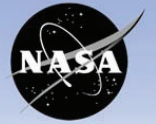


National Aeronautics and Space Administration



# LAGNIAPPE

John C. Stennis Space Center

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November 2022



NASA's Space Launch System (SLS) rocket carrying the Orion spacecraft launches on the Artemis I flight test, Nov. 16, 2022, from Launch Complex 39B at NASA's Kennedy Space Center in Florida. NASA's Artemis I mission is the first integrated flight test of the agency's deep space exploration systems: the Orion spacecraft, SLS rocket, and ground systems. SLS and Orion launched at 12:47 a.m. CST. Photo Credit: (NASA/Joel Kowsky)

# LIFTOFF!

See Pages 3-5

**H**ave you ever taken time to think about... time? Some of my best thinking happens doing just that while sitting outside in my favorite lawn chair.

One definition of time is the indefinite continued progress of existence and events in the past, present, and future regarded as a whole. Time could be considered one's most valuable resource, so how we use it and who it is spent with matters.

Stennis Space Center proves time and again that work happening here in the past, present, and future is completed with excellence by people that make this a great place to call home away from home.

The month of November is a time where there might be a natural tendency to slow down with the sun setting much earlier and temperatures lowering. However, the first part of the month has been anything but slow at Stennis. Look no further than this month's Lagniappe that highlights the flurry of activity taking place.

There was Safety and Health Day 2022 where many gathered and shared the camaraderie while

being reminded of the excellent safety culture here at Stennis – a culture that is strengthened through events like the one hosted Nov. 3. There is something special about being in the room with one another, spending time together.

The following day many gathered to welcome Rocket Lab to Stennis. The federal city continues to grow as new people make their way to south Mississippi for a bright future of testing and pushing the limits of what is possible.

An opportunity to spend time with family came during Stennis Family Day at INFINITY Science Center the first Saturday in November. I even constructed a custom-made spacecraft, which earned cool points with the grandgators.

Ah, yes ... time. When one thinks of it as a whole – the past, present, and future – the times at Stennis are like no other.

It makes me feel thankful, and with the Thanksgiving holiday almost here, I will pause with gratitude and remind myself that time – a valuable resource – spent around fine folks, like here at Stennis – another valuable resource – is time well spent.



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# NASA's Artemis I Mega Rocket Launches Orion to Moon



Following a successful launch of NASA's Space Launch System (SLS), the most powerful rocket in the world, the agency's Orion spacecraft is on its way to the Moon as part of the Artemis program. Carrying an uncrewed Orion, SLS lifted off for its flight test debut at 12:47 a.m. CST Nov. 16 from Launch Pad 39B at NASA's Kennedy Space Center in Florida.

The launch is the first leg of a mission in which Orion is planned to travel approximately 40,000 miles beyond the Moon and return to Earth over the course of 25.5 days. Known as [Artemis I](#), the mission is a critical part of NASA's Moon to Mars exploration approach, in which the agency explores for the benefit of humanity. It's an important test for the agency before flying astronauts on the [Artemis II](#) mission.

"What an incredible sight to see NASA's Space Launch System rocket and Orion spacecraft launch together for the first time. This uncrewed flight test will push Orion to the limits in the rigors of deep space, helping us prepare for human exploration on the Moon and, ultimately, Mars," said NASA Administrator Bill Nelson.

After reaching its initial orbit, Orion deployed its solar arrays and engineers began performing checkouts of the spacecraft's systems. About 1.5 hours into flight, the rocket's upper stage engine successfully fired for approximately 18 minutes to give Orion the big push needed to send it out of Earth orbit and toward the Moon.

Orion separated from its upper stage on its outbound coast to the Moon powered by its service module, which is the propulsive powerhouse provided by ESA (European Space Agency) through an international collaboration.

"It's taken a lot to get here, but Orion is now on its way to the Moon," said Jim Free, NASA deputy associate administrator for the Exploration Systems Development Mission Directorate. "This successful launch means NASA and our partners are on a path to explore farther in space than ever before for the benefit of humanity."

A series of 10 small science investigations and technology demonstrations, called CubeSats, deployed in the hours following the launch from a ring that connected the upper stage to the spacecraft. Each CubeSat has its own mission that has the potential to fill gaps in our knowledge of the solar system or demonstrate technologies that may benefit the design of future missions to explore the Moon and beyond.

Orion's service module performed the first of a series of burns to keep Orion on course toward the Moon approximately eight hours after launch. Mission controllers at NASA's Johnson Space Center in Houston conducted additional checkouts and course corrections in the days following the launch as needed. Orion is expected to fly by the Moon on Nov. 21, performing a close approach of the lunar surface on its way to a distant retrograde orbit, a highly stable orbit thousands of miles beyond the Moon.

"The Space Launch System rocket delivered the power and performance to send Orion on its way to the Moon," said Mike Sarafin, Artemis I mission manager. "With the accomplishment



(Above photo) Guests watch the launch of NASA's Space Launch System (SLS) rocket carrying the Orion spacecraft on the Artemis I flight test Nov. 16 from Operations and Support Building II at NASA's Kennedy Space Center in Florida. NASA's Artemis I flight test is the first integrated flight test of the agency's deep space exploration systems: the Orion spacecraft, SLS rocket, and ground systems. SLS and Orion launched at 12:47 a.m. CST, from Launch Pad 39B. Photo Credit: (NASA/Bill Ingalls)

(Left photo) NASA's Space Launch System rocket carrying the Orion spacecraft launches on the Artemis I flight test Nov. 16 from Launch Complex 39B at NASA's Kennedy Space Center in Florida. Through Artemis missions, NASA will land the first woman and the first person of color on the surface of the Moon, paving the way for a long-term lunar presence and serving as a stepping stone for astronauts on the way to Mars. Photo Credit: (NASA/Joel Kowsky)

of the first major milestone of the mission, Orion will now embark on the next phase to test its systems and prepare for future missions with astronauts."

The SLS rocket and Orion spacecraft arrived at Kennedy's Launch Pad 39B on Nov. 4 where they rode out Hurricane Nicole. Following the storm, teams conducted thorough assessments of the rocket, spacecraft, and associated ground systems and confirmed there were no significant impacts from the severe weather.

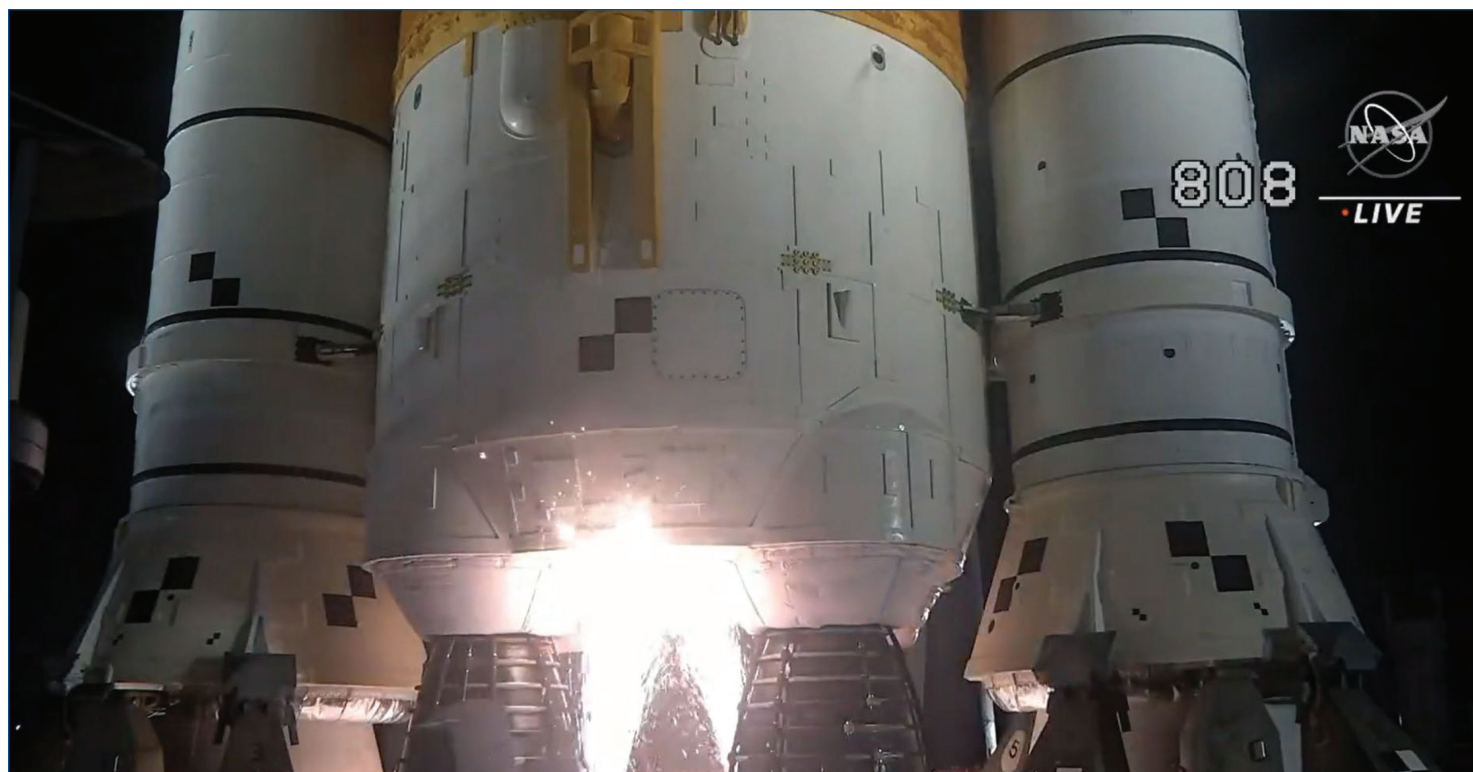
Engineers previously rolled the rocket back to the Vehicle Assembly Building (VAB) Sept. 26 ahead of Hurricane Ian and after waving off two previous launch attempts Aug. 29 due to a faulty temperature sensor, and Sept. 4 due to a liquid hydrogen leak at an interface between the rocket and mobile launcher.

