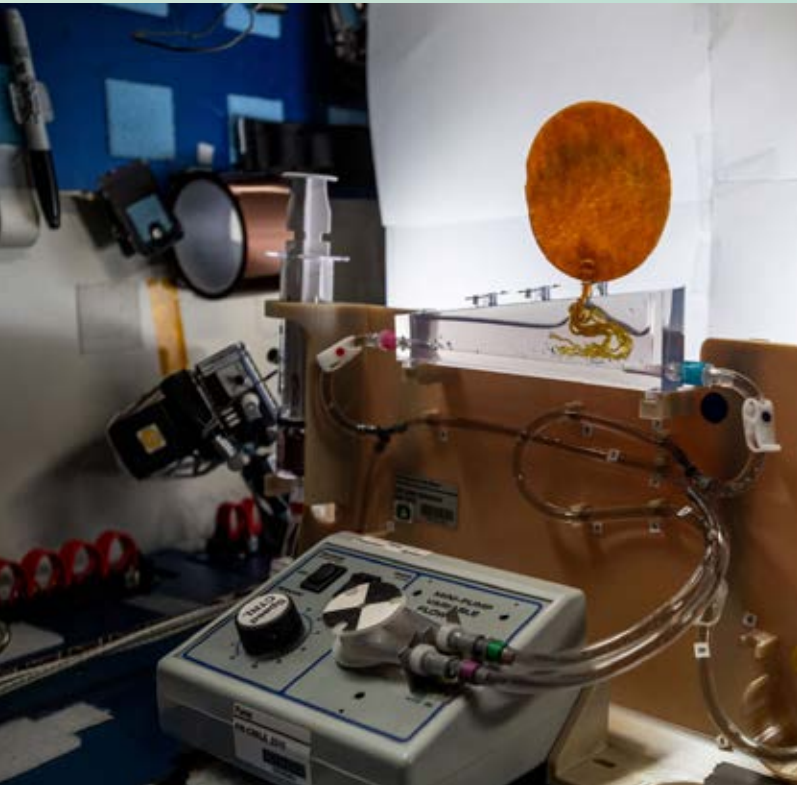
When running the experiment, fruit punch was used in lieu of water. The juice contained nutrients and sugar, which helped simulate more Earth-like conditions for a plant. Additionally, the color of the juice could be easily seen during plant absorption.

Data collection centered mainly on visual aspects of the experiment and how quickly the plants absorbed the fruit punch. Cameras were used to capture video of the PWM process on the space station, which was then relayed to Glenn researchers.

The PWM project completed the first set of space station operations at the end of February and its final iteration in early April. The team gathered valuable data and hopes to run more tests in the future.

“As an early-career researcher, it was rewarding to work on an experiment that went into space,” said Hatch. “Running the experiment and obtaining the data within a year or two was an amazing opportunity.”

By Adam Schabel



GRC-2021-CN-00026

Photo by NASA

Researchers used the PWM hydroponics test cell to determine the most effective way to provide adequate hydration and aeration for plants to grow in space. The PWM project completed its final iteration in early April.



GRC-2021-CN-00031

Photo by Emily Griffin

Hatch gathers data at the Telescience Support Center at Lewis Field.



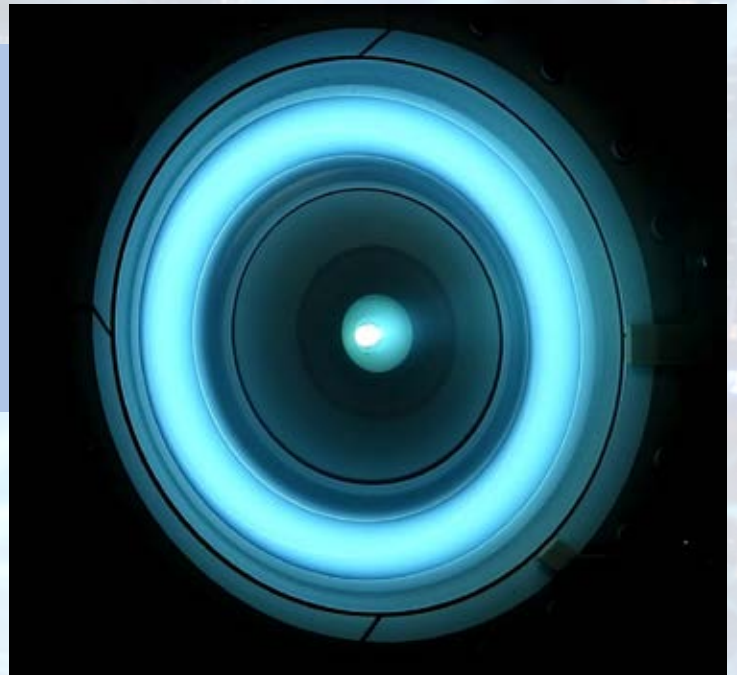
# *We're Fired Up!* Gateway's Propulsion System Passes First Test

