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LAGNIAPPE

John C. Stennis Space Center

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NASA completes pair of core stage tests

See page 4

Not having a long work commute these days has given me some unexpected time. I would like to say it has been used most productively – and occasionally, it has. Other times, well, I just sit and think or even just sit and enjoy not thinking. Ark!

One thing I have been thinking about is the history we are making at Stennis these days with Space Launch System (SLS) testing. One day, the adventures we will help launch will be part of history books, which is no big surprise. Stennis has been powering space dreams and helping to write space history since it was built.

Testing of the SLS core stage is proceeding despite workplace limitations the COVID-19 virus has placed on us. Preparations are underway to resume testing of individual RS-25 engines for SLS this fall as well. We sure have come a long way in the last several years.

It was just six years ago this month that the very first RS-25 engine – No. 0525 – was lifted onto the A-1 Test Stand at Stennis in preparation for a series of developmental tests. NASA had spent a year preparing the stand for the test series, so installation of an engine was a pretty big milestone.

NASA conducted the first RS-25 test on the A-1 stand in early January 2015 – and has continued developmental and flight testing since then. The latest round of hot fires should begin within a few months.

In that same July in 2014, Orbital Sciences Corporation launched its Antares rocket on a third successful cargo supply mission to the International Space Station (ISS). The rocket and mission were part of NASA's effort to work with commercial companies in public-private partnerships to provide low-Earth orbit missions to the ISS. Of course, it should be no big surprise to know Stennis was right at the forefront of that historic effort, testing the AJ26 engines that helped launch Antares on its early missions.

Commercial partnerships are big news with the recent launch of astronauts aboard a SpaceX rocket. Yet, Stennis has been working with commercial companies for years on technology development and propulsion testing. The center is not just a part of history; it is regularly writing history with its work. I guess folk around here take my Papagator's philosophy to heart – that it is best not to follow the herd all the time. Otherwise, people will start thinking you are a cow. Ark!

Stennis operators test an Aerojet AJ26 engine on the E-1 Test Stand on Jan. 17, 2014.

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NASA's MOON to MARS MISSION

Stennis test complex facilities provide critical Green Run support

One day in the sooner-rather-than-later future, people across the nation will rearrange daily schedules to witness a long-anticipated event – the maiden launch of NASA's new Space Launch System (SLS) rocket.

A pair of solid rocket boosters and four RS-25 engines will fire at a south Florida launchpad to generate more than 8 million pounds of thrust, lifting the 321-foot SLS rocket into the sky on its way to the Moon and back.

The launch will herald the beginning of a new great era of space exploration, one set on establishing a sustainable presence on the Moon and placing human footprints on Mars.

In no small part, success of the new era rests on hard work provided by Stennis Space Center, which is testing the rocket engines and SLS core stage that will power the new rocket to unprecedented destinations.

Lagniappe is featuring a series of articles under the "Go ... Go ... Go!" heading that detail aspects of NASA's next step into deep space and Stennis' role in making such missions possible. The following represents the latest installment.

It is tempting to say it takes a village to conduct a large propulsion test. However, "it takes a city" would be closer to the truth. When the core stage of NASA's new Space Launch System (SLS) rocket – with its four RS-25 engines – is test fired at Stennis Space Center this fall, test complex support facilities will be called on to supply city-level supplies of electricity, water, high-pressure gases and propellants. All must work in careful concert.

The four-engine hot fire will conclude a series of Green Run core stage tests and mark the biggest milestone yet in the march to the next great era of human space exploration. NASA will use SLS to launch Artemis program missions to return humans, including the first woman, to the Moon and to prepare for eventual missions to Mars.

Two Stennis support facilities will play essential roles (the roles of other facilities will be presented next month).

High-Pressure Industrial Water (HPIW) Facility

The Stennis HPIW facility fills two critical propulsion test needs, most notably water. Rocket engines and stages are tested in the same way they are fired during a launch. During a test, the engine or stage is anchored into place on a large stand, with exhaust directed outward by an L-shaped steel flame deflector. The exhaust can reach 6,000 degrees Fahrenheit, hot enough to melt the steel. NASA uses water to keep that from happening.

A single rocket engine test requires more than 200,000 gallons of water per minute, piped to the stand and sprayed through thousands of small holes into the flame deflector to protect it. When the pressurized water hits the exhaust, it turns to a cloud of steam. Some water also is held in reserve in case of a fire or mishap.

For the Green Run hot fire, more than 300,000 gallons of water per minute will be needed. In addition to protecting the flame deflector and providing fire protection, some water will be sprayed around the core stage to dampen the noise and vibrations that accompany a test. The noise and vibrations are loud and intense enough to damage a stage. A curtain of water will help prevent that.

The water will be drawn from a 66-million-gallon reservoir and piped through 96-inch pipes from the HPIW facility, using 10 large diesel pumps from the 1960s and one new electric pump. Each diesel pump provides more than 10 times the horsepower of a typical pickup truck. The water is pumped at about 250 psi, which compares to the 60 psi most city water pipes use. That pressure has to be constant – and monitored carefully. Otherwise, serious piping and stand damage can occur.