Prior to rolling back to the VAB, teams successfully repaired the leak and demonstrated updated tanking procedures. While in the VAB, teams performed standard maintenance to repair minor damage to the foam and cork on the thermal protection system and recharge or replace batteries throughout the system.

Artemis I is supported by thousands of people around the world, from contractors who built Orion and SLS, and the ground infrastructure needed to launch them, to international and university partners, to small businesses supplying subsystems and components. Through Artemis missions, NASA will land the first woman and the first person of color on the surface of the Moon, paving the way for a long-term lunar presence and serving as a steppingstone for astronauts on the way to Mars.

View more photos of Artemis I [here](#).

# NASA's Artemis I Mega Rocket Launches Orion to Moon



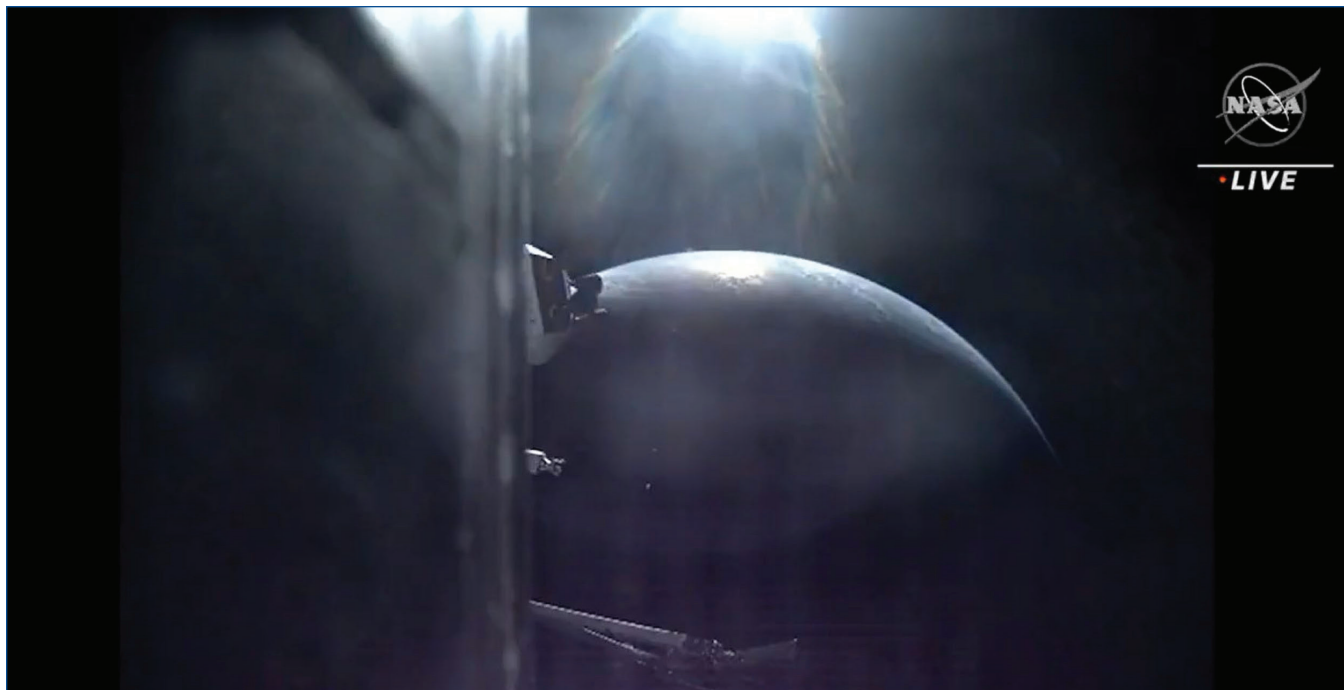
(Above photo) A panoramic photo shows the launch of NASA's Space Launch System (SLS) rocket carrying the Orion spacecraft during the Artemis I flight test on Nov. 16 from Launch Complex 39B at NASA's Kennedy Space Center in Florida. Photo Credit: (NASA/Bill Ingalls)

(Left photo) A screen capture shows the four RS-25 engines of the Space Launch System (SLS) core stage just seconds prior to ignition for launch of the Artemis I mission Nov. 16. RS-25 engines for the first four Artemis space missions have been tested and proven flight-worthy at NASA's Stennis Space Center. In 2021, Stennis also tested the SLS core stage that propelled Artemis I, firing its four RS-25 engines – built by Aerojet Rocketdyne, lead contractor for SLS engines – just as during an actual launch. Photo Credit: (NASA Television)

(Right photo) Guests at the Banana Creek viewing site watch the launch of NASA's Space Launch System rocket carrying the Orion spacecraft on the Artemis I flight test Nov. 16 at NASA's Kennedy Space Center in Florida. Photo Credit: (NASA/Keegan Barber)



# NASA Releases Images of Earth From Orion



Images of Earth are seen as NASA's Orion spacecraft travels 57,000 miles away from Earth toward the Moon 9.5 hours following launch of the Space Launch System (SLS) rocket on the Artemis I flight test on Nov. 16. The images of Earth captured by the human-rated spacecraft were the first seen from that distance since 1972 during the final Apollo mission. During the Apollo era, the Earth images captured the imagination of a generation. A new generation now – the Artemis generation – now has the opportunity to see similar images taken by the new spacecraft. During Artemis I, NASA's SLS rocket will send the agency's Orion spacecraft on a trek 40,000 miles beyond the Moon before returning to Earth. To capture the journey, the rocket and spacecraft are equipped with cameras that will collect valuable engineering data and share a unique perspective of humanity's return to the Moon. There are 24 cameras on the rocket and spacecraft – eight on SLS and 16 on Orion – to document essential mission events including liftoff, ascent, solar array deployment, external rocket inspections, landing and recovery, and capture images of Earth and the Moon. The SLS rocket carrying the Orion spacecraft launched on the Artemis I flight test from Launch Complex 39B at 12:47 a.m. CST on Nov. 16 at NASA's Kennedy Space Center in Florida. The Artemis I mission is the first integrated flight test of the agency's deep space exploration systems: the Orion spacecraft, SLS rocket, and ground systems. To read more about the cameras used to capture new images of Orion, the Earth, and Moon, click [here](#). Photo Credit: (NASA Television)



# Fred Haise Test Stand Readies For Next Test Series



Preparations are underway for the next RS-25 engine test series expected to begin at Stennis Space Center in December. Following an RS-25 engine test in March, tanks were emptied and routine maintenance performed at the test stand. In recent weeks, the cryogenic fluids that power a RS-25 engine test were brought to the test stand.

(Above photo) A barge carries liquid oxygen to the Fred Haise Test Stand Oct. 26. The fuel that powers testing is a mix liquid hydrogen (LH) and liquid oxygen (LOX). The test stand tanks hold 110,000 gallons of LH and 40,000 gallons of LOX.

