



# AeroSpace FRONTIERS

VOLUME 23 • ISSUE 12 • DECEMBER 2021

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**Happy Holidays!**





## Celebrating the Year

I want to thank you for all that you've accomplished throughout this past year. I am extremely proud of your commitment and dedication to advance the NASA mission in space and aeronautics. We look forward to 2022 with excitement as we prepare to make history together in the new year with the launch of Artemis 1. Let us also be mindful that this can be a difficult time of year for many, so make sure to reach out and let them know you care. Please continue to follow all COVID-19 recommendations during the holidays to safeguard your family and our workforce. The Employee Assistance Program is available to provide support and assistance at <https://www.grc.nasa.gov/smad/employee-assistance/>.

Wishing you and your families a very happy and safe holiday season!

## 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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# Ballistic Air Guns, Mock Moon Rocks Aid in Search for Durable Space Fabrics

The surface of the Moon is a harsh environment with no air, low gravity, dust, and micrometeorites—tiny rocks or metal particles—flying faster than 22,000 mph. These conditions can pose a hazard to astronauts, their dwellings, and spacecraft.

Engineers at NASA Glenn's Ballistic Impact Lab are working to help the agency select materials for future Artemis missions and predict how they will perform while on the lunar surface.

The innovative lab features a 40-foot-long air gun capable of firing at velocities of 3,000 feet per second. It has become a go-to destination for NASA as it examines situations ranging from the effects of bird collisions with aircraft to ballistic impacts on spacecraft.

Now, the team has been called to test several different textiles that will protect humans during Artemis missions to the Moon and beyond.

"If the object is pressurized, a leak can be catastrophic depending on how big and fast the leak is," said Mike Pereira, Ballistic Impact Lab technical lead. "Running this type of ballistic impact test is essential to a variety of NASA aeronautics and space exploration missions to ensure equipment and materials reliability."

In the first series of tests, the team evaluated materials NASA is considering for habitats, which are designed to be relatively soft and flexible, but very stiff if struck.

To assess the potential fabrics and gauge how many layers would be needed to stop micrometeorite penetration, engineers used



### On the Cover:

*Holiday Flashback - This 2017 photo outside the Director's Office shines brightly with holiday spirit.*

Photo by Marvin Smith  
GRC-2017-C-09897



the facility's air gun to fire steel ball bearings at various fabrics. The team connected the air gun to a vacuum chamber to remove air resistance, allowing it to shoot faster, while a suite of sensors and high-speed cameras measured how each material absorbed or deflected energy.

The resulting impacts take each fabric to the brink of failure to better understand the upper limits of durability and to ensure each can handle the harsh, punishing environment of space exploration.

Other materials tested included spacesuits that could be used for extravehicular activities on the lunar surface and in orbit. Understanding how materials respond to impacts is important for astronaut safety, according to Pereira.

The composite materials were a combination of substances that include fibers for strength and bonding resins to allow transfer of stress and energy. To evaluate these potential materials, engineers used the lab's vertical-impact-drop tester to hurl mock simulated moon rocks made of basalt onto potential spacesuit materials.

Engineers at NASA's Johnson Space Center are analyzing the ballistics testing data to determine which materials will be best for a variety of lunar exploration items.

The next challenge for the Glenn team is testing materials that could capture space debris. New types of aerogels that are lighter and stronger might be the key to developing and deploying in-space devices given ease of use and reduced mass for launch.

By Ellen Bausback

GRC-2020-C-01110

Photos by Bridget Caswell

*Pereira prepares a vertical-impact-drop tester before a spacesuit materials test.*



GRC-2020-C-01123

*Engineers pummeled potential spacesuit materials with mock moon rocks made of basalt like these to see how the fabrics would hold up on the lunar surface.*

# Center Selects Director of Space Flight Systems

**Dr. Michael J. Barrett** has been selected for the Senior Executive Service position of director of Space Flight Systems, effective Dec. 5. He has over 30 years of government, academe, and industry experience and is recognized nationally and internationally as an expert in aerospace flight systems development as well as research and technology development.

Barrett previously served as chief of the Power and Propulsion Project Office in the Space Flight Systems Directorate and project manager of the Gateway Power and Propulsion Element. He earned a Bachelor of Science degree in aeronautical and astronautical engineering from Purdue University, and a Master of Science degree and Doctor of Philosophy degree in mechanical engineering from the University of Houston. Barrett is the recipient of the American Society of Mechanical Engineers Warren M. Rohsenow Prize and NASA's Outstanding Leadership Award.



