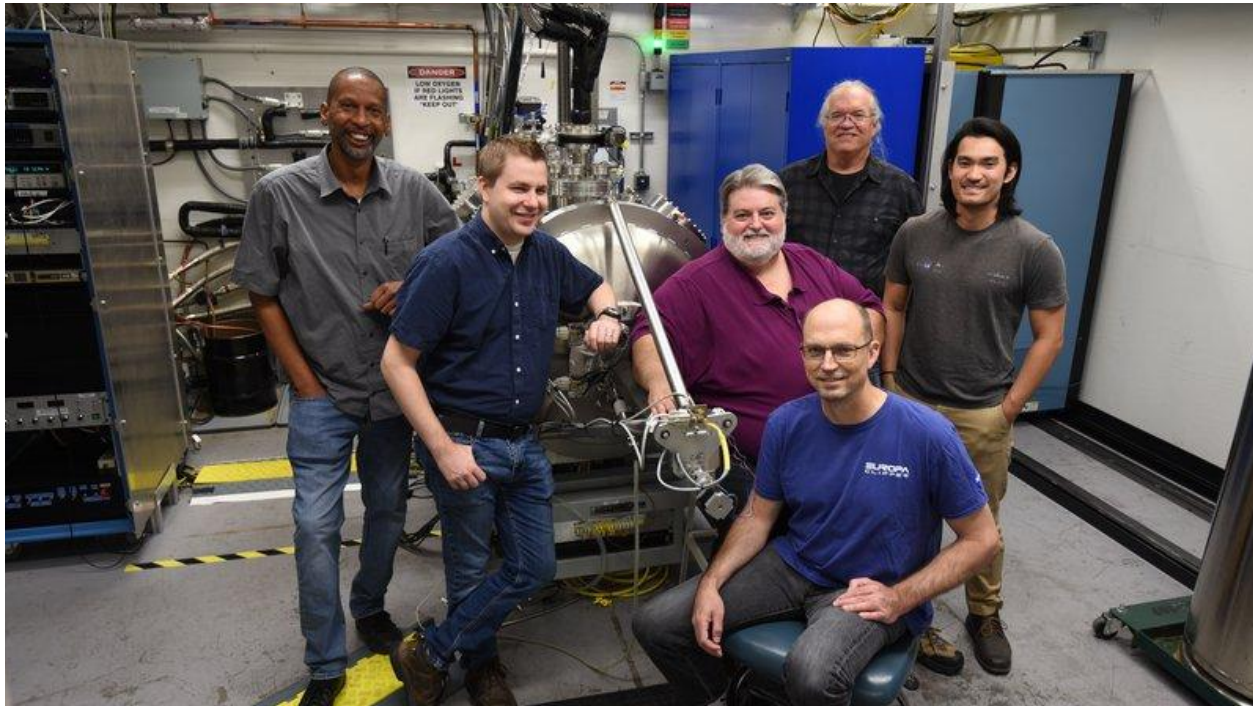


Featured Stories



(Left to right): Dennis Thorbourn, Allen Andersen, Nelson Green, Anthony Eyre (seated), Michael McKee, Jarrett Chai. Image Credit: Nelson Green