(Below photo) NASA engineers monitor the chill down phase of the initial loading of LOX from the Test Control Center. When filling the tanks, a warm tank requires extended periods of flowing gaseous oxygen followed by a slow and controlled fill with LOX. Monitoring the LOX transfer system operations in the control center were (l to r): NASA engineer Bradley Tyree, Fred Haise Test Stand Director Jeff Henderson, NASA engineer Jared Grover and NASA engineer Ryan Seals.

(Right photo) Mechanical Technician Don Necaie, left, and NASA operations engineer Joshua Greiner ensure pressures and flow paths are set properly for liquid oxygen to be transferred to the Fred Haise Test Stand, pictured in the background. Photo Credits: (NASA/Danny Nowlin)



# Teams Install RS-25 Engine For Upcoming Hot Fire Series

Teams at NASA's Stennis Space Center installed RS-25 engine No. 10001 (E10001) on the Fred Haise Test Stand on Nov. 15 in preparation for an upcoming series of certification hot fires. The certification series is designed to confirm the design and process that contractor Aerojet Rocketdyne will use in producing new RS-25 engines to help power NASA's Space Launch System rocket on future Artemis missions to the Moon.

The future engines will feature new components and involve updated production processes designed to save time and cost. To certify the new components and new processes, operators plan to conduct 13 tests during the upcoming series – one system check hot fire next month and 12 certification tests in 2023. Operators will fire the engine at power levels ranging from 80% to 113%. Tests are scheduled for 500 seconds in duration with one longer test planned for 650 seconds.

The series will include gimbaling tests using the [Stennis-developed thrust vector control system](#). In a gimbaling test, operators use the thrust vector control system to rotate engines on a circular axis as they must move during flight to ensure proper trajectory.

(Right photo) RS-25 engine, E10001, is delivered to Stennis Space Center's Fred Haise Test Stand on Nov. 15. Aerojet Rocketdyne is contracted to produce 24 new RS-25 engines using an updated design to support future Artemis missions beginning with Artemis V.

(Below photo) Crews begin the installation process of the RS-25 engine at the Fred Haise Test Stand at Stennis Space Center on Nov. 15. RS-25 engine tests at Stennis are conducted by a combined team of NASA, Aerojet Rocketdyne, and Syncom Space Services operators. Syncom Space Services is the prime contractor for Stennis facilities and operations. Photo Credits: (NASA/Danny Nowlin)

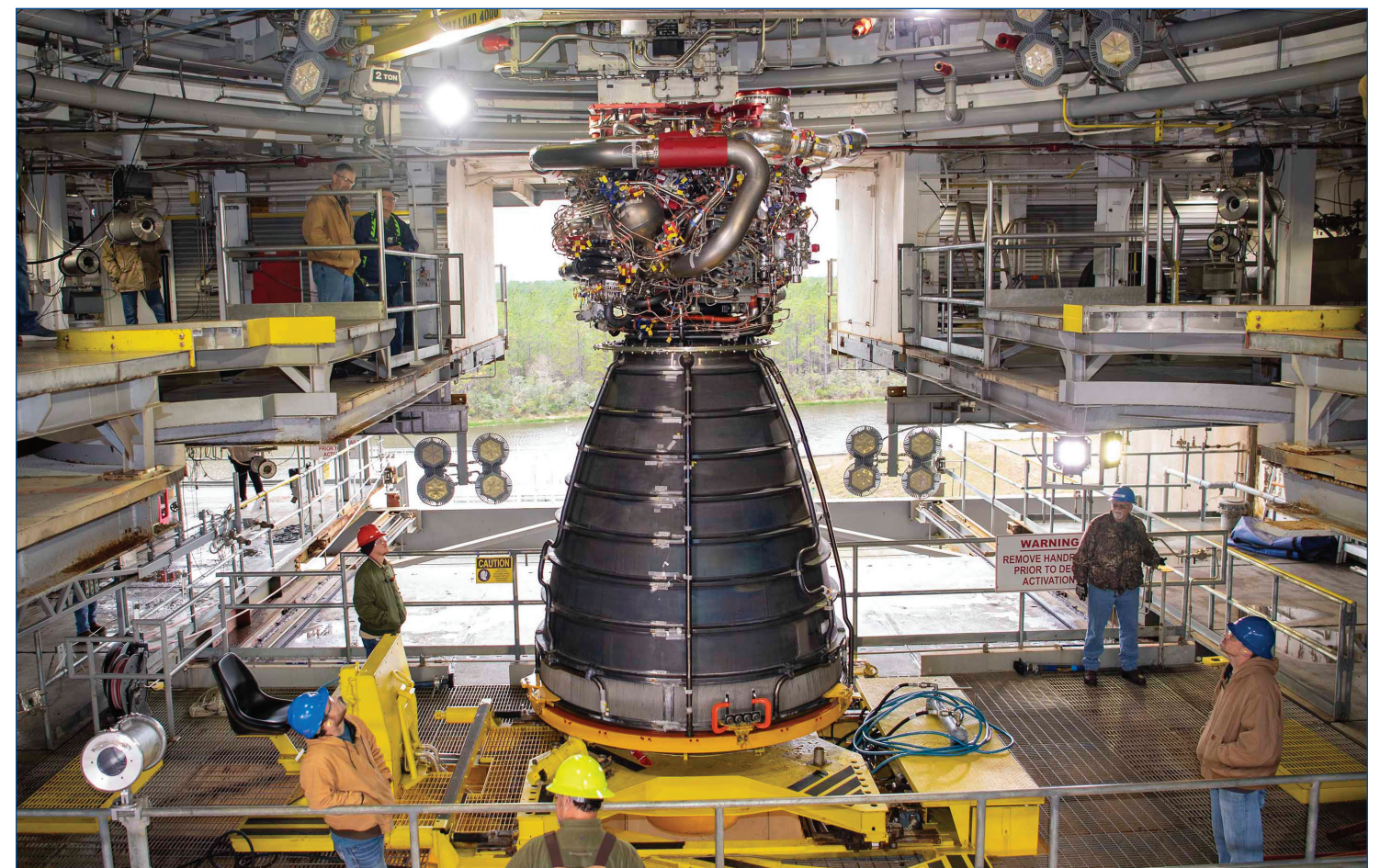


# Teams Install RS-25 Engine For Upcoming Hot Fire Series



(Above photo) Following its arrival to the test stand on the engine transport trailer, a crane lifts RS-25 engine, E10001, on the west side of the Fred Haise Test Stand at Stennis Space Center on Nov. 15.

(Top right photo) Crews place the RS-25 engine on the engine vertical installer (EVI) at Stennis Space Center's Fred Haise Test Stand on Nov. 15. The EVI is on a rail system that slides the engine under the gimbal block. The EVI raises the engine and technicians attach the engine to the test facility.



(Bottom right photo) Crews finish the installation process of the RS-25 engine at Stennis Space Center's Fred Haise Test Stand on Nov. 15. Once the engine is attached to the test facility, the EVI lowers and moves away. Next, technicians will ensure all connections to the test facility are complete, leading to the first engine test that is expected to take place in December.

Photo Credits: (NASA/Danny Nowlin)



# Relativity Space Plans Expanded Operations at Stennis

NASA's Stennis Space Center joined with Relativity Space on Oct. 18 as the company outlined plans for a major expansion of its rocket and engine test facilities at the south Mississippi site.

Relativity Space plans to build comprehensive facilities in the Stennis Test Complex to test its Aeon R engines. The company envisions the completed project as one of the largest commercial test facilities in the nation.

The Mississippi Development Authority is working with Relativity Space to assist with the project. Stennis, located near Bay St. Louis, Mississippi, will provide a range of site services as part of the partnership agreement.

"This expanded partnership is a testament to Stennis expertise and standing as the nation's premier rocket propulsion test site," Center Director Dr. Rick Gilbrech said. "Relativity Space continues to grow as an aerospace company, and Stennis is pleased to support its continued development. Working with them for the past four years, Relativity Space has become a valued member of the Stennis federal city."

Relativity Space already is clearing ground for construction of several new facilities. Company plans call for construction of new engine test stands, office buildings, and a vehicle facility. The company already is housed in several other locations within the Stennis test complex. It also has existing agreements to test its engines and rocket components on various Stennis test stands.