Dr. Barrett

## Dr. Pérez-Davis Featured in Lessons From Our Leaders Finale

As part of Glenn's 80th Anniversary celebration, the center held a series of discussions featuring former leaders who helped make our center what it is today. Center Director Dr. Marla Pérez-Davis concluded the series on Nov. 4.

Pérez-Davis led an open dialogue discussion with Adabelle Narvaez-Legeza, Chief Engineer Office; José Méndez, Neil A. Armstrong Test Facility; and Andrew Deenanauth, Logistics and Technical Information Division, with members of senior leadership in the audience in the Administration Building Auditorium at Lewis Field. Students and Glenn employees watched the presentation online.

Pérez-Davis shared what leadership means to her and discussed challenges she has overcome during her career. She also talked about her transition from deputy director to director, before expressing her excitement for the Artemis I mission and the importance of advancements in air travel and safety. A question-and-answer session with audience members followed.

The event concluded with a video featuring NASA

Associate Administrator, Bob Cabana, and former Johnson Space Center Director, Dr. Ellen Ochoa, congratulating Pérez-Davis on being named Engineer of the Year by Great Minds in STEM (GMiS). In October, Pérez-Davis was honored as part of GMiS's 33rd Annual Class of Hispanic Engineer National Achievement Awards Corporation (HENAAC) winners.

Robyn Gordon, Center Operations Directorate, and Dr. Rickey Shyne, Research and Engineering Directorate, led a presentation to recognize Pérez-Davis' achievement in receiving the HENAAC award.

By Adam Schabel



GRC-2021-C-03765

Photo by Marvin Smith

Panel members, from left to right, Méndez, Dr. Pérez-Davis, Deenanauth, and Narvaez-Legeza, emphasize the importance of leadership during their discussion.

# Glenn's NEXT-C Set to Debut on DART Mission

NASA's Evolutionary Xenon Thruster—Commercial (NEXT-C) will be demonstrated for the first time on the Double Asteroid Redirection Test (DART), which launched on Nov. 24.

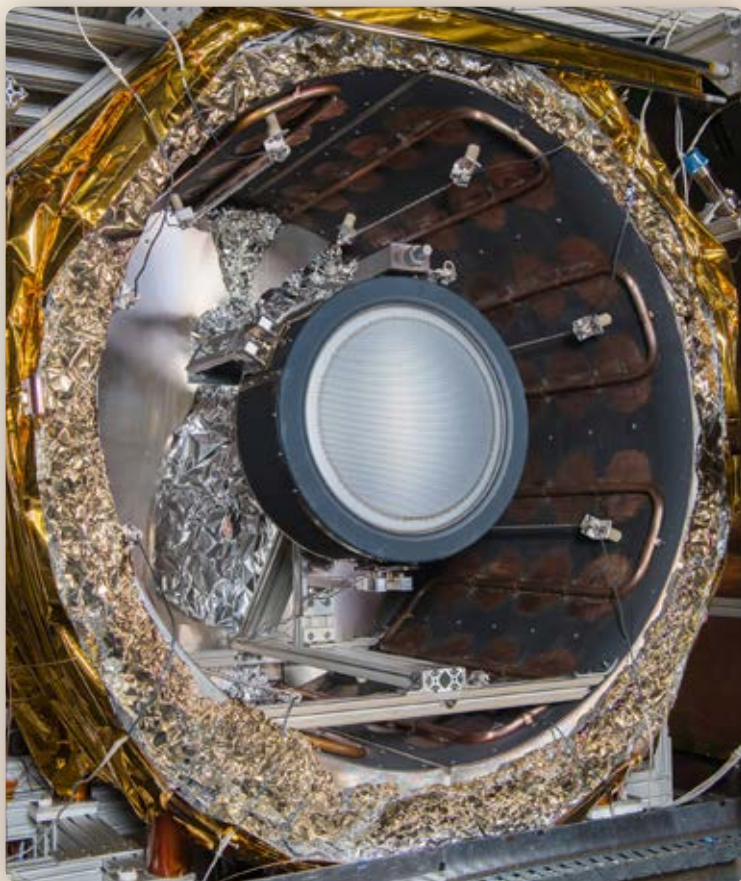
NEXT-C is a powerful next-generation solar electric propulsion system that could propel future long-duration science missions. The technology was developed at Glenn, and the flight hardware was designed and built by Aerojet Rocketdyne. The Glenn and Aerojet Rocketdyne team conducted vibration, thermal vacuum, and performance tests on the flight hardware in Glenn's Vacuum Facility 6 in late 2019. The test campaign concluded with engineers mating the thruster with its power processing unit for an

integration test. The environmental testing verified that NEXT-C could withstand the extreme launch vibrations and temperatures of spaceflight.