In addition to water, the HPIW facility will provide the electricity needed to conduct the core stage hot fire. A propulsion test is a precise operation; any deviation in process can be costly. This is very true when it comes to power. Relying on the commercial power grid puts a test at the risk of a blackout, brownout or power glitch when a bird perhaps hits a transformer. Even a small interruption in power supply – a mere second or less – can disrupt or scuttle a test and prove very costly.

Stennis avoids the risk by shifting test complex power from the commercial grid to four generators housed in the HPIW facility. Each of the four generators can produce up to 1.5 megawatts of power. They are original equipment from the 1960s, but their control systems and switches have been upgraded through the years. Facility teams also have incorporated procedures to ensure they are operating efficiently. The generators are connected to the test complexes through underground cables, offering another level of protection from disruption.

High Pressure Gas Facility (HPGF)

The HPGF is responsible for providing the gaseous nitrogen, helium, and hydrogen, as well as the missile-grade air, needed for test complex pressurization, purging lines and systems, valve operation, and pushing propellant to barges and test stands. Its network includes miles of piping needed to maintain systems and support test activity.

The HPGF has not ceased operations since the 1960s. Propulsion test systems cannot be turned on and off like a piece of lawn equipment but must maintain constant pressures and ongoing flows to ensure system integrity. System depressurization could contaminate countless pipes and components. Recovery could cost millions.

The HPGF ensures the gases needed to maintain the systems are available. The facility receives helium in gaseous form, but hydrogen and nitrogen arrive in liquid form, are pumped to high pressure, then are vaporized and distributed through the piping network. Air is collected from the atmosphere, then scrubbed and cleaned through compressors to the missile-grade purity needed.

Core stage testing poses a particular challenge for the HPGF, which underwent several modifications to provide the high volume of high-pressure nitrogen needed. The modifications have been completed and tested to ensure they are ready to support core stage operations. For core stage hot fire, the HPGF will provide:

Gaseous nitrogen. Core stage testing will use considerably more gaseous nitrogen than during a typical large engine test – about 12-and-a-half times more on test day and four to five times more for post-test activities. Some gas will be used to pressurize propellant tanks, maintain a clean system before and after testing, and actuate valves. For core stage testing, the bulk of the gaseous nitrogen will travel from the HPGF to the B-2 Test Stand through a 1.5-mile-long pipeline, then through five heaters, with heating capacity equivalent to the energy needed to light 6,000 New Orleans streetlights. The heated gas will be piped into core stage sections to help keep the compartments and their sensitive electronics warm and dry from the chill and moisture of the super-cold propellants used for testing. Following testing, gaseous nitrogen also will be used to dry the core stage's four RS-25 engines.

Gaseous helium. Core stage testing will use about 25 times more gaseous helium than usual, primarily because the core stage and its propellant tanks use helium, instead of gaseous hydrogen or nitrogen, for pressurization. Helium is also used to inert the hydrogen tank posttest.

High-pressure air. Core stage testing will require more high-pressure air than usual, primarily to purge electrical boxes and the 100 or so cameras on the stand. Air also is used by B-2 stand systems and can be used as part of the engine drying sequence in lieu of nitrogen.

Gaseous hydrogen. A small amount of gaseous hydrogen will be needed to warm vent lines and push fluid in propellant transfer lines back to the barges.

NASA's MOON to MARS MISSION

NASA completes avionics power up and fail-safe systems tests on SLS core stage at Stennis

NASA marked a pair of milestones in testing the first flight core stage of its new Space Launch System rocket during recent weeks – completing both the avionics power up test and the fail-safe systems test on the B-2 Test Stand at Stennis Space Center.

The dual achievement continues the agency's progress towards the ultimate core stage test, a full power up of all its integrated systems and hot fire of its four RS-25 engines to generate 1.6 million pounds of combined thrust, just as during an actual launch.