"This announcement is the latest step in an ongoing relationship with Relativity Space," said Duane Armstrong, manager of the Stennis Strategic Business Development Office. "Stennis has worked with Relativity Space for several years to assist with the development and testing of its Aeon engines. The new expansion at Stennis is another demonstration of the value of the assets and expertise the center offers emerging aerospace companies. We look forward

to working with Relativity Space as it continues to grow and pursue its space goals."

Relativity Space originally partnered with Stennis to test its Aeon 1 engine on the site's E-3 Test Stand. The partnership quickly expanded in 2018 to grant Relativity Space exclusive use of the E-4 Test Complex at Stennis.

The latest partnership agreement focuses on 153 acres located near the E-4 Test Complex and provides the company room to grow its operations for Terran R, its fully reusable, entirely 3D-printed launch vehicle.

Relativity Space, based in Long Beach, California, has created an entirely 3D-printed, expendable Terran 1 rocket scheduled for its maiden launch in upcoming months. The company also is developing a fully reusable, entirely 3D-printed Terran R rocket. The Terran 1 rocket will be capable of carrying small satellite payloads. The Terran R rocket is being developed to launch payloads up to 44,000 pounds (20,000 kilograms) to low-Earth orbit.

In both instances, the company is using 3D printing and other state-of-the-art techniques, including machine learning and autonomous robotics, to develop rockets with 100 times fewer parts. It already has developed the largest metal 3D printers in the world and anticipates the production process will enable rockets to be created within 60 days.

The Terran 1 rocket will be powered at launch by nine Aeon 1 engines, each capable of producing 23,000 pounds of sea-level thrust. The Terran R rocket will use seven Aeon R engines, each producing 302,000 pounds of thrust during launch. Both rockets will use a single Aeon engine for second stage propulsion.

The Aeon engines are powered by liquid natural gas. Relativity Space already has conducted hundreds of hot fire tests at Stennis for their development.



An aerial image shows a cleared area at NASA's Stennis Space Center where Relativity Space plans to build several new test-related facilities. The aerospace company is substantially expanding its presence at Stennis

to support development and testing of its Terran R rocket and Aeon R engines. The four large stage and engine test stands at Stennis Space Center are visible in the background.

***"This expanded partnership is a testament to Stennis expertise and standing as the nation's premier rocket propulsion test site."***

**-Stennis Director Rick Gilbrech**

# Stennis Flashback: E Test Complex Generates Buzz

NASA's Stennis Space Center operated much like a musical symphony at the site's most versatile testing area – the E Test Complex – 10 years ago with high levels of coordination and a variety of tempos.

Over a three-day stretch the week of Nov. 5-9, 2012, test complex operators conducted 27 tests on three different rocket engines/components on three different test stands. The work demonstrated the flexibility of Stennis employees and their desire to fulfill NASA and commercial space company testing needs.

“This is not something just anybody can do,” then-NASA E-2/E-3 Test Director Craig Chandler said at the time.

The accomplishment involved conducting tests on a Blue Origin engine thrust chamber, a modified steam generator, and a prototype liquid oxygen, liquid methane engine. It also demonstrated the expertise of the Stennis test complex team and the unique capabilities of Stennis' E Test Complex facilities.

The test team expertise and test complex capabilities have continued to grow since that historic week, operating as a valuable resource as NASA focuses on deep space missions to explore the secrets of the universe for the benefit of all and commercial space initiatives grow.

“What makes the E Test Complex unique is the pressures and flow rates it is capable of handling,” explained Stennis Chief of Test Operations Maury Vander.

The three-stand complex includes seven separate test cells that can support testing with ultra high-pressure gases and cryogenic fluids. The capability includes the delivery of liquid oxygen, liquid hydrogen, and liquid methane at pressures up to 8,500 pounds per square inch (PSI).

“There are all sorts of elevated pressures that are not available anywhere else at flow rates like that,” Vander said. “If you have a relatively large engine and are trying to validate a component, it takes high pressure and a high flow rate to do that. That is what really makes the E Test Complex unique, not just for the agency but for the world. There are not many places that can do that.”

In addition, the E-3 Test Complex offers its own unique capabilities. With slightly lower pressures, the E-3 facilities require less modifications to begin a project, meaning commercial partners can receive data in a quicker timeframe at Stennis.

Since the November 2012 record-setting week, Stennis personnel in the E Test Complex have worked with more and more commercial companies. Companies such as Blue Origin, Launcher, SpaceX, Ursa Major, and Virgin Orbit have taken advantage of complex capabilities. Some of these are currently testing engines/components in the area with success. SpaceX tested engine components on E-1 and E-2 test stands while developing its Raptor engine for the Starship spacecraft. In April 2021, NASA selected [Starship](#) for its human landing system.

In 2017, a California-based space company, Relativity Space, began its partnership with Stennis by testing on the E-3 Test Stand. The relationship soon expanded in 2018, allowing Relativity exclusive use of the E-4 Test Complex.

Relativity now tests on the E-2 and E-4 stands. Last month, it also announced plans for a major [expansion](#) of its rocket and engine test facilities at Stennis.

“That's an example of a company that has a vision and came to Stennis, took advantage of some of our resources and facilities, and are headed toward a launch soon,” Vander said. “They are good example of the value of the E Test Complex.”

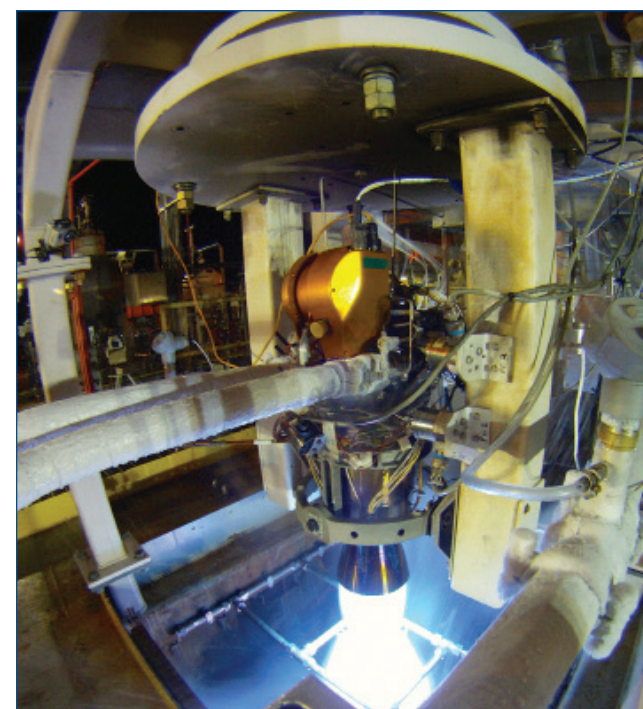
In addition to the complex being highly adaptable to meet customer needs, chief among the valuable resources at Stennis are the people working to help companies to be successful in their development and test efforts.

“It was that way 10 years ago and it is even more that way now,” Vander added. “We are getting more involved in the intimate details of our customers, and they are taking advantage of the resources and people who work here to do things we never thought they would do in the past. Our workforce is getting smarter, and our customers are getting smarter. It all leads to being the best we can be and to increasing the likelihood of success for our customers.”

(Top right photo) NASA recorded a historic week Nov. 5-9, 2012, conducting tests on all three stands in the E Test Complex at Stennis Space Center. Inset images show the types of tests conducted on the E-1 Test Stand (right), the E-2 Test Stand (left) and the E-3 Test Stand (center). The E-1 photo is from an October 2012 test and provided courtesy of Blue Origin. Other photos are from tests conducted the week of Nov. 5, 2012.

(Far right photo) Jason Hopper of NASA works in the E-1 Test Stand Control Center Nov. 8, 2012.

(Near right photo) A test of the liquid oxygen, liquid methane Project Morpheus engine is conducted Nov. 8, 2012, on the E-3 Test Stand at Stennis Space Center.



# Stennis, Rocket Lab Cut Ribbon on New Tenant Agreement

NASA's Stennis Space Center and Rocket Lab USA cut the ribbon Nov. 4 on a new agreement for the aerospace company to locate its engine test complex at the rocket propulsion site near Bay St. Louis, Mississippi.

NASA, Rocket Lab, and key elected officials gathered in the Stennis Test Complex for an official ribbon-cutting ceremony to mark the launch of the new 10-year agreement. Rocket Lab expects to make a substantial capital investment in the project in upcoming years and also create dozens of jobs for the surrounding area.