Battling Radiation Before Launch: Europa Clipper's Timely Testing

By Taylor Hill

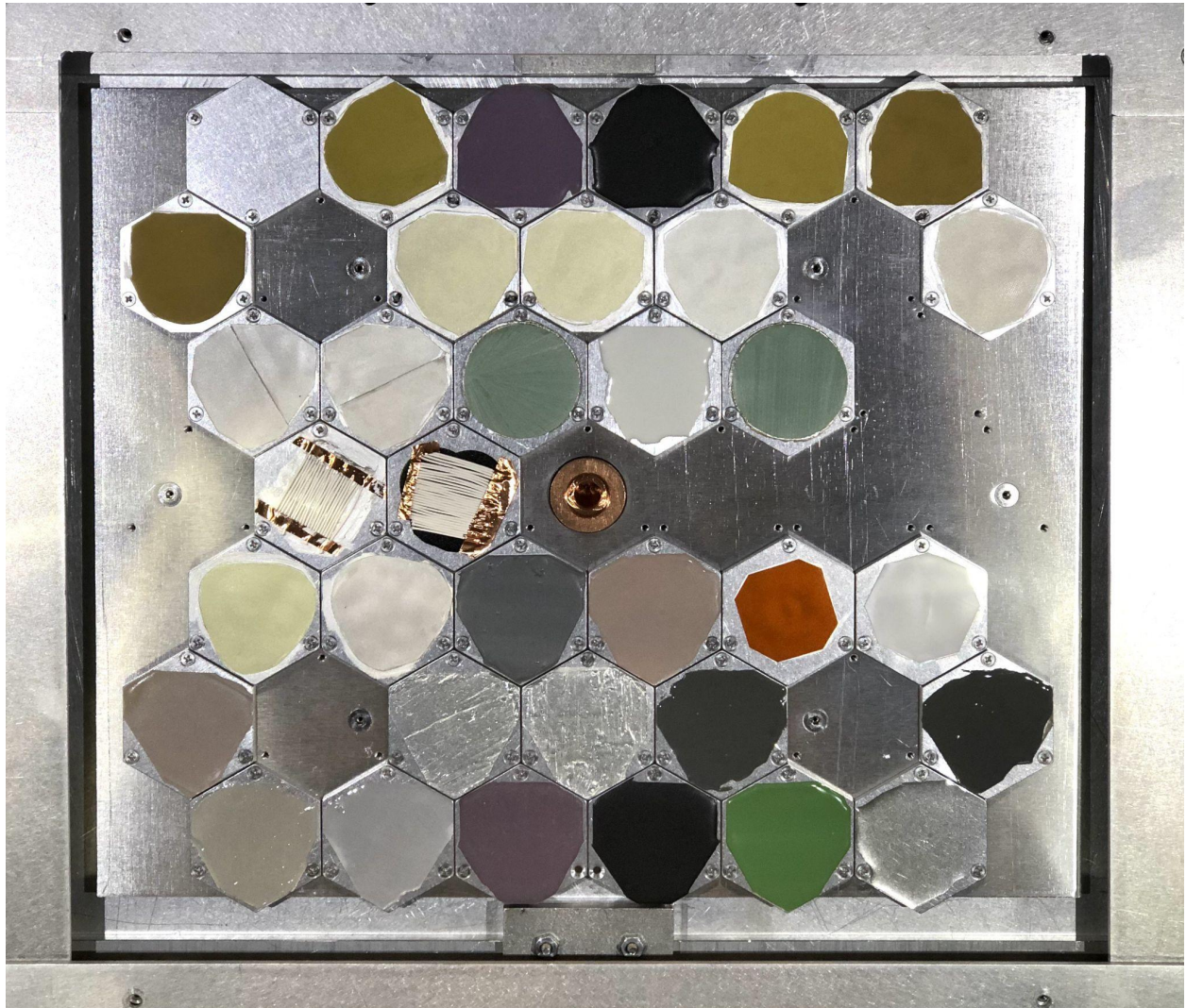
It's 9 a.m. on Wednesday, June 23 at JPL's Dynamitron Lab, located deep underneath Building 183, and a team of engineers and technologists is preparing to zap a batch of sample materials with a high-energy electron gun.

In this batch, 34 samples are placed on a metallic stage within a vacuum chamber chilled to -32 degrees Fahrenheit. The materials being charged include wiring insulators, polymers, adhesives, paints, and even zip ties—most of which are slated for use in the construction of the Europa Clipper spacecraft.

Slated for launch in 2024, Europa Clipper's components are expected to experience repeated heavy doses of radiation during its flybys of Europa. This new test is one of many ways JPL is working to ensure that

when Clipper is conducting detailed reconnaissance of Jupiter's icy moon, its critical components and scientific instruments will endure passage through the hostile environment.

The high-energy electron gun, powered by the Lab's recently refurbished particle accelerator, mimics the level of radiation Europa Clipper will experience as it orbits Jupiter and flies through its powerful magnetic field. For this test, the beam is pushing 1.7 million electron volts (MeV) through the samples—enough to produce a radiation-induced conductivity (RIC) response—and give the team valuable data on which materials could be susceptible to accumulating electrical charge, potentially leading to discharges or sparks that could damage or disrupt the highly sensitive science instruments and other key electronics within the spacecraft's vault.