The thruster system that will propel NASA's Gateway around the Moon was recently fired up for the first of many ground tests to ensure the Power and Propulsion Element (PPE) is ready for flight.

NASA, along with Maxar Technologies and Busek Co., successfully completed a test of the 6-kilowatt (kW) solar electric propulsion (SEP) subsystem destined for the PPE. The hot fire tests were funded by NASA's Space Technology Mission Directorate, which helps foster the development of commercial space capabilities. The test included multiple startups and shutdowns and other flight-like scenarios to demonstrate the system is ready for the transit to the Moon and extended operations there.

"This is an exciting first step toward proving the PPE's propulsion system will meet Gateway's requirements," said Mike Barrett, Glenn's PPE manager, Power and Propulsion Project Office. "These thrusters will be critical in delivering the first elements of Gateway to lunar orbit and will help us create a dynamic exploration platform over Gateway's 15-year lifespan."

This SEP thruster is about 30% more powerful than anything Maxar or Busek have previously flown. Several of these 6-kW thrusters will later be combined with other higher-power thrusters to complete the PPE's 50-kW electric propulsion system. In total, the PPE will be the most



GRC-2021-CN-00033

Photo courtesy of Busek Company

Engineers from NASA, Maxar Technologies, and Busek Co. in March successfully completed a test of the 6-kW solar electric propulsion subsystem destined for Gateway's Power and Propulsion Element.

powerful electric propulsion spacecraft ever flown, and it will maneuver Gateway around the Moon, opening up more of the lunar surface for exploration than ever before.

A critical part of NASA's Artemis program, Gateway is an orbiting lunar outpost, providing vital support for sustainable, long-term human and robotic exploration. The Gateway's foundational components—the PPE and the Habitation and Logistics Outpost—will be joined together on Earth before launching on a SpaceX Falcon Heavy.

By Jimi Russell

## Great Minds Through Time Think Alike

Can innovators who lived 100 years apart share a common distinction? During the "Wright Brothers and Ingenuity: Great Minds Think Alike" program on April 16, NASA looked back and ahead in time. Glenn joined NASA's Aeronautics Mission Directorate and NASA's Ames Research Center (ARC) in presenting the virtual program that featured panelists who provided the links between the Wright Brothers' first aircraft and the Ingenuity Helicopter on Mars. Panelists included Orville Wright, portrayed by Glenn's Roger Storm (Paragon TEC), education specialist in the Office of STEM Engagement; and ARC's Larry Young, aerospace engineer, and Michelle Dominguez, Engineering Pathways intern. Center Director Dr. Marla Pérez-Davis welcomed students—across six states and Washington D.C.—from Shades of Blue and Experimental Aircraft Association Young Eagles.



GRC-2021-C-01097

Photos by Marvin Smith

Top row: Panelists Dominguez and Young. Bottom row: Catherine Graves, Office of STEM Engagement; and panelist Benson (Orville Wright).



# Glenn Team Helps Mega Moon Rocket Pass Key Readiness Test

NASA achieved a critical milestone along the path to the Artemis I pad on March 18 when it completed the hot fire portion of the Space Launch System (SLS) Green Run test. This is the final check of the rocket’s core stage before launch. The rocket successfully fired its four RS–25 engines for 8 minutes and 19 seconds, at NASA’s Stennis Space Center.

Members of Glenn’s SLS Mission and Fault Management (M&FM) team supported the tests, which verified that the core stage systems performed exactly as they should during launch. This milestone ensures the core stage is ready to be assembled with the other parts of the rocket in preparation for the first integrated flight of SLS and the Orion spacecraft on Artemis I later this year.