"We are pleased that Rocket Lab selected Stennis Space Center for development of its new test complex," Stennis Space Center Director Rick Gilbrech said. "With finalization of this agreement, we look forward to working with Rocket Lab as it develops and moves forward in achieving its space goals. This represents an exciting opportunity not only for Stennis but also for the Gulf Coast region and the entire state of Mississippi."

With the new agreement, the A-3 Test Stand and about 24 surrounding acres at Stennis will be incorporated into the Archimedes Test Complex. Archimedes is Rocket Lab's new liquid oxygen and liquid methane rocket engine that will power its large, reusable Neutron rocket.

Rocket Lab will have exclusive access to use and develop the A-3 Test Stand area, including associated propellant barge docks and buildings. The initial 10-year agreement includes an option to extend an additional 10 years.

The Mississippi Development Authority is providing assistance for Rocket Lab to develop the new site and to relocate and install needed equipment.

"It was only a few weeks ago when we announced Stennis as the location of our Archimedes Test Complex and we're already fast at work to get the site up and running to deliver Neutron," said Peter Beck, founder and CEO of Rocket Lab. "Thanks to our partnership with NASA and the state of Mississippi, we can begin to develop the existing infrastructure and test stand at Stennis to fast-track Neutron's first launch. We look forward to breathing fire in the great state of Mississippi."

Rocket Lab, founded in 2006, is headquartered in Long Beach, California. It already builds and flies Electron rockets for small satellite launches. Its new Neutron rocket is designed as the world's first carbon-composite rocket to deliver large spacecraft to low-Earth orbit and to support a sustained human presence in space. It will be powered by Rocket Lab's reusable Archimedes engines and an advanced upper stage for complex satellite deployments.

"This agreement with Rocket Lab is part of an ongoing process to attract space companies to Stennis and create economic opportunities for the region, said Duane Armstrong, manager of the Stennis Strategic Business Development Office. "The partnership and the infrastructure already in place at Stennis will dramatically reduce the time it takes Rocket Lab to develop their new engines and create this new launch vehicle, which will provide services to NASA, other parts of the federal government, and industry."

Rocket Lab expects to begin construction in the Archimedes Test Complex at Stennis to build two newly built horizontal engine test cells for single engine testing. As testing of the Archimedes engine gets underway, Rocket Lab also envisions building an additional test cell with the ability to test individual engine components.



(Top photo) Officials prepare to cut the ribbon during a Nov. 4 ceremony marking an agreement for Rocket Lab USA to locate its new engine test complex at NASA's Stennis Space Center. Participating in the ceremony were (l to r): Rocket Lab Vice President of Launch Systems Shaun D'Mello, U.S. Sen. Roger Wicker of Mississippi, Stennis Space Center Director Rick Gilbrech, and U.S. Sen. Cindy Hyde-Smith of Mississippi.

(Left photo) Rocket Lab USA Vice President of Launch Systems Shaun D'Mello (c) talks with Stennis Space Center Director Rick Gilbrech (l) and Stennis Deputy Director John Bailey about the new Archimedes Test Complex prior to a ribbon-cutting event at the site Nov. 4. Photo Credits: (NASA/Danny Nowlin)



***"With finalization of this agreement, we look forward to working with Rocket Lab as it develops and moves forward in achieving its space goals."***

**-Stennis Director Rick Gilbrech**



NASA's James Webb Space Telescope has captured an image of the famous Pillars of Creation — first imaged by the Hubble Space Telescope in 1995 — that reveals new details about the region. The three-dimensional pillars look like majestic rock formations but are far more permeable. The columns are made up of interstellar gas and dust that sometimes appear semi-transparent in near-infrared light. Webb's new view of the Pillars of Creation will help researchers revamp models of star formation by identifying more precise counts of newly-formed stars, along with the quantities of gas and dust in the region. Over time, researchers will build a clearer understanding of how stars form and burst out of these dusty clouds over millions of years.

## NASA in the News

### Satellites Help Scientists Track Dramatic Wetlands Loss in Louisiana Since the 1980s

From Lake Pontchartrain to the Texas border, Louisiana has lost enough wetlands since the mid-1950s to cover the entire state of Rhode Island. Using a first-of-its-kind model, NASA-funded researchers quantified the wetlands losses at nearly 21 square miles (54 square kilometers) per year since the early 1980s. Scientists used the NASA-U.S. Geological Survey Landsat satellite record to track shoreline changes across Louisiana from 1984 to 2020. Some of those wetlands were submerged by rising seas; others were disrupted by oil and gas infrastructure and hurricanes. The primary driver of losses was coastal and river engineering, which can have positive or negative effects depending on how it is implemented. Centimeter-by-centimeter, wetlands are built by the slow accumulation — accretion — of mineral sediment and organic material carried by rivers and streams. Read more [here](#).

### How NASA's Roman Telescope Will Scan for Showstopping Explosions Known as Kilonovae

What happens when the densest, most massive stars — that are also super small — collide? They send out brilliant explosions known as kilonovae. Think of these events as the universe's natural fireworks. Theorists suspect they periodically occur all across the cosmos — both near and far. Scientists will soon have an additional observatory to help follow up on and even scout these remarkable events: NASA's Nancy Grace Roman Space Telescope, which is set to launch by May 2027. The key actors in kilonovae are neutron stars, the central cores of stars that collapsed under gravity during supernova explosions. They each have a mass similar to the Sun, but are only about six miles (10 kilometers) in diameter. And when they collide, they send out debris moving near the speed of light. Read more [here](#) about how this telescope will provide valuable data.

# NASA ASTRO CAMP® Tops Milestone to Finish Fiscal Year

What do students of varying ages and ethnicities from schools, museums and libraries in Mississippi, Ecuador, Louisiana, Spain, Hawaii, and Mexico have in common? Thanks to an innovative collaboration initiative, they all have experienced NASA's ASTRO CAMP® and STEM activities.

They also have helped the [NASA ASTRO CAMP® Community Partners](#) (ACCP) program set milestone marks in fiscal year 2022, as it partnered with more than 200 community sites to help inspire youth, families, and educators with STEM (science, technology, engineering, and mathematics) activities and experiences. ACCP activities offer real-world opportunities for students to join in, and contribute to, NASA science missions and to enhance scientific understanding while inspiring lifelong learners and explorers.

"Students at schools and children attending community programs at 194 locations nationally encountered NASA science with NASA ACCP's activities this past year," said Kelly Martin-Rivers, principal investigator for NASA's ACCP. "The reach of the program has expanded internationally. Seven sites outside the United States bring the total to 201 ACCP programs for 2022, setting new records for NASA's ACCP growth."

A summary of the year's efforts shows that ACCP spanned 29 states and the countries of Ecuador, India, Mexico, Spain, and Ukraine. A total of 35,033 participants were directly involved in ACCP programs through registered student activities. An additional 43,789 participants served in unique STEM ACCP special events, setting the program record for its 30-year history.

ASTRO CAMP® began as a single one-week camp at Stennis Space Center in the 1990s and has developed into several adaptable models for schools, museums, universities, libraries, and youth service organizations, enabling a worldwide expansion. The ACCP program is an infrastructure project, within NASA's Science Mission Directorate–Science Activation program support. The ACCP program grows with each passing year, reaching far, wide, and across both geographical and cultural borders.

The ACCP program highlights current and past NASA missions while using hands-on activities to expand STEM interests in astrophysics, Earth science, heliophysics, and planetary science. The unique methodology teaches students to work collaboratively to complete missions and provides trained community educators to implement the themed NASA modules, developed by the ACCP team, seated at Stennis. ASTRO CAMP® sites are not limited to school settings, although many have embraced the initiative. For instance, Pukalani Elementary School on the island of Maui in Makawao, Hawaii, a first-time collaborator, became the 200th ACCP program site this year and is using the NASA science

curriculum throughout the first 2022-23 term. In 2022, ACCP also served 2,605 Hispanic K-12 participants.

"The NASA ACCP team seeks to put NASA's resources into traditionally underserved and underrepresented communities," said Martin-Rivers. "ACCP community site reports show that the girls' attendance was equal to the boys' and Hispanic ethnicity was the highest population reported by our partners this year."

The Ecuador ASTRO CAMP site, Testlab Fun Science located in Santa Elena, is a second-year partner that has experienced growing interest and an increase in participants.

"We are loving to share NASA science with Ecuadorians from all ages, and we are now thinking on more ways to do it," camp facilitator Guillermo Gilbert said.