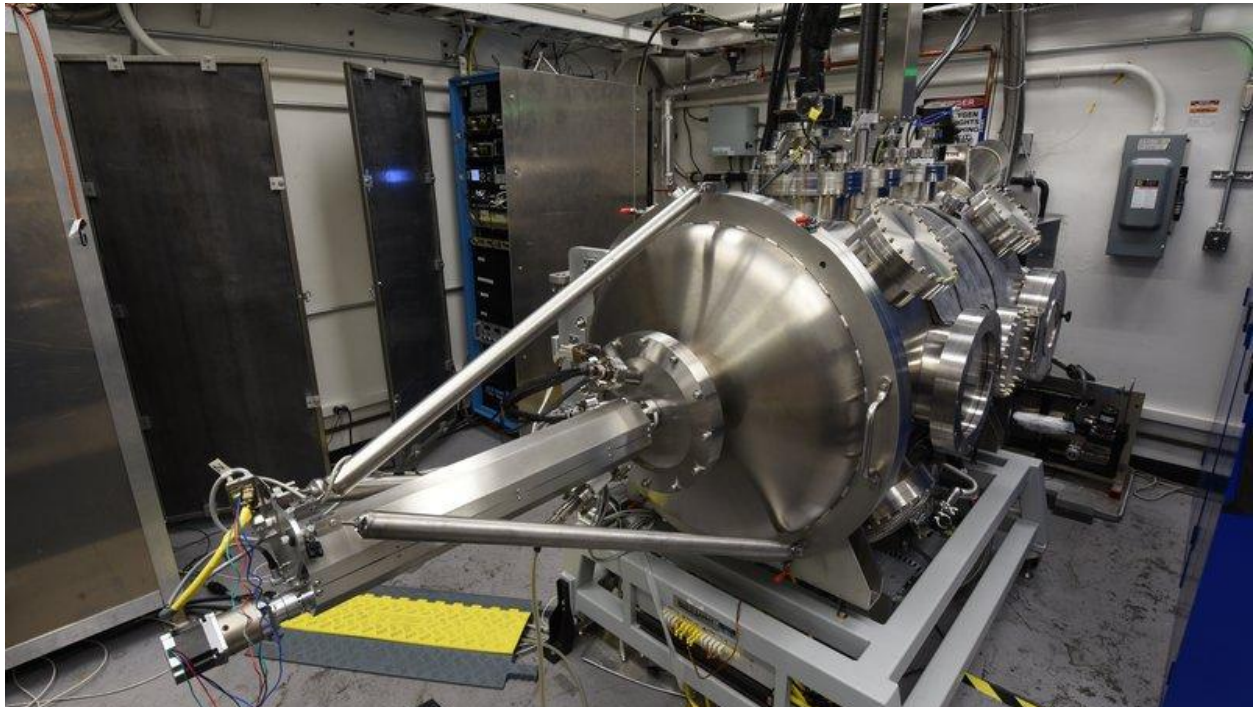


A sample plate filled with sample materials tested in the Dynamitron Lab's vacuum chamber. Image Credit: Courtesy of Nelson Green

But the test didn't start today, explained Dynamitron's lead engineer Dennis Thorbourn. The samples were placed in the vacuum chamber two days prior, and they were exposed to a brand-new, low-energy electron beam of 25,000 electron volts. The team has been monitoring the charge decay since then.

"That's the beauty of it," Thorbourn said. "You've got two ranges of energy that we can test in a flight-like environment without having to move them to various facilities, and we're testing multiple materials at a time. It's a capability that didn't exist and will be giving the Europa Clipper team a new degree of confidence in the materials they're choosing to use, and where extra precautions may be necessary."

The new testing capability is the brainchild of Allen Andersen, a technologist with the Natural Space Environments Group who has been working with the Electrostatic Discharge working group for Europa Clipper.



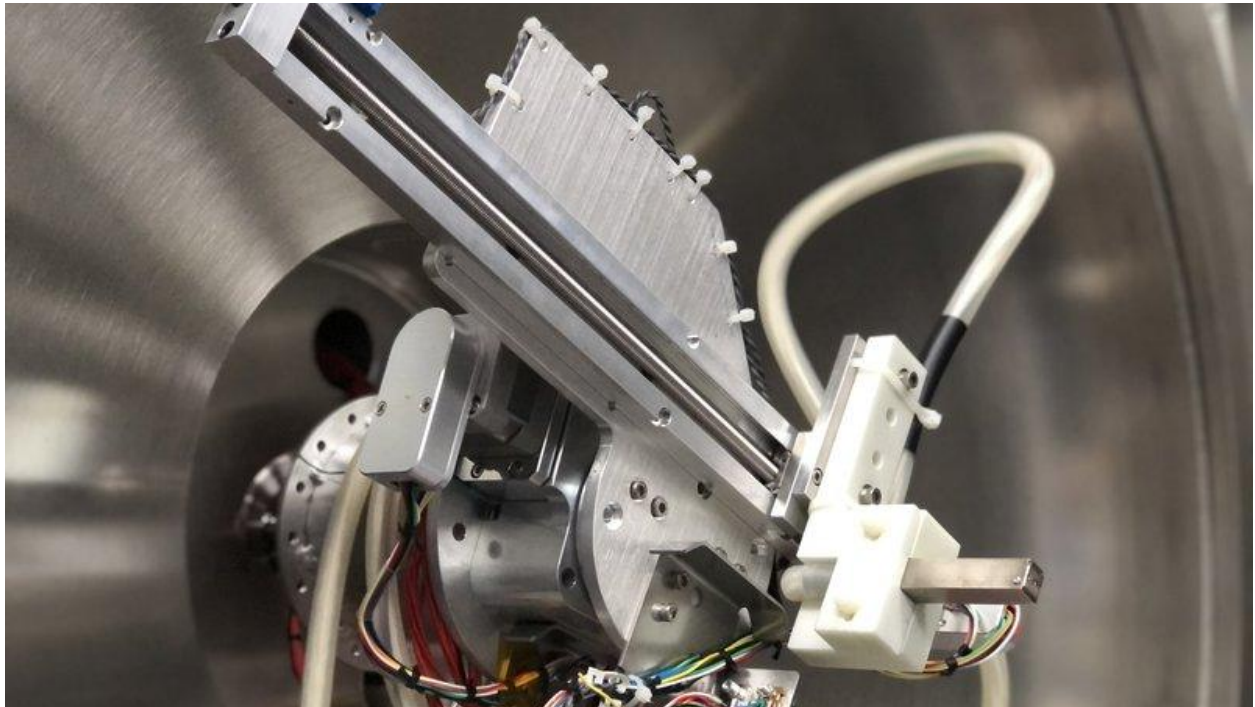
The Dynamitron Lab's 90-degree vacuum chamber with the new low-energy electron gun and new automated measurement system with voltage probe. Image Credit: Courtesy of Nelson Green



The 90-degree chamber open, showing the sample plate system inside. Image Credit: Courtesy of Nelson Green

“The electrostatic discharge control plan for Clipper was almost finalized before I got to JPL full time in 2015,” Andersen said. “And in that plan, the team talks about how they really don’t want any discharge to occur within the vault, because there are so many sensitive computer components and non-conductors in

there, that it's hard to predict how electrostatic discharge would propagate throughout the complex volume."