DART is a demonstration of technologies for preventing a hazardous asteroid from impacting Earth by changing the motion of the asteroid in space. DART will be the first space mission to demonstrate asteroid deflection by kinetic impact.

Appropriate for a wide range of solar system exploration and commercial missions, NEXT-C would enable Discovery, New Frontiers, Mars Exploration, and outer-planet missions to carry larger payloads and use smaller launch vehicles.

By Adam Schabel



GRC-2020-C-00798

Photo by Bridget Caswell

*The NEXT-C flight thruster is mounted within a thermal shroud in one of NASA Glenn's vacuum chambers. The thermal shroud subjects the thruster to the extreme thermal environments it has been designed to withstand.*

## Glenn Connection

DART is powered by Roll-Out Solar Arrays (ROSA). ROSA is a highly modular, elastically deployable, flexible blanket system for powering commercial, civilian, and government spacecraft. ROSA was provided by Redwire, with the original technology developed by Glenn, the Air Force Research Laboratory, and Deployable Space Systems under Small Business Innovative Research contracts. The technology was advanced by the Glenn-managed Solar Electric Propulsion project. Glenn ground tested the technology and supported a demonstration on the International Space Station in 2017.

DART will also demonstrate Transformational Solar Array Technology. Laced within ROSA, these high-efficiency solar cells and reflective concentrators can provide three times more power than standard solar arrays at distances near Jupiter and Saturn. The Johns Hopkins University Applied Physics Laboratory partnered with three companies to develop a Transformational Array under a Glenn-managed research and development program.

# A CADRE of Mini Rovers Navigate the Lunar Soils of SLOPE

A squad of mini rovers traversed the simulated lunar soils of NASA Glenn's SLOPE (Simulated Lunar Operations) lab recently. The shoebox-sized rovers were tested to see if they could navigate the conditions of hard-to-reach places such as craters and caves on the Moon.

NASA's Cooperative Autonomous Distributed Robotic Exploration (CADRE) project is developing small robots programmed to work as a team to deploy into environments too risky for full-sized rovers. They would explore as a group to collect data as well as 3D imagery to map areas of the Moon and eventually Mars.

A team of researchers from NASA's Jet Propulsion Laboratory in California worked with SLOPE engineers for a week to see if the robots could manage the challenging, fine-grained lunar soils.

"We tested the traction of the wheels in different soils and soil conditions," said Alex Schepelmann, lead roboticist for SLOPE. "The rover wheels were also tested to see if they could negotiate large lunar rocks and climb the slopes of our tilt beds that simulate the hills of the Moon's surface."

The SLOPE team also used scientific imaging equipment to determine the amount of wheel slip in the soil, which could affect the rover's ability to determine location in its onboard computer.

"Since there is no global positioning system (GPS) on the rovers, location is determined by wheel rotation," said Schepelmann. "If the wheel slips on the soil, the rover might think it has gone farther than it has actually traveled."

Schepelmann said the spoked wheels on the CADRE robots are a mini version of the wheels on the VIPER rover, which will be sent to the Moon in 2023 to look for water ice.

The CADRE rovers continue to be developed and tested at JPL. CADRE is targeted to fly as a technology demonstration on a commercial robotic lander within the next five years via NASA's Commercial Lunar Payload Services (CLPS) Initiative.

By Nancy Smith Kilkenny

*NASA Jet Propulsion Laboratory roboticist William Reid sets up an obstacle on SLOPE's tilt bed prior to rover testing.*



GRC-2021-C-03896

Photos by Alex Schepelmann

*NASA Jet Propulsion Lab roboticist Michael Paton works on the electronics of a mini rover before testing at Glenn's SLOPE Lab.*



GRC-2021-C-03895

# Coins Awarded for Glenn HEROICS



In 2016, Glenn's Senior Management Team developed a set of Glenn core values. These became known as Glenn's 7 Expected Behaviors, or HEROICS: (1) Helping All To Succeed, (2) Excellence, (3) Respect, (4) Openness, (5) Integrity, (6) Cooperation, and (7) Safety. In 2019, senior leadership commissioned a HEROICS Coin to recognize employees who embody the spirit of the seven HEROICS tenets.