“Our team’s support of the hot fire test was the culmination of over 10 years of flight software algorithm development and analysis,” said Edmond Wong, team lead, Intelligent Control and Autonomy Branch. “This test demonstrated that our algorithm designs will perform as intended to help keep the vehicle safe and contribute to a successful mission.”

During the tests, the Glenn team conducted console operation and engineering analysis as an integrated part of the SLS M&FM team operating in the Vehicle Management Support Center at NASA’s Marshall Space Flight Center. They monitored real-time telemetry data and provided the status and observations of the Thrust Vector Control (TVC) and the Sensor Data Qualification and Consolidation (SDQC) algorithms. Due to the current telework requirements, the team performed console operations remotely from their homes.

Leading up to the tests, the team defined performance objectives and success criteria related to the Glenn-developed algorithms. They designed the specialized display software used to monitor the live-streamed test data and status. Later, they performed analysis



GRC-2021-CN-00028 Photo by Edmond Wong  
Wong assesses the performance of the SDQC algorithms, which ensure flight-critical sensor data is acceptable for use by the flight software’s mission and safety functions.

of the test data to identify, assess, and resolve anomalies, and supported recommendations for improvements in flight software parameters.

“Green Run gave us invaluable experience, which will be used when we provide console operation and engineering analysis for the Artemis I launch,” said Wong.

In addition to Wong, HX5 LLC employees, Michael Mackin and William Maul, Intelligent Control and Autonomy Branch; and Laurie Levinson, Multiscale and Multiphysics Modeling Branch, round out Glenn’s M&FM team.

By Doreen B. Zudell



GRC-2021-CN-00029 Photo by Lenore Maul  
Maul operates the specialized console display software, which he helped develop to monitor live-streamed sensor measurements and status from the TVC subsystem.



GRC-2021-CN-00030 Photo by Laura Mackin  
Mackin monitors the status of the TVC subsystem and evaluates the algorithms developed to manage the nominal and off-nominal operations of this component of the core stage.



# Planning an Event? Relax. LTID's Got This!



Art by Jami Drost

Many elements go into conducting an event. LTID helps customers determine what they need and how to get it.

Through the years, Glenn's Logistics and Technical Information Division (LTID) has successfully supported their customers' activities. When the center moved into a predominantly telework environment last year, LTID rolled with the changes—both to help customers now with virtual event planning and to plan ahead for on-site and hybrid events.

Prior to telework, LTID had formed an Event Planning Team consisting of representatives from each functional area within the division to address the event planning process. With the assistance of Glenn's Lean Six Sigma program, the team was able to streamline and simplify the process for the convenience of their customers.

"Our team was very happy with the new processes, but we understood that our customers had been launched into an unfamiliar environment," said Betsy Lavelle, Event Planning Team lead. "We took that to heart and reviewed our processes to see what we could do to address this new style of work and anticipate the needs of the future."

The team's efforts resulted in a streamlined, customer-focused process and a user-friendly tool that clarifies and centralizes that process: the LTID In-Person and Virtual Event Planning Guide. This brand-new customer checklist walks users through all the steps needed to plan meetings and events—from room scheduling, audiovisual support, and photography to janitorial services, move operations, publishing, and transportation. The guide also provides links to event planning partners such as the Office of Protective Services and Safety and Mission Assurance Directorate.

Customers can also link directly to the appropriate GRC forms for acquiring services, most notably the GRC130 series for reserving

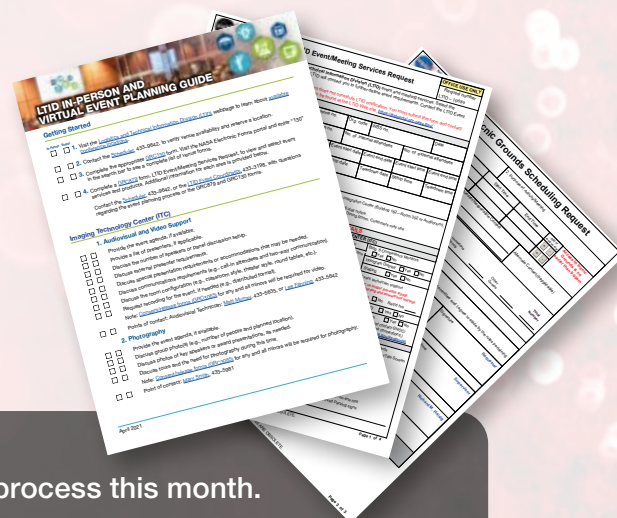
various center facilities and the GRC879 LTID Event/Meeting Services Request. These forms have been evaluated and revised to address virtual, in-person, and hybrid events.