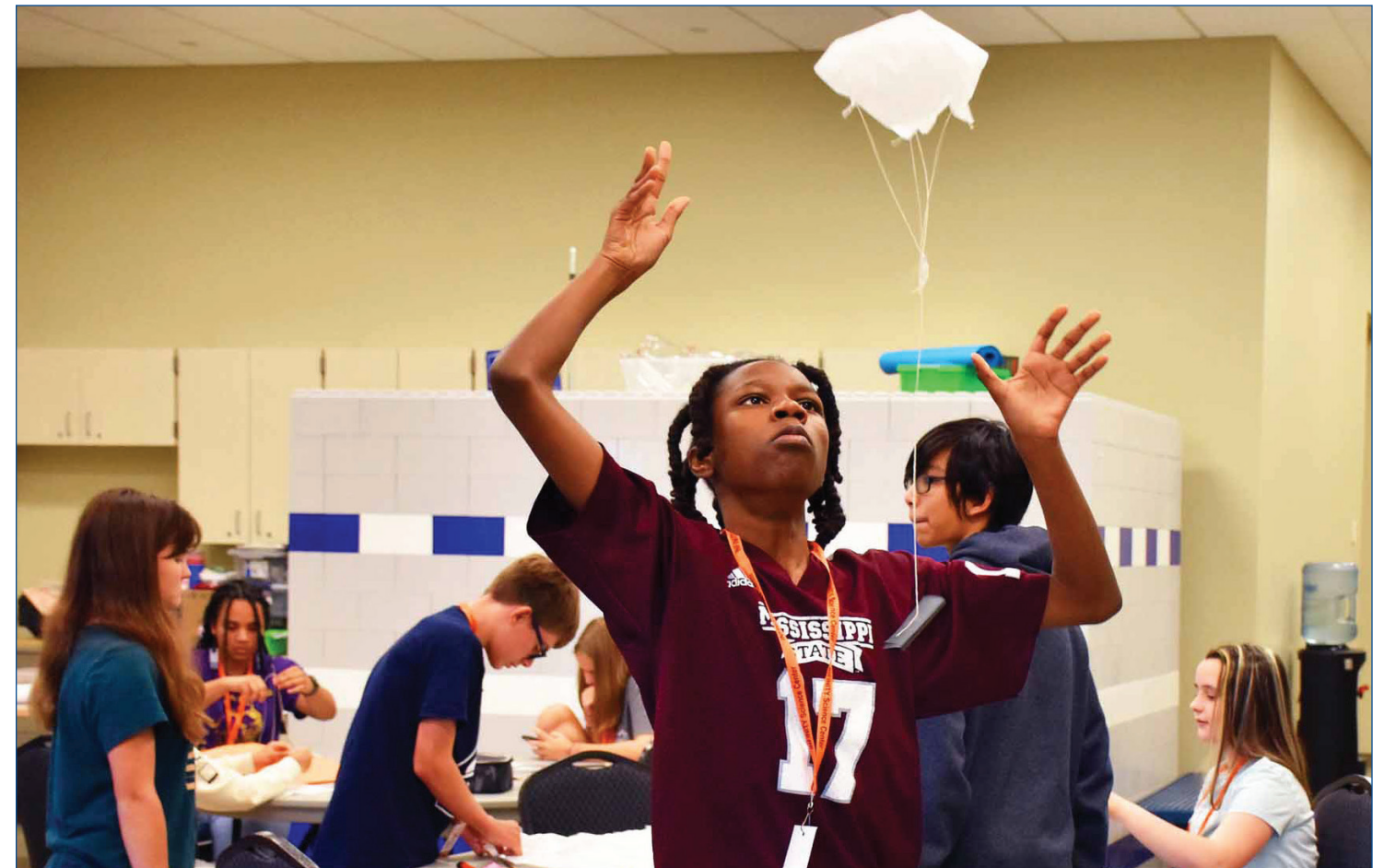
Testlab Fun Science has acquired 24 acres of natural forest in Ecuador to create a scientific experience inspired by NASA.

"There are so many things we are working on now as we want to take the NASA experience in Latin America to a new level," Gilbert said. "We are now starting to plan a NASA camp for spring 2023."

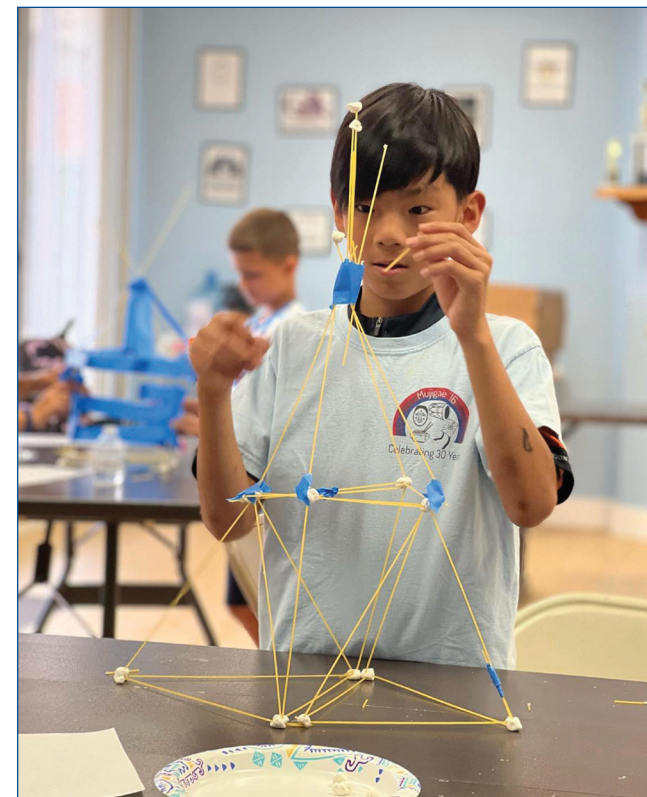
Meanwhile, Dr. Jafar Al-Sharab, a three-year ACCP facilitator with Northwestern State University of Louisiana stated, "We strongly believe that the (NASA) ASTRO CAMP team inspired youth, families, and educators to explore the realms of space and the STEM fields of science, technology, engineering, and mathematics. It is very evident, based on the student participation, and students who return to the camp every summer, that we are on the right track to inspire the Artemis generation and to prepare a future STEM workforce."

ACCP 2022 focused on "We Go ... Bringing NASA Science Home Together!" The program incorporated NASA's [Next Gen STEM](#) Artemis Camp experience modules, the Texas State University-NASA Educational Professional Development Collaborative, and various science collaboration opportunities. Science Mission Directorate–Science Activation cross-collaborations in 2022 included: [NASA eClips](#); [NASA's Neurodiversity Network](#) from Sonoma State University in California; [Planetary Learning that Advances the Nexus of Engineering, Technology, and Science](#) from Northern Arizona University in Arizona; and [Northwest Earth and Space Sciences Pipeline](#) from Central Washington University in Washington.

For more information about collaborating with the NASA ASTRO CAMP Community Partner program, contact: Kelly Martin-Rivers at [kelly.e.martin-rivers@nasa.gov](mailto:kelly.e.martin-rivers@nasa.gov) or 228-688-1500; or Maria Lott at [maria.lott@nasa.gov](mailto:maria.lott@nasa.gov) or 228-688-1776. For more on the ASTRO CAMP Community Partner program, visit [here](#).

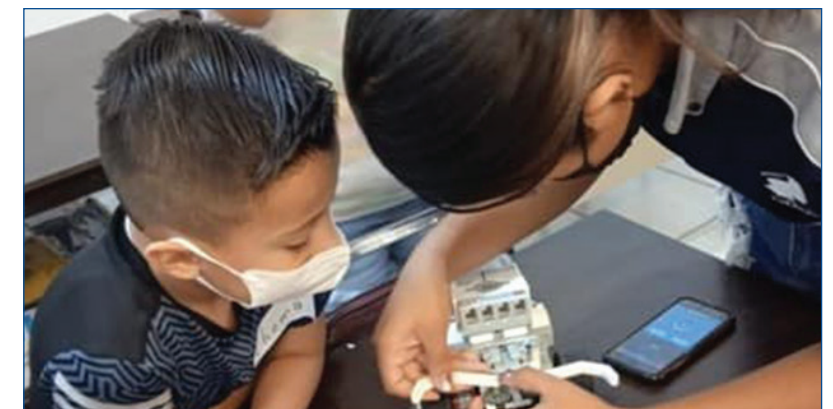


(Top photo) A camper tests a parachute design during a week of NASA's ASTRO CAMP® Community Partners (ACCP) activities at INFINITY Science Center. Photo Credit: (INFINITY Science Center)