Center Director Dr. Marla Pérez-Davis is proud to recognize the employees who received Glenn's HEROICS Coins in 2021:

**Scott Broensen**, Office of the Director, for your support to the successful NASA Glenn Neil A. Armstrong Test Facility renaming ceremony on Aug. 12. Your efforts as the Glenn Legislative Affairs Officer, assisting in the overall planning for the event, were extremely valuable.

**Lauren M. Demirjian**, NASA Office of the Chief Human Capital Officer, for your outstanding leadership and contributions to enabling Glenn to successfully, and in a timely manner, address executive staffing, training, and development needs.

**Seth Harbaugh**, Center Operations Directorate, for your support to NASA Glenn's COVID-19 response and to the Return to Onsite Work efforts. Your hard work and efforts in coordinating and leading several cross-organization teams ensured continued safety and health and streamlined the onboarding of backlogged services at the center.

**Jay W. Jackson**, Office of the General Counsel, for your leadership to the NASA Glenn Return to Onsite Work Stage 2 coordination during the COVID-19 pandemic. For your efforts in spearheading the formulation and development of the NASA Glenn Stage 2 plan.

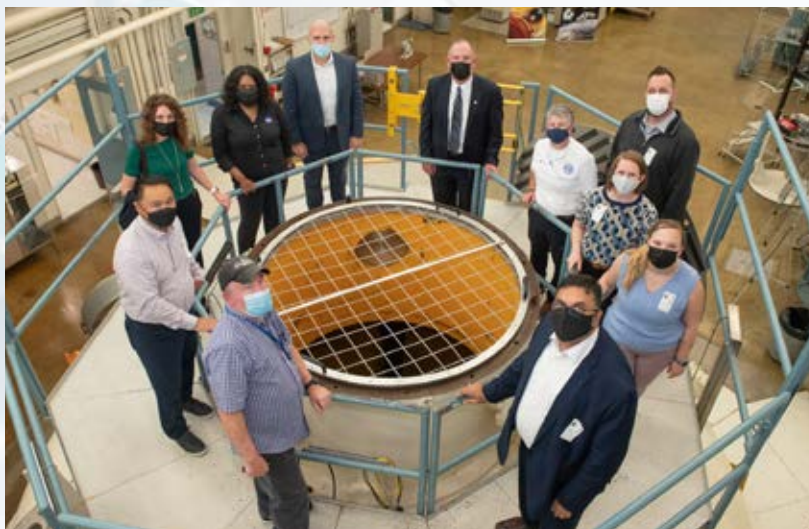
**Luz Jeziorowski**, Safety and Health Division, for the many hours you worked to maintain COVID-19 data. This enabled center leadership to be continuously updated, demonstrating your commitment to the safety of our employees.

**Christie J. Myers**, Environmental Management Office, for your support during the Fiscal Year 2021 Glenn Environmental Management System audit.

**Bryan Smith**, Facilities, Test and Manufacturing Directorate, for your support to NASA Glenn's Return to Onsite Work efforts. Your collaborations across organizations allowed for the completion of mission critical work.



# Visit Strengthens Ties With Cybersecurity and Infrastructure Security Agency



GRC-2021-C-03456

Photo by Marvin Smith

*Natarajan (front, right) and staff join members of Glenn's workforce in the Zero Gravity Research Facility.*

Nitin Natarajan, deputy director for the Department of Homeland Security's Cybersecurity and Infrastructure Security Agency (CISA), visited Lewis Field on Oct. 14. Glenn Associate Director Larry Sivic provided a center overview and accompanied Natarajan and several members of his staff on facility tours. The group viewed the Icing Research Tunnel and the Zero Gravity Research Facility. They discussed cybersecurity aspects of operational technology and critical infrastructure relative to Glenn's varied missions.

## NEWS AND EVENTS

### SCaN Team Wins Best Paper

Glenn's Space Communications and Navigation (SCaN) Wideband User Terminal project team earned the International Communications Satellite Systems Conference (ICSSC) best paper at the joint 26th Ka and Broadband Communications Conference and 38th ICSSC. The paper, "Development and Demonstration of a Wideband RF User Terminal for Roaming between Ka-band Relay Satellite Networks," was co-authored by Glenn's Marie Piasecki, Joseph Downey, Nang Pham, James Nessel, Adam Gannon, Daniel Zeleznikar, and Mick Koch. Glenn's Wideband Project has developed a user terminal that allows for network roaming in space, advancing space communications interoperability for future NASA near-Earth missions.