This new process enabled LTID to closely partner with the Office of the Chief Information Officer to help customers plan their virtual events. They teamed up to publish a flyer for customers with step-by-step instructions for requesting event broadcast support from the Enterprise Service Desk and identify other event services from LTID.

"In LTID, we're happy when our customers are happy," said Lavelle. "We want everyone to know that we're not just here for in-person activities. We're here for all of it! Whenever you're planning any kind of event, reach out—we'll help you."

As workplace dynamics continue to evolve over the coming months and year, the new planning guide and updated forms will serve as valuable tools to assist Glenn employees in carrying out NASA's mission.

By Doreen B. Zudell and Sandy Mason



Betsy Lavelle will lead a virtual training session on the new process this month. Watch Today@Glenn for details on registration and rollout of the new products.



# Employees Green Their Space

How do you Green Your Space? In recognition of Earth Day on April 22, Glenn's Sustainability Working Group invited employees to share photos of themselves doing something great for the planet. A collage of all the photos was shared with the Glenn community on Earth Day. Here is a selection of those photos.



GRC-2021-C-01066

*Jeff Cronin composts food scraps to use for gardening and mulch.*



GRC-2021-C-01060

*Peggy Cornell bikes whenever possible instead of driving.*



GRC-2021-C-01058

*Christie Myers uses all-electric heating and cooling.*



GRC-2021-C-01065

*Brianna DeMattia uses environmentally friendly cleaning products with reusable glass bottles.*



GRC-2021-C-01063

*David Smith aerates his backyard compost pile.*



GRC-2021-C-01054

*Dr. Christopher Dellacorte gardens with all-natural fertilizer and heirloom seeds.*



GRC-2021-C-01061

*David DeFelice plants an evergreen tree to green his environment.*



# Glenn Connects With UC, Ohio Industry on Aeronautics' Evolving Future



GRC-2021-C-00994

Photo by NASA

Glenn's Office of Technology Incubation and Innovation is committed to sharing information on technologies and engagement opportunities by connecting NASA's researchers and program managers with academia and industry.

On March 19, Glenn teamed up with the University of Cincinnati (UC) to explore collaborations and opportunities in support of NASA's goals in evolving aeronautics areas. The event "The Future of Aeronautics: Connecting UC, NASA, and Industry in Ohio" drew nearly 400 attendees, including faculty and students from UC and other Ohio universities and representatives from the aeronautics industry.

"Working in collaboration with Glenn's Aeronautics Directorate, we focused on Ohio's strength in aeronautics and highlighted research development efforts in traditional aviation and the emerging market of advanced air mobility," said Mary Lobo, director, Office of Technology Incubation and Innovation.

Center Director Dr. Marla Pérez-Davis joined UC leaders in welcoming participants. NASA Acting Administrator Steve Jurczyk shared his support and enthusiasm for the event in a prerecorded video message. Aeronautics Research Mission Directorate (ARMD) Associate Administrator Robert Pearce provided the keynote address.

U.S. Representatives Anthony Gonzalez and Tim Ryan, U.S. Senators Sherrod Brown and Rob Portman, and Lt. Gov. Jon Husted supported the event through live talks and videos.

In addition to Lobo, several members of Glenn staff participated as presenters or moderators: Harvey Schabes, chief, Technology Transfer Office; Deborah Waters, chief, Test Facility Management Branch; Dr. Kenneth Suder, senior technologist, Propulsion Division; Dr. Ajay Misra, deputy director, Research and Engineering Directorate; and Rick Bozak, Propulsion Systems Laboratory facility manager.

The coordination team included Lobo; Matt Deans, Innovation and Integration Office; Lisa O'Connor, Aeronautics Directorate; and Jeannette Owens, Office of Communications.

The event with UC is part of a series of collaborative efforts with universities across Ohio. Last September, Glenn connected with the University of Toledo in the virtual program "Connecting to Space Technology Through the NASA Glenn Research Center."

By Doreen B. Zudell



GRC-2021-C-00982

Photo by Marvin Smith

Pearce provides the keynote address.



# Online Exchange Store Supports Employee Morale

## News You Can Use

Be on the lookout for emails from the Glenn Exchange that highlight specific items to help you show your NASA pride.