A closeup of the automated measurement system and voltage probe mounted inside the 90-degree vacuum chamber. Image Credit: Courtesy of Nelson Green

So even within Europa Clipper's radiation vault, the team expects small amounts of radiation to seep in. And while a few materials had previously been tested for electrical conductivity in a Jovian environment, most of the non-metallic materials—including wire coatings, circuit board glues, cable ties, board connectors, epoxies and more—have not, and could potentially hold a charge.

"There's just no reliable data on a lot of these materials, as far as electrical conductivity," Andersen said. The reason for that is there hasn't been a motive or really a method to test materials at these extreme levels, because no other spacecraft has had to deal with such a harsh environment—not Voyager, not Cassini...not even Juno.

Within the particular elliptical orbit of Europa Clipper, the craft will be experiencing a 40-hour window of charging flux each time it passes the Jovian moon before setting off on its 14-day orbit.

"It really becomes an interesting calculation, where you've got the spacecraft going into this period of charging flux, but then it heads away from Europa," Andersen said. "So, it becomes a materials question: if the charge can decay within the materials faster than it takes for the spacecraft to come back around, then you basically reset, and you avoid accumulating charge."

But if a material holds a charge beyond that 14-day window, then there is the potential for a material to accumulate charge over the course of multiple orbits, raising the risk of a spark.

Europa Clipper Sees the Need for New Test

In mid-2020, with the support of Europa Deputy Chief Engineer Jason Feldman and Deputy Mission Assurance Manager Michael Kokorowski, Andersen and Electromagnetic Compatibility Engineer Nelson Green proposed outfitting one of the Dynamitron's vacuum chambers for a more comprehensive and Jupiter-simulating electrostatic discharge testing station dubbed the "Batch Screen Test."

By December 2020, the new testing program was approved, with funding for development coming from 5x and operations and testing funding apportioned by 4x. Now, Andersen and the team had to make the Batch Screen Test a reality in a hurry so that the Europa Clipper team could access the data and make informed decisions on materials properties as the craft moves toward assembly in 2022.

By May, the development team led by Green and Thorbourn had added a low-energy electron gun to the vacuum chamber, complementing the high-energy beam already in place, and they designed and developed the mechanical test plate capable of testing and collecting data on electric charge decay levels for more than 30 sample materials in one batch. Over the past few weeks, the team has been successfully running the new test method, getting valuable data sets in the process.

“The ability to hit multiple materials with low-energy and high-energy beams in a space-simulated vacuum chamber is giving us measurements that would have taken us months, if not years to complete under the previous test method,” Andersen said. “Our intent was to do a radiation-induced conductivity measurement, which is a more flight-like measurement, and it will potentially give us greater confidence in more materials.”

Continuing to Lead

While the Batch Screen Test is a new feather in the cap for JPL’s radiation effects, electromagnetic compatibility, and natural space environments groups, Green says the task of determining how internal electrostatic discharge could impact Europa Clipper has been in the works for years.

“In 2014, I know we were looking to see if carbon composite materials planned in the construction of Europa Clipper’s solar arrays panels would create discharges when exposed to electrons,” Nelson said, who is now the Batch Screen Test team lead. “We’ve been thinking about these potential issues for years.”

For Green, the new test is an extension of what he spent the first decade of his career at JPL doing. Back in 2005, Green was in the RATT [Reliability Assurance Technology Test] Lab in Building 197 using a lower-energy electron gun, looking at the resistivities of materials as they might be exposed in space to electrons.

“It would take us months to get measurements on seven or eight samples,” Green said. He sees the new tests as an extension of the Lab’s work from back then, but with the added capability of being able to test with two energy beams—which has never really been done at JPL—and getting multiple samples tested all at once.

As the results of the materials tests come out over the next month, the team hopes its findings help the Europa Clipper project assess and better understand any potential electrostatic discharge risks in their findings. Beyond Clipper, the new testing capability gives JPL the ability to better simulate space radiation environments, and it will be an improved materials testing tool for future missions.

“We’re really excited to be able to give the Europa Clipper team greater confidence in the materials they are using, and also add to the body of knowledge across the space industry by sharing the results of these materials measurements, including those never tested before. It’s a fascinating and exciting time.”