(Left photo) The image shows a student's struggle to engineer and design a spaghetti tower at the CT STEM Academy collaborating site in Wallingford, Connecticut, on July 11. NASA's ASTRO CAMP® Community Partners activities are designed to be inexpensive and make NASA's science meet the needs of students at all levels, abilities, and learning styles. Photo Credit: (CT STEM Academy)

(Bottom photo) The image shows Hispanic students working on robotics activities at the collaborating site in Gómez Palacio, located in Durango, Mexico, on July 23. NASA's ASTRO CAMP® Community Partners reach Hispanic communities with NASA's activities as the largest participating ethnicity in 2022. Photo Credit: (CP-BOTS)



# Stennis News



## Senator Tours Autonomous Systems Lab

United States Sen. Cindy Hyde-Smith of Mississippi visits the Autonomous Systems Lab (ASL) at Stennis Space Center on Nov. 4. The senator learned about how the innovative autonomous operation technology applications developed at Stennis use the NASA Platform for Autonomous Systems (NPAS). NPAS is a sophisticated platform for autonomous systems that understands the behavior of complex systems, can detect and identify anomalies, and can apply sound strategies based on the current state of the system to mitigate issues and optimize performance. Pictured (l to r) are Stennis Chief of Facilities Engineering Division Thom Rich, Stennis Director of Engineering and Test Directorate Joe Schuyler, Stennis Chief of Planning and Development Office Tim Pierce, Ground Operations Lead/ASL Lab Lead Travis Martin, U.S. Roger Wicker Field Representative Chris Vignes, State Director Umesh Sanjanwala, U.S. Sen. Hyde-Smith, Stennis Strategic Business Office Manager Duane Armstrong, ASL Project Manager Lauren Underwood, Autonomous Systems and Operations subject matter expert Fernando Figueroa, ASL software engineer Landon Tynes, Chief Technologist Anne Peek, ASL Deputy Project Manager Zach Lewton, Stennis Chief of Staff and Legislative Affairs Officer Troy Frisbie. Photo Credit: (NASA/Danny Nowlin)



## Stennis Hosts Safety and Health Day 2022



NASA's Stennis Space Center hosted Safety and Health Day 2022 in the Roy S. Estess Building on Nov. 3. The annual event, organized by the Stennis Safety and Mission Assurance Directorate, is a reminder to the Stennis workforce about the importance of a safe work environment. "We pause our daily activities so we can give our undivided attention to the topic here without distraction," Stennis Associate Director Rodney McKellip said. "We engage with each other and special guests with a variety of activities to be reminded of the safety culture we have, so that we can reflect on this culture and be reminded it's not just the big things but also the little things we must remain vigilant about to safely conduct our lives and our work." Keynote speaker Ricky Rollins shared stories from his employment at a steel mill and his personal life to illustrate how taking safe measures factored into the outcome of life-altering events. The day concluded with employees visiting various safety exhibits, which an the opportunity to receive health screenings. Photo Credit: (NASA/Danny Nowlin)

## Stennis News

# Stennis Family Day Creates Memories at INFINITY

More than 600 employees, family members, and friends attended Stennis Space Center's Family Day Nov. 5 at INFINITY Science Center. It marked the first family day event hosted at Stennis since the COVID-19 pandemic. It featured hands-on activities for children of all ages. Games and giveaways provided an opportunity for many to learn about the Artemis space program, design a mission patch, and color NASA-themed pictures. Attendees sent good wishes to Artemis I by signing their name to a large banner. Many that make Stennis a thriving federal city joined NASA for the event with booths set up including: Mississippi State University – Northern Gulf Institute, National Oceanic and Atmospheric Administration, Aerojet Rocketdyne, General Dynamics Information Technology, and Lockheed Martin. Photo Credits: (NASA/Danny Nowlin)



# Stennis News



## NASA Honors Stennis Employees

Several employees from Stennis Space Center and other NASA centers were recognized for contributions to flight safety with NASA Space Flight Awareness (SFA) awards during an Aug. 27 ceremony in Orlando, Florida. The ceremony was held in conjunction with the first launch attempt of Artemis I. Awards were presented by NASA Associate Administrator for Space Operations Kathy Lueders, Associate Administrator for Exploration Systems Development Mission Directorate Jim Free, Stennis Center Director Rick Gilbrech, and NASA astronaut Stephanie Wilson. Honorees are listed with their company designation. Honorees include: (Front row, 1 to r) Beth Nguyen (SaiTech), John Briou Bourgeois (NASA Engineering and Test Directorate), Gilbrech, Sheldon Murphy (NASA Office of the Chief Procurement Officer), Daniel Goad (NASA Engineering and Test Directorate), and Christopher Ladner (Aerojet Rocketdyne). (Back row, 1 to r) Robert Simmers (NASA Office of Safety and Mission Assurance), Ryan Roberts (NASA

Engineering and Test Directorate), Thomas Meredith (NASA Engineering and Test Directorate), and Timothy Henshaw (Aerojet Rocketdyne). Not pictured is Casa Compton (Alutiq Essential Services). NASA's Space Flight Awareness Program recognizes outstanding job performances and contributions by civil service and contract employees throughout the year and focuses on excellence in quality and safety in support of human spaceflight. The Honoree Award is one of the highest honors presented to employees for their dedication to quality work and flight safety. Recipients must have contributed beyond their normal work requirements toward achieving a particular human spaceflight program goal; contributed to a major cost savings; been instrumental in developing material that increases reliability, efficiency, or performance; assisted in operational improvements; or been a key player in developing a beneficial process improvement.  
Photo Credit: (NASA/Kennedy Space Center)



## NASA Deputy Chief Human Capital Officer Visits Stennis

NASA Deputy Chief Human Capital Officer Brady Pyle (seated second from right) visits with Stennis Space Center Director Rick Gilbrech (center), Stennis Associate Director Rodney McKellip (left), Stennis Deputy Director John Bailey (second from left), Stennis Chief Office of Human Capital Terrance Jones (right), and senior center managers during a site visit Oct. 20. Pyle works from NASA's Johnson Space Center in Houston, Texas and is responsible for supporting the chief human capital officer and leading human resources services for NASA.  
Photo Credit: (NASA/Danny Nowlin)



# Stennis News



(Above photo) Guests of the Louisiana Technology Transfer Center stand at the B Test Stand Nov. 1 during a day-long visit to Stennis Space Center. The group included members of the Louisiana Small Business Development Center, Louisiana Economic Development Office of Management and Finance, and Baton Rouge Area Chamber of Business Development. Stennis Deputy Director John Bailey welcomed the group. Duane Armstrong, manager of the Stennis Strategic Business Development Office, provided overview of Stennis to the guests.

(Left photo) The Central Gulf Coast Section of the American Society of Naval Engineers stand at the base of the B Test Stand during a visit Oct. 7. The group's half-day visit included a tour of Aerojet Rocketdyne's Engineer Assembly Facility. Photo Credits: (NASA/ Danny Nowlin)

## NASA Manager Contributes to Stennis Range Safety

**N**ASA Range Safety Manager Karma Snyder's excitement for the space program and what she has learned during 25 years of working at Stennis Space Center is contagious and something she takes beyond the gates of the south Mississippi site.

Snyder's wide experience at the nation's largest propulsion test site has given her the opportunity to share more about NASA with her children's scout troops and others. She also mentors students interested in pursuing careers in engineering.

The Biloxi, Mississippi, native earned a bachelor's degree in mechanical engineering and a master's degree in aerospace engineering, both from Auburn University in Alabama. Snyder tells people she mentors that an engineering degree provides one with the tools to perform a job effectively but that not everything can be taught in a classroom.

While teaching engineering mechanics at Mississippi Gulf Coast Community College, Snyder told students the college courses were a good starting point but much of the learning would take place on the job.

At a buzzing federal city like Stennis, there is a flurry of activities taking place on any given day. It is a place where much learning can happen on the job, and Snyder's current role is to help facilitate that.

She has the experience to do so. Through the years, Snyder has worked as a student intern, a systems and test engineer, a test conductor, and a project manager. In her current role as the range safety manager, Snyder helps ensure ongoing site operations are conducted in a safe manner. This is a welcome challenge and something Snyder finds fulfilling because it allows her to work with many people.

"I really enjoy collaborating with all the different organizations," Snyder said. "At Stennis, we all work

together to make miracles happen. The diversity of our Stennis workforce ensures that all angles of an issue are explored, increasing our capabilities to creatively and effectively tackle a challenge."