Are you looking for that perfect gift? Or just looking to show off your NASA pride? Look no further than the online Glenn Exchange Store, a one-stop shop where you can find NASA apparel and accessories. From sweatshirts to drinkware, the Exchange Store is a great place to find that NASA-themed item. The store is open 24/7 to employees and the general public.

Along with traditional items, the site offers brand-name apparel from The North Face, Eddie Bauer, Nike, and Under Armour. You will find an array of hats, T-shirts, polo shirts, sweatshirts, and jackets.

For those looking for items that commemorate Glenn's 80th Anniversary, the Exchange Store has merchandise featuring the anniversary logo. It can be seen on T-shirts, polo shirts, and long-sleeved shirts.

"We've been selling a lot of shirts and jackets," said Lori Manthey, Exchange Operations manager. "Merchandise celebrating NASA Glenn's 80th Anniversary is also selling well."

Manthey said shopping at the store aids the Glenn community. "Buying from the store benefits the NASA Exchange, which ultimately benefits employees," said Manthey. "The Exchange supports center picnics, annual holiday events, and other employee activities. By supporting the store, you are also supporting employee morale activities."

Visit the Exchange Store at [www.NASAShop.com](http://www.NASAShop.com) to get coveted NASA-themed apparel and accessories.

By Adam Schabel



## PROMOTIONS



Abadie

**Marc J. Abadie** has been selected chief, Chemical and Thermal Propulsion Systems Branch, Propulsion Division for the Research and Engineering Directorate. He has held several roles over his 20 years of service at NASA. Most recently, Abadie served as the deputy manager for NASA's Radioisotope Power Systems Program.

**James A. (Tony) Doglio** has been selected deputy chief, Testing Division for the Facilities, Test and Manufacturing Directorate. He previously served as chief of the Project Management Branch, as well as chief of the Operational Safety Branch, Safety and Mission Assurance Directorate.



Doglio



## RETIREMENTS



*Soeder*

**John F.X. Leone**, Testing Division chief, Facilities, Test and Manufacturing Directorate, retired April 30, 2021, with 38 years of NASA service.

**James F. Soeder**, Power Division, Research and Engineering Directorate, retired April 30, 2021, with 46 ½ years of NASA service.

**Jack Telesman**, High-Temperature and Smart Alloys Branch, Materials and Structures Division, Research and Engineering Directorate, retired April 28, 2021, with 38 years of NASA service.

## MORE THAN A MEMORY



*Ebihara*

**Ben T. Ebihara**, 92, a 1995 retiree with 36 years of service, died March 29. A Korean War veteran and mechanical engineer, Ebihara was part of a team that provided technical assistance for two traveling-wave-tube amplifiers, which were used on NASA's Cassini spacecraft. He received several notable awards, including an Exceptional Engineering Achievement Medal (1993), a Space Act Award (1987), and a Sustained Superior Performance Award (1987). He retired from the Electron Beam Technology Branch of the Space Communications Division. In his later years, Ebihara advocated for racial equality.

**Bobby W. Sanders**, 81, a 1996 retiree with 33 years of service, died Aug. 29, 2020. As a designer and experimental researcher, Sanders spent most of his career working on supersonic aircraft inlet research and development. He helped author 60 publications and eight patents. Sanders received several awards, including an Exceptional Service Medal (1991), a Steven V. Szabo Engineering Excellence Award (2005), and a Distinguished Publication Award (2009). After retirement, he continued to conceive and develop inlet concepts for NASA and Air Force-sponsored research programs for more than 20 years.



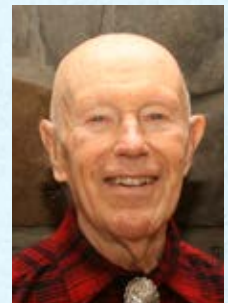
*Sanders*



*Savel*

**Frank P. Savel Jr.**, 83, a 1995 retiree with 36 years of NASA service and an Army veteran, died April 2. As a pipefitter in the Facilities Operation Division, Savel supported many projects at the center's high pressure and chemical facilities. In the Mechanical Support Branch in the 1990s, Savel contributed to the construction of the Space Experiments Laboratory and the rehabilitation of the Propulsion Systems Laboratory cooler. He received a Special Achievement Award (1973) and a Special Act Award (1991).