## Have You Chosen Your CFC Charity?

The 2021 Combined Federal Campaign (CFC) is well underway. Have you made your pledge and chosen your charity? Several charities were highlighted during Glenn's CFC virtual Agency Fair on Nov. 10. Glenn's campaign runs through Jan. 15, 2022, with the goal of raising \$275,000.

For more information, visit Glenn's CFC page at <https://www.grc.nasa.gov/cfc/>.

For a list of charities, download <https://ohiocfc.givecfc.org/sites/cfczone28/files/2021-09/2021%20Charity%20Listing%20Ohio-508.pdf>.



GRC-2021-C-03870

Photo by Bridget Caswell

*Trea Kiser, Special Olympics Ohio, was one of several charities highlighted during the agency fair.*

## NASA Accepts Nuclear Lifetime Achievement Award

Lori Glaze, director of NASA's Planetary Science Division, accepted a Lifetime Achievement Award on behalf of NASA at The Observatory at the America's Square on Oct. 19 during the opening ceremony for Nuclear Science Week.

National Museum of Nuclear Science and History Director Jim Walther honored NASA and the Department of Energy with the 2021 Nuclear Lifetime Achievement Award for their work in nuclear science, space exploration, and discovery.

Glaze remarked on the successful partnership between NASA and the Department of Energy that has enabled more than 25 space science missions to carry nuclear power systems.

As the scientific community continues to benefit from these missions, NASA is building on the success of nuclear in space and investing in new technology to enable a robust human presence on the Moon and eventually human missions to Mars.

This June marked 60 years since the launch of the United States' first nuclear-powered spacecraft, Transit IV-A. Glenn has played a vital role in nuclear power technology. To find out more about our center's role, visit <https://go.nasa.gov/3HJ00BJ>.



GRC-2021-CN-00065

Photo by NASA/Aubrey Gemignani

*Glaze (left) accepts a Lifetime Achievement Award from Walther.*

# Congratulations to the 2021 Golden Shoe Recipient!

Glenn's Human Resources Office has earned the 2021 Golden Shoe Award for its participation in the Virtual Health Walk. Safety and Mission Assurance Directorate (SMAD) took second place, while the Office of the Chief Financial Officer finished third. The activity was part of the SMAD's Safety and Health Awareness event in September. Thanks to everyone who stepped out, got in some exercise, and enjoyed the competition!



GRC-2021-C-03848

## Retirements

**Robert Romanofsky**, Communications and Intelligent Systems Division, Research and Engineering Directorate, retired Nov. 30, 2021, with 38 years of NASA service.



*Romanofsky*

## More Than a Memory



*Truskot*

### Truskot's Attention to Detail Contributed to Project Success

**Floyd J. Truskot**, 59, an engineering technician in the Space Environments Test Branch, died Oct. 5. Truskot began his career at NASA Lewis as an electrical draftsman after graduating from Lorain County Community College in 1992 with an associate degree in Engineering Technology. He supported many projects throughout his 29 years at the center. Truskot's attention to detail led to requests for his assistance on technical projects where he provided drafting services. He was a member of Glenn's Disability Awareness Advisory Group.

"Those who worked closely with Floyd described him as a gentleman who was always very professional and thorough," said Shelly Doehne, Truskot's supervisor. "He was proud of NASA and his opportunity to work for the agency."

**Robert J. Antl**, 87, a 1989 retiree with 32 years of NASA service, died Oct. 9. He worked on small rocket engines and participated in testing of the RL-10 engine for Centaur. Antl also studied inlet distortion in jet engines, helped calibrate the General Electric J-85, and contributed to the Engine Component Improvement (ECI) and Advanced Turboprop programs. He received a Group Achievement Award (1980) for contributions involving the ECI project.



*Antl*

*Join us*  
for this virtual event  
MONDAY  
December 13, 2021  
12 TO 2 P.M.  
See Today@Glenn for more information.