One of NASA’s Solar System Ambassadors Will Soon Be an Astronaut

By Taylor Hill

Dr. Sian Proctor—a Tempe, Ariz.-based community college geosciences professor by day and “analog astronaut” when possible—is shedding her Earth-bound designation for full-blown “astronaut” as she prepares for the all-civilian Inspiration4 spaceflight aboard SpaceX’s Dragon capsule.

The three-day mission is the first all-civilian-crewed spaceflight, and is set to launch into Earth orbit as soon as Sept. 15. Proctor was awarded her seat on March 30 by winning an online competition put on by billionaire entrepreneur Jared Isaacman, who purchased his own ticket and three other seats from SpaceX.

“The stars aligned for this, and I still can’t believe it,” Proctor said. “I wrote a poem about why they should take me, I read the poem and submitted the video of it, it resonated with people, and here we are.”

In addition to lectures at South Mountain Community College and participating in analog missions such as a four-month NASA-funded Mars simulation in Hawaii, Proctor is a Solar System Ambassador—the JPL-originated NASA volunteer program aimed at raising public awareness of space exploration.

Since joining in 2018, Proctor has done a variety of events both in-person and online, reaching a broad segment of the population across the country including professional education societies, community college students, science festival participants, community-focused organizations, amateur astronomy clubs, nonprofits supporting STEM education, and the general public.

“She even collaborated with Solar System Ambassadors in other states for a global Twitter chat about space exploration,” said Solar System Ambassador coordinator Kay Ferrari.

Below, Proctor describes her experience of being selected for the mission, the winding path she took to reach space, her hopes for humanity and the future of space exploration, and how the Solar System Ambassador program has enhanced her ability to spread her message.

"I first heard about the competition because of a Super Bowl ad, where Jarrod's [Isaacman] company announced two seats; one 'generosity seat' for a person who makes a donation to St. Jude's Children Research Hospital, and one "Entrepreneurship seat" to a person who opened up an online shop through their website, and made a video submission as to why they should be selected," Proctor said. "Funny thing was I didn't even watch the Super Bowl, but someone on Twitter told me I should sign up."



Sian Proctor training in the SpaceX simulators to familiarize herself with piloting the Crew Dragon spacecraft. Image Credit: Courtesy of SpaceX

A Winding Path to Space

Proctor had been down the astronaut road before, and has a lifetime of NASA influence.

"My father really was one of the 'hidden figures,'" Proctor said. "I was born on Guam directly because of human spaceflight, as my dad had worked at the tracking station during the Apollo missions. About eight-and-a-half months after Neil Armstrong stepped foot on the Moon, I was born—a literal moon landing celebration baby."

She grew up wanting to be a fighter pilot with the goal of getting into space through the military, but she required glasses as a kid.

"Even back then I had imposter syndrome, as I didn't think I was smart enough to be an astronaut any other way than through the military," Proctor said. But in her late 30s, as her career in education and science communication blossomed, she was persuaded to apply for NASA's astronaut program.

"I was qualified. I had a Ph.D., pilot's license, Scuba certification ... I just didn't speak Russian," Proctor said. "Still, I didn't think I'd even get past the first round because I worked at a community college, and felt like you needed to go to MIT or Stanford or something."

In 2009, Proctor made it to the final 47 applicants that NASA selected from 3,500 submissions. The space agency chose nine new astronauts that year, but Proctor was not one of them. Over the next decade, she applied twice more and was not among the finalists. When NASA announced another round of applications in February 2020, Proctor passed.

“I had just turned 50, and just felt it wasn’t my route to space anymore,” Proctor said. “And even as I was turning that down, I remember saying that maybe one day I could figure out a commercial space route, thinking it would be a decade away at least. Not realizing it was going to be literally one year later.”

In that year, like most of the country, Proctor spent a lot more time at home due to Covid. Her favorite hobby of traveling was out of the question, so she picked up poetry and painting.

“I put my time and all of my creative energy into training myself to be an artist,” Proctor said. Her art pieces are done in the style of Afrofuturism, and ended up being the center pieces for the online marketplace she needed to develop to be entered in the astronaut competition, along with her video submission.

“My art reflects the idea in my poem submission about ‘JEDI’ space [Justice, Equity, Diversity, Inclusion], and how we need to think about access to space,” Proctor said. “We all want that ‘Star Trek’ world, where you have representation and equal access to space. And when you start looking at how many female Black astronauts there have been at NASA, it’s a poor showing. There’s been just one Black astronaut assigned to the ISS in the past 20 years. You start thinking about all of the phone calls to schools, and the science videos they’ve done on the ISS, and there are no Black people in them. When kids are looking for role models in those places, we’ve got to be actively pursuing that ‘JEDI’ space.”

With her ticket punched, Proctor—who will operate as pilot—is training with the three other members of the Inspiration4 Dragon crew—Isaacman, who will be commander of the mission, Lockheed Martin engineer Christopher Sembroski, and St. Jude physician assistant Hayley Arceneaux. The team recently completed a three-day hike to Camp Muir on Washington’s Mt. Rainier as a crew bonding exercise.