**Leonard K. Tower**, 97, a 1979 retiree with 35 years of federal service, died March 27. He served in the Air Corps Enlisted Reserve and joined NACA in 1944. After retirement, Tower returned to Glenn as a support service contractor for 8 years before concluding his career with 20 more years as a distinguished research associate in 2016. He worked on developing fuels for jet engines and completed testing for a variation of a buzz bomb engine used by Germany in World War II. Tower authored at least 50 publications, primarily as first author, successfully expanding our knowledge in the critical fields of power systems for aeronautics and space applications.



*Tower*



# New Assistant Editor Joins *AeroSpace Frontiers*



Schabel

Glenn's *AeroSpace Frontiers* staff welcomed Adam Schabel (ATS) to the newsletter team as assistant editor on March 22. Schabel graduated from Cleveland State University with a Bachelor of Arts degree in Journalism and Promotional Communication. He previously worked at *The Morning Journal* in Lorain.



Veris

Schabel succeeds S. Jenise Veris (ATS), who retired in December. Veris' career at Glenn spanned 28 years, with 26 of them supporting the Office of Communications as *AeroSpace Frontiers* assistant editor.

## Memorial Day

# May 31

### Remembering our Fallen Heroes

#### INFORMATION CAFÉ

On Wednesday, May 19, from 11-11:45 a.m., the Library will host a mini lesson about "Data Literacy 101 With Records Management." Check Today@Glenn for the link.  
POC: Robin Pertz, 3-5776

#### VIRTUAL FACILITY TOURS

Glenn is hosting a virtual public tour season, featuring seven world-class facilities, through October. To learn more about the featured facilities, visit <https://www.nasa.gov/nasaglenntours>. The next two tours include: May 19, Ballistics Impact Laboratory; June 22, Space Environments Complex at Neil A. Armstrong Test Facility. Registration opens 1 month before the tour date. Space is limited. Tell your friends and family!  
POC: Debbie Lockhart, 3-8655

#### OUTDOOR SIREN TESTING

Emergency Management Office staff will conduct a mass notification voice test at Buildings 100 and 302 on Wednesday, June 2, at Lewis Field. An audible siren test will be conducted on the "HAZMAT" tone on Saturday, June 5.  
POC: Allen Turner, 3-6826

Deadline for the next calendar section is **Wednesday, May 19, noon**. News and feature stories require additional time.

# Earth Day 2021



## NASA Aeronautics' New Earth Day Video

Learn how NASA Aeronautics is expanding climate change research and testing new automation tools for greener airspace operations and sustainable energy options for aircraft propulsion. Watch this video to learn more! [https://www.youtube.com/watch?v=Tb2j\\_Ndhq-8](https://www.youtube.com/watch?v=Tb2j_Ndhq-8)





National Aeronautics and  
Space Administration

John H. Glenn Research Center

Lewis Field

21000 Brookpark Road  
Cleveland, Ohio 44135

Neil A. Armstrong Test Facility

3597 E. Scheid Road  
Sandusky, Ohio 44870

[www.nasa.gov](http://www.nasa.gov)

Read AeroSpace Frontiers online at <http://www.nasa.gov/centers/glenn/news/AF/index.html>.



## Celebrating 80 Years Looking Back Through the Decades

NASA Glenn was originally established in 1941 as the Aircraft Engine Research Laboratory (AERL), part of the National Advisory Committee for Aeronautics (NACA). The laboratory became a national resource for innovations in aircraft engine technology that transformed commercial and military propulsion systems.

Over the decades, NASA's Cleveland-based scientists and engineers advanced technology in both aviation and space exploration, propelling the U.S. into a leading role in the aerospace industry.

### The Space Program: 1960s

The center contributed to the space program with a series of tests for Project Mercury, an intensive study into the storage and handling of liquid hydrogen, and management of the Centaur upper-stage rocket. By the late 1960s, the center was again shifting back toward aeronautics.



GRC-1960-C-52742

Photo by NASA

*In 1960, Mercury astronaut John Glenn prepares for a test in the Multi-Axis Space Test Inertia Facility (MASTIF) inside the Altitude Wind Tunnel at the NASA Lewis Research Center.*

### Emergency and Inclement Weather Lines

Lewis Field: 216-433-9328 (WEAT)  
Neil A. Armstrong Test Facility: 419-621-3333

### Connect With Glenn