Whether it involves the use of Stennis airspace, waterway transportation, or anywhere else throughout the more than 130,000 acres of the site, Snyder and the range safety officers are there to see that all bases are covered.



NASA Safety Range Manager Karma Snyder remembers pressing her face to a window in elementary school to catch a glimpse of space shuttle launches being shown on the classroom television. Now, Snyder helps keep NASA's Stennis Space Center safe as testing is conducted at the nation's premier rocket propulsion test site. Photo Credit: (NASA/Danny Nowlin)

"Safety is not merely a check-the-box activity or something to prevent our operations from occurring," Snyder said. "Safety is a collaborative effort with operations to help ensure our work is accomplished with mitigating risks that may prevent us from meeting mission objectives."

Whether helping others accomplish their work at Stennis or helping future engineers realize their dreams, Snyder is doing so at the outset of NASA's most ambitious lunar initiative yet with the launch of Artemis I.

For her part, Snyder was closely involved in supporting unmanned aircraft system operations during Green Run testing of the first Space Launch System core stage on the B-2 Test Stand at

Stennis. She also served as a systems engineer during the Green Run effort, which involved conducting a series of integrated tests on the core stage that will help launch the Artemis I mission to the Moon.

"I am incredibly excited to be part of this historic time in our space program," she said. "Recently, I had the opportunity to see the Artemis rocket inside the vehicle assembly building at Kennedy Space Center. As the rocket came into view, I became quite emotional. I was emotional because I know how much work from our center, other NASA centers, and industry has gone into making this incredible machine that will take us to the Moon. I had an immense sense of pride as I looked up at the rocket."

# 1995 – Stennis Partners with Choctaw Tribe



An image from Feb. 7, 2000, shows Patricia Overstreet, NASA coordinator for Choctaw Tribal Schools, working with students at Choctaw Central High School near Philadelphia, Mississippi, during a class on basic rocketry,

while Phillip Martin, tribal chief for the Mississippi Band of Choctaw Indians watches. The partnership received national recognition for its success. Photo Credit: (NASA)

Long before settlers arrived in North America, the Choctaw tribal land consisted of 35,000 acres of land stretching across the state of Mississippi. The Choctaw tribe made a historical impact in areas surrounding NASA's Stennis Space Center.

When the French arrived in Hancock County during the 18th century, they worked in cooperation with native tribes. Due to the willingness of Choctaw tribes to participate in their traditional business affairs, they provided aid to the French through navigational instructions, food, and even battle.

The Choctaw tribe received federal recognition from the United States in 1945 and became a nation of over 11,000 members. This community has provided an abundant amount of Native American cultural insight and has expanded its partnerships with many organizations, including Stennis Space Center.

Almost 30 years ago, Stennis established a lead role in advancing education through partnering with the Mississippi Choctaw Tribal Council of Philadelphia, Mississippi.

In May 1995, Stennis Space Center worked with the Choctaw community to provide new resources through academic and vocational-technical training programs. Educators involved with the new expansive program

received an abundant amount of resource materials from the NASA Educator Resource Center (ERC).

Because of this new accessibility to NASA's resources, students were able to experience space-related lessons, such as understanding the vacuum of space, basic rocketry, elements of weather, and robotics.

The center aided students in robotics competitions by allowing them to participate in events such as the First Lego League (FLL). The FLL is an international program for children, typically ages 9-14, that combines hands-on and interactive robotics with presentations meant to build focus on problem-solving, team building, analytical skills, and creativity.

Through NASA's partnership with the Choctaw tribe and expanding educational opportunities, students created technological and engineering solutions to the annual challenge provided by FLL.

This partnership between Stennis Space Center and the Choctaw community became nationally recognized through the Hammer Award Program. The Hammer Award is presented to teams of federal employees who have made significant contributions in support of reinventing government principles.

## Office of Diversity and Equal Opportunity

# Celebrate the First Indigenous Woman in Space

**N**ative American Heritage Month (NAHM), also known as American Indian and Alaska Native Heritage Month, is celebrated in November.

President George H.W. Bush signed a joint resolution in 1990 declaring November as [Native American Heritage Month](#). NAHM is a time to learn more about the history, heritage, culture, and achievements of Native Americans, Alaska Natives, and Native Hawaiians.

This year marks the first Native American woman to go to space as a NASA astronaut. NASA astronaut Nicole Aunapu Mann departed on the fifth crewed mission of the Commercial Crew Program on Oct. 5, as a mission commander to the International Space Station (ISS). Crew-5 joined “the crew of Expedition 67 and [will] conduct science experiments as a part of Expedition 68.” [Universe Today](#)

“It’s very exciting,” Mann said in an interview with Indian Country Today. “I think it’s important that we communicate this to our community, so that other Native kids, if they thought maybe that this was not a possibility or to realize that something of those barriers that used to be there are really starting to get broken down.”

The crew will have a six-month stay on the ISS and are expected to conduct approximately 250 experiments, as well as engage in possible extra-vehicular activity, or spacewalking. One experiment involves a 3D-printing project designed to fabricate living tissue samples. Crew-5 successfully docked at the ISS on Oct. 6. To stay updated on NASA’s

Commercial Crew Program, visit [here](#).

Mann was born June 27, 1977, in Petaluma, California. She is a member of the Wailacki nation, which is part of the Round Valley Indian Tribes in northern California. Mann attended the U.S. Naval Academy, where she majored in mechanical engineering and later received her master’s degree in mechanical engineering from Stanford University. Afterwards, she attended Naval Air Station in Pensacola, Florida, for flight training.

Mann graduated flight training in 2002 and served as a military naval aviator in Iraq and Afghanistan. She received the rank of colonel with the aviation arm of the United States Marine Corps.



Selected as an astronaut candidate in June 2013, Nicole A. Mann recently became the first Native American woman to fly to space as a NASA astronaut. In 2018, she was chosen as one of the nine astronauts to crew the first flight tests and missions of the Boeing CST-100 Starliner and SpaceX Crew Dragon. In her first spaceflight, she launched to the International Space Station as commander of NASA’s SpaceX Crew-5 mission aboard the SpaceX Crew Dragon spacecraft on Oct. 5, 2022. Photo Credit: (NASA/Bill Ingalls)

During her career, she accumulated over 2,500 hours of flight time in 25 types of aircrafts, made 200 carrier landings, and flew a total of 47 combat missions. In 2013, Mann was selected as one of eight members of NASA Astronaut Group 21 and completed her training in 2015.

After her military career, Mann worked as a NASA engineer and supported development of the Orion spacecraft, the Space Launch System, and the Exploration Ground Systems.

To learn more about Nicole Aunapu Mann, her possible mission with Artemis, and other accomplished Native American, Alaskan Native, and Native Hawaiian people, read Mann’s interview with [Indian Country Today](#) and view her [NASA biography](#).

# Online Resources

Click the links below for more about NASA's Stennis Space Center

- [WLOX: Stennis Space Center Celebrates Artemis I Launch](#)
- [WLOX: Artemis I Mission Takes Flight](#)
- [Stennis Video Short: Stennis Begins Work on Key Testing Component](#)
- [Stennis Video Short: Data Acquisition System](#)
- [Stennis Video Short: Thrust Vector Control System](#)
- [Stennis Space Center Fact Sheets](#)
- [I Am Stennis Facebook Videos](#)



Watch Orion's Journey

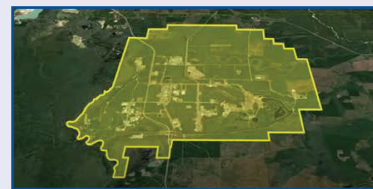
- Part 1: [Leaving Earth](#)
- Part 2: [Entering Distant Retrograde Orbit](#)
- Part 3: [Return Home](#)



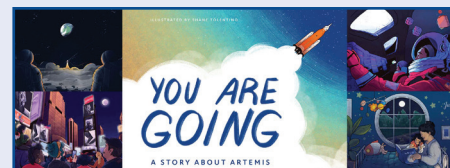
First Woman Graphic Novel



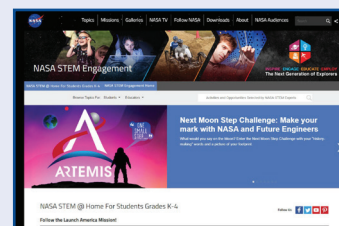
Stennis Artemis Resources



Stennis Virtual Tour



You Are Going  
Children's Book



NASA STEM@Home for Students