“NASA does similar crew experiences with their astronauts,” Proctor said. “And this hike was by far one of the hardest I’ve done in my life. But for our crew, it was a great learning experience. You get pushed to your limits in an activity you’re not used to, and you end up relying on your crew to find the strength to continue on with the endeavor.”



The four-person all-civilian Inspiration4 crew (left to right) Christopher Sembroski, Hayley Arceneaux, Sian Proctor, and Jared Isaacman standing at historic Launchpad 39A. Image Credit: Courtesy of SpaceX

Bringing Solar System Ambassadorship to Space

With her flight now just months away, Proctor is already thinking of what she can bring on the voyage.

“I plan on bringing each of my four Solar System Ambassador badges that I’ve received since joining in 2018. I want to bring as much of the history behind my journey that got me here, and this program is a part of that,” Proctor said.

“As a representative on this unique mission on a civilian space flight, it really is giving me that moment to share my love of STEAM, and a new platform to create a space to inspire. And the Solar System Ambassador program has always been about that. The amount of outreach that I’ve been able to do increases more and more, and it makes me very proud to be a part of this program, and to be able to highlight it on this journey.”



Sian Proctor at the helm of a Citation CJ3 jet en route to training events for the Inspiration4 crew at SpaceX's Hawthorne facility. Image Credit: Courtesy of SpaceX

For Ferrari at JPL, Proctor’s plan to bring along her badges struck a chord.

“I’m tearing up hearing about it,” Ferrari said. “Solar System Ambassadors take great pride in the connection they have with NASA through the SSA program.”

As for what this level of exposure might mean for the program, Ferrari sees the potential for another large wave of new volunteer applicants.

“Last I heard, Sian’s flight is scheduled for September – our application period,” she says. “It feels like Solar System Ambassadors are coming out of their Covid hibernation with their events. It’s a slow and deliberate process to begin doing more in-person events – which is okay with us. We want everyone to stay safe and follow the guidelines. One lesson we all learned is that they’re not going to give up the virtual events they’ve been doing over the past year, and we’re likely to see more hybrid events being reported in the future.”

And the future of SSA is looking especially bright, thanks to Proctor’s affiliation.

“I think this type of exposure could give us another ‘2017 Eclipse’ response – only potentially larger,” Ferrari said.



Image credit: NASA/JPL-Caltech

NASA Selects Two Missions to Venus, Including JPL's VERITAS

On June 2, NASA Administrator Bill Nelson announced the agency's latest choices for robotic planetary missions, both headed to Venus—JPL's VERITAS mission and Goddard Space Flight Center's DAVINCI+.

VERITAS

VERITAS, which stands for Venus Emissivity, Radio Science, InSAR, Topography, and Spectroscopy, will map Venus' surface to determine the planet's geologic history and understand why it developed so differently than Earth. VERITAS also will map infrared emissions from Venus' surface to map its rock type, which is largely unknown, and determine whether active volcanoes are releasing water vapor into the atmosphere. JPL's Suzanne Smrekar is the principal investigator, and JPL will provide project management. The German Aerospace Center will provide the infrared mapper with the Italian Space Agency and France's Centre National d'Etudes Spatiales contributing to the radar and other parts of the mission.

DAVINCI+

The other selected mission is DAVINCI+ (Deep Atmosphere Venus Investigation of Noble gases, Chemistry, and Imaging) managed by Goddard Space Flight Center. DAVINCI+ will measure the composition of Venus' atmosphere to understand how it formed and evolved, as well as determine whether the planet ever had an ocean. The mission consists of a descent sphere that will plunge through the planet's thick atmosphere, making precise measurements of noble gases and other elements to understand why Venus' atmosphere is a runaway hothouse compared the Earth's. In addition, DAVINCI+

will return the first high resolution pictures of the unique geological features on Venus known as “tesserae,” which may be comparable to Earth’s continents, suggesting that Venus has plate tectonics.

NASA is awarding approximately \$500 million per mission for development. Each is expected to launch in the 2028-2030 timeframe.

These investigations are the final selections from four mission concepts NASA picked in February 2020 as part of the agency’s Discovery 2019 competition.

Read the full news release:

<https://www.jpl.nasa.gov/news/nasa-selects-2-missions-to-study-lost-habitable-world-of-venus>



NASA-JPL/Caltech

Help NASA Hunt for Exoplanets—from Home

The search for exoplanets—planets orbiting other stars—is a burgeoning field of space exploration, with about 4,400 exoplanets discovered during the past 25 years.

Now NASA is asking amateur astronomers and astronomy students to join in a new [Exoplanet Watch](#) project, to help study distant planets. Participants might even get an author credit in a science journal.