2021  
*Holiday Virtual Townhall*

**OUTDOOR SIREN TESTING**

Emergency Management Office staff will conduct an audible siren test on the “tornado” tone on Saturday, Jan. 1, at Lewis Field. A mass notification voice test at building 3 will be conducted on Wednesday, Jan. 5.  
POC: allen.r.turner@nasa.gov

**COLLEGE NOW MENTORING**

The College Now Mentoring Program connects college mentors and students online, where they stay in touch with two emails per month and three virtual meetings per year. The time commitment is minimal (an average of 2 hours per month), and the program is life changing. A virtual information session will be held on Jan. 12 at noon with College Now staff and NASA colleagues who are mentoring.

POC: jeresha.n.nixon@nasa.gov

**INFORMATION CAFÉ**

Glenn’s Library will continue hosting its popular Information Café series in 2022. Mark your calendar for Wednesday, Jan. 19, from 11–11:45 a.m., for the first session of the new year. Topic to come. Check Today@Glenn for the link.

POC: robin.n.pertz@nasa.gov

**BIG BROTHERS/BIG SISTERS MENTORING**

Glenn’s Office of STEM Engagement is partnering with Big Brothers/Big Sisters of Greater Cleveland (BBBSGC) in support of their mission to create and support one-on-one mentoring relationships. BBBSGC is seeking responsible adults to serve as volunteers to youth, ages 7–15. All training and program enrollment is being done virtually, but mentors are doing in-person activities with mentees. Mentors meet with mentees 2–4 times a month. More information is available online at [www.bbbscle.org](http://www.bbbscle.org).

POC: jeresha.n.nixon@nasa.gov

Deadline for the next calendar section is **Wednesday, Dec. 15, noon**. News and feature stories require additional time.

## Why the Moon?

*NASA’s new Why the Moon video showcases the agency’s broad and collective work to advance Artemis. The video features Glenn’s contributions and an appearance by Dr. Dionne Hernandez-Lugo. The video debuted at the 36th Space Symposium, and was subsequently shared with national and international audiences on the agency’s social media channels.*

<https://www.youtube.com/watch?v=bmC-FwibsZg&t=5s>

### Attention Employees and Retirees

## Do You Know This Person?

Glenn’s Logistics and Technical Information Division needs your help identifying people, places, and research from archived images. If you recognize a photo placed here, email [GRC-ITC@mail.nasa.gov](mailto:GRC-ITC@mail.nasa.gov).

To ensure your email reaches the right individuals, please enter “DYKTP” into the subject line. Although we cannot respond to individual emails, please know your participation is appreciated!

GRC-1990-C-03592

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

Read AeroSpace Frontiers online at <https://www.nasa.gov/glenn/aerospacefrontiers>.



## NASA Glenn Named Finalist for 2021 R&D 100 Award

Glenn's Small Spacecraft Electric Propulsion (SSEP) System was named a finalist for the 2021 R&D 100 Award.

The R&D 100 Awards have served as the most prestigious innovation awards program for the past 58 years, honoring great research and development pioneers and their revolutionary ideas in science and technology.

The SSEP System is a high-performance sub-kilowatt Hall-effect thruster and power processing unit that revolutionizes the capability of low-cost small spacecraft to achieve more ambitious missions throughout the solar system. This technology offers exceptional improvements in thrust, efficiency, and lifetime compared to the state-of-the-art electric propulsion technologies.

SSEP Systems have applications in aerospace for the propulsion system, intended for small spacecraft using Hall effect thrusters. Commercial space-related applications include station keeping, orbit raising, spacecraft servicing, and missions beyond Low Earth Orbit/Geosynchronous Equatorial Orbit.

Congratulations to the SSEP team, consisting of researchers and engineers across four different branches in Glenn's Research and Engineering Directorate. They include **Matthew Baird, Gabriel Benavides, Randy Clapper, Ariel Dimston, Timothy Gray, Thomas Haag, Scott Hall, David Jacobson, Hani Kamhawi, Thomas Liu, Jonathan Mackey, James Myers, Luis Piñero, Corey Rhodes, Timothy Sarver-Verhey, and John Yim.**

For a full list of the 2021 finalists, visit <https://www.rdworldonline.com/finalists-for-2021-rd-100-awards-are-unveiled/>.



GRC-2020-C-03459

Photo by Jef Janis

*Rhodes (left) and Liu stand in front of Vacuum Facility 8 preparing the H71M-PM Hall-effect thruster for testing.*

### Emergency and Inclement Weather Lines

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

### Connect With Glenn