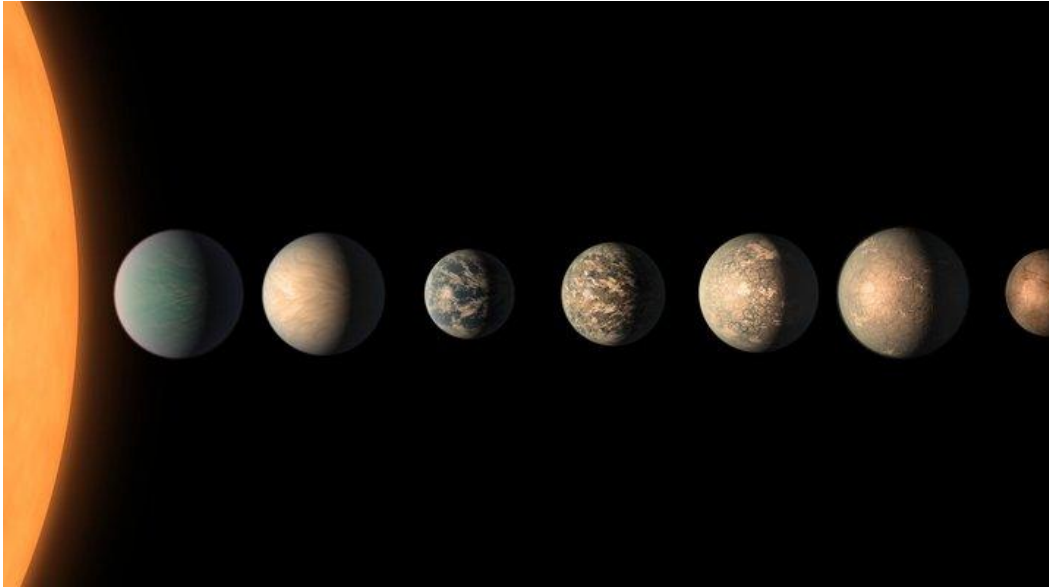
In the first phase of the project, anyone with a modest backyard telescope and camera can trace the tiny, dim shadows these planets cast as they pass in front of their parent stars. JPL-developed software called EXOTIC will turn your observations into light curves, showing how much of the star’s light is blocked (indicating how large the exoplanet is) and how often the light is blocked (indicating how long a year is for the planet, and whether it could support liquid water on its surface).

Exoplanet Watch helps keep transit times fresh so future observations made by larger ground-based telescopes—or even space-based telescopes—can be more efficient. Citizen scientists’ observations may also help NASA determine whether any of those distant worlds might be habitable.

In a later stage of the project, anyone with a computer will be invited to help participate in analyzing the data.

Find out how to get involved at: https://exoplanets.nasa.gov/exoplanet-watch/EW_release_story/

Events



Von Karman Lecture Series - Science + Art: Picturing Discovery

Thursday, July 22

7 to 8 p.m.

[YouTube link](#)

[Ustream link](#)

A scientist and an artist walk into a room... In this STEAM inspired chat, we'll discuss how science influences art and art, in turn, influences science. We'll discuss how JPL artists collaborate with scientists to create artistic renderings of scientific discoveries and how artists take information and enhance it through data visualization.

Speakers: Morgan Cable, Ocean World Astrochemist, NASA/JPL and Joby Harris, Visual Strategist, NASA/JPL

Host: Brian White, Public Service Office, NASA/JPL

Co-Host: Nikki Wyrick, Public Service Office, NASA/JPL

JPL Family News

Retirees

The following JPL employees recently announced their retirements:

40+ Years:

Richard J. Doyle, Section 8000, 40 years

30+ Years:

George Greanias, Section 1610, 38 years

20+ Years:

Yih-Chiao J. Liu, Section 173C, 26 years

Wade Kafkaloff, Section 2210, 23 years

John C. Forgrave, Section 5130, 23 years

Stephen E. Canell, Section 319C, 23 years

10+ Years:

Paul Wolgast, Section 3970, 18 years

Paula Caterina, Section 1190, 18 years

Scott C. Burleigh, Section 312B, 15 years

Letters

The family of Ronald F. Draper wishes to thank those who attended the Celebration of Life service. Without a guest book, we were unable to capture addresses to send personal thank you notes. We appreciated the sharing of memories and kind condolences. Thank you so much. **-Adah Draper (Mrs. Ronald F. Draper)**

Section 398/3918 and JPL Family, THANK YOU ALL for the BEST farewell - Your generosity is amazing and touched my heart. You made me feel important and appreciated. Thank you so much for throwing me such a memorable retirement party, especially during Covid. I'll always remember your kindness! Thank you to all my managers and peers throughout my career. I've appreciated all the great relationships with all of you. A special thank you to my managers: Claudia Tobar, and Andy, Irina, Luke, Charles, Dana, Elias, and Janet. My business team: 3918: Claudia, Debra, Cynthia, Tami, Val, Dave, Paul, Valentina, Kristine, and Ferne. JPL has been my life for most of my life (the past 42 years) and has been a wonderful place to

work. I thank you all, my JPL Family, Section 3918, Section 398 all of you. What you do is amazing, continue to “Dare Mighty Things.” -**Rosemary Guerrero**

My husband and I would like to thank JPL for the beautiful plant and card sent to us to acknowledge the death of my father. -**Alex Murray**

Awards

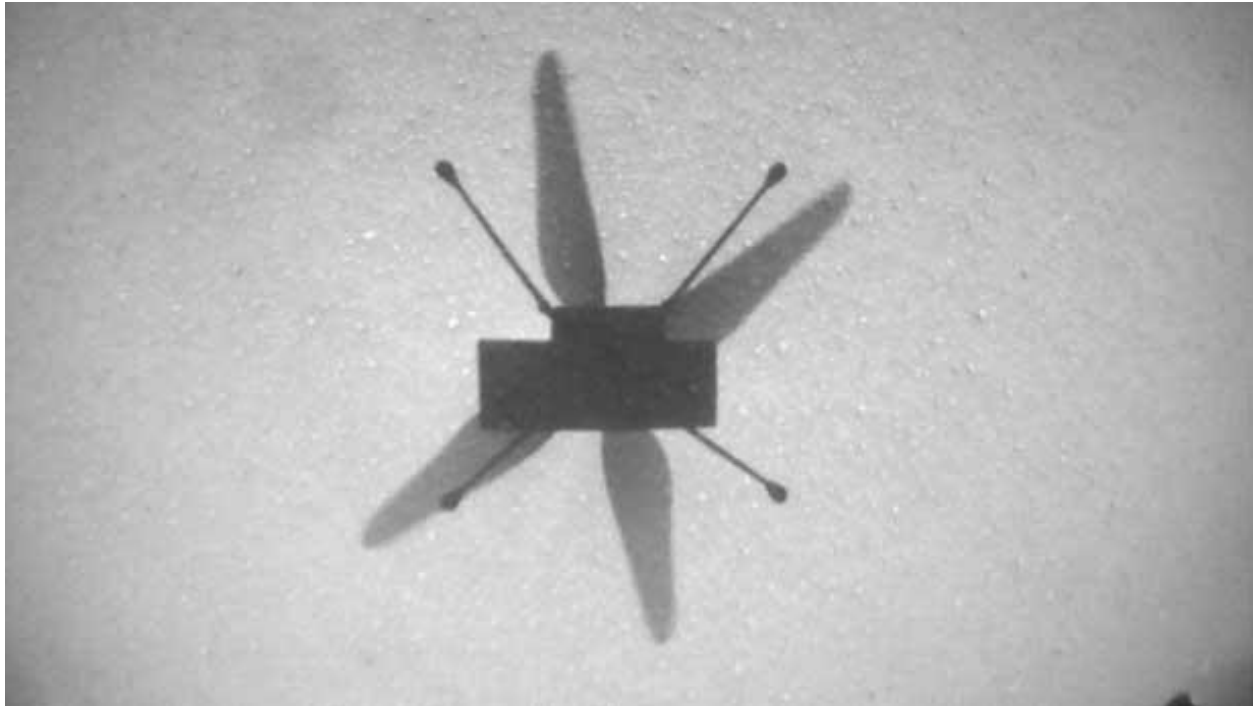


National Space Society Honors Bobby Braun, Rob Manning for EDL Contributions

JPL's Director for Planetary Science Bobby Braun and the Lab's Chief Engineer Rob Manning are each receiving a 2021 Space Pioneer Award from the National Space Society. The awards are for their accomplishments in solving the problem of Entry, Descent and Landing (EDL) at Mars.

The awards recognize individuals and teams whose accomplishments have helped to open the space frontier. The organization says the intent is “to recognize those who have made significant contributions in different fields of endeavor to develop a spacefaring civilization that will establish communities beyond the Earth.”

A presentation of the two awards was videotaped at JPL and will be shown as part of the virtual National Space Society International Space Development Conference, June 24-27. The awards will be streamed live on June 25. Schedule and viewing information is at the [event website](#).



Space Foundation Honors Ingenuity Helicopter

The Ingenuity Mars Helicopter Team is the 2021 winner of the John L. "Jack" Swigert, Jr. Award for Space Exploration from the Space Foundation. The award will be presented Aug. 23 during the opening ceremony of the 36th Space Symposium in Colorado Springs.

A Space Foundation news release says Ingenuity "has proven itself a milestone in aviation and aeronautics history."

The annual Swigert Award recognizes extraordinary accomplishments by a company, space agency, or consortium of organizations in the realm of space exploration and discovery. It honors the memory of astronaut John L. "Jack" Swigert, Jr., one of the Apollo 13 astronauts. The mission and its crew were in peril after an oxygen tank ruptured while they were en route to the Moon. During that time of high drama and high anxiety, people around the globe watched NASA work against the clock and against the odds to return the crew safely to Earth. In that spirit of accomplishment, the Jack Swigert Award was created.

JPL has received an impressive percentage of the Swigert Awards, including honors for the InSight-Mars Cube One Joint Project Team, Dawn, Cassini, Kepler, and the Mars Science Laboratory Mission Team. Full list of winners is [here](#).

In their news release, Space Foundation CEO Tom Zelibor says, "As a multiple-time recipient of the John L. 'Jack' Swigert Jr. Award for Space Exploration, the NASA JPL team continues to raise the bar when it comes to extraordinary accomplishments in the realm of space exploration and discovery. The work of this most unique team has changed history not just on this planet, but it has also truly accomplished a feat beyond compare."