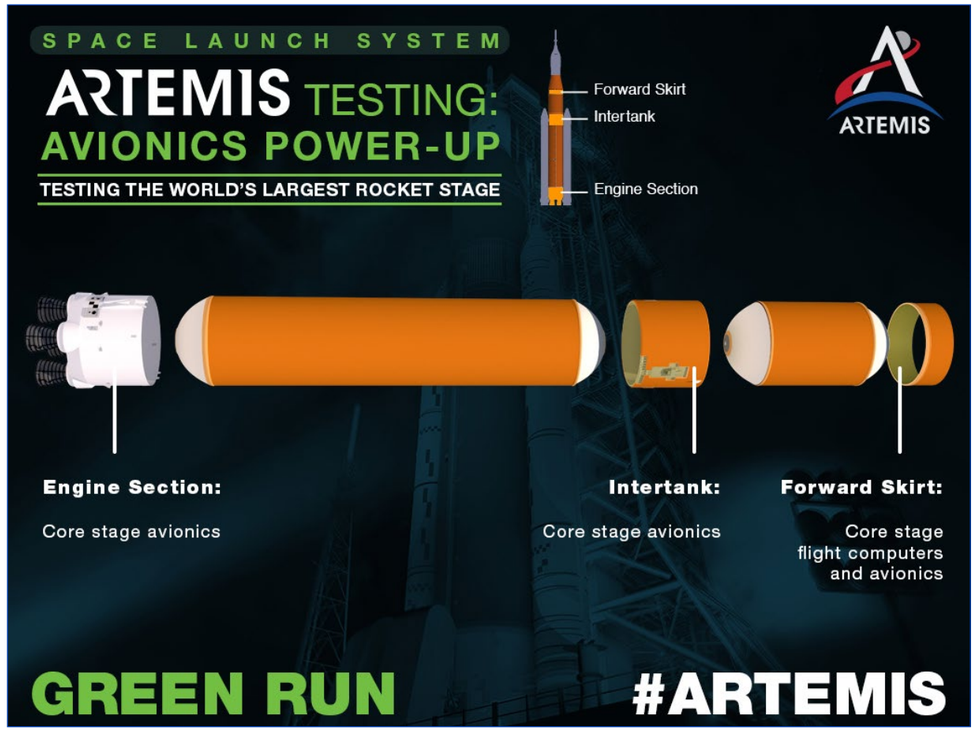
Completion of the recent tests also continues progress toward the maiden launch of NASA's Artemis program to return humans, including the first woman and next man, to the Moon by 2024. Artemis I will launch as an uncrewed mission, using the core stage now being tested at Stennis.

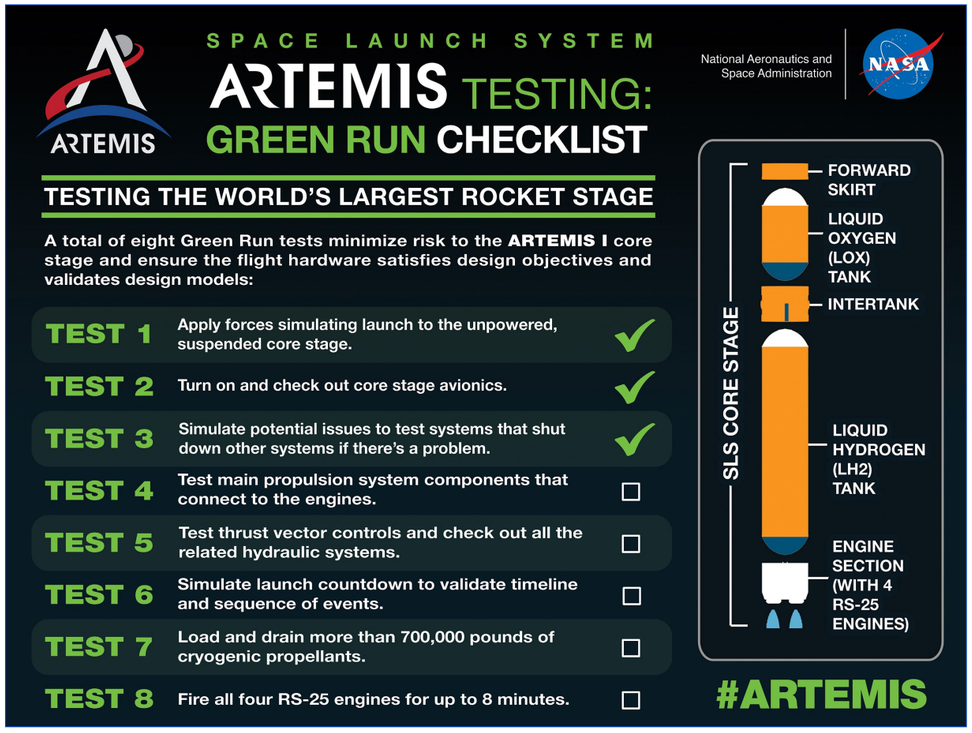
The avionics test began in the final week of June and concluded in the opening days of July. For the test, operators powered up the SLS flight computers and avionics and completed a thorough systems checkout. The test used Green Run software that was developed for the test and loaded in the flight computers for the first time.

The SLS avionics power on and checkout was the second of eight tests in the Green Run test series at Stennis. The test steadily brought the core stage flight hardware, which controls the rocket's first eight minutes of flight, to life for the first time.

The three flight computers and avionics are located in the forward skirt, the top section of the 212-foot tall core stage, with more avionics distributed in the core's intertank and engine section. (See accompanying image).

Engineers from NASA and Boeing, the core stage prime contractor, worked in control rooms as the avionic systems inside the Artemis I core stage were powered up and checked out.





While this is the first time the Green Run software was used to control all the avionics in the flight core stage, it was not untested. Engineers had qualified the avionics and computers with earlier tests in the Systems Integration and Test Facility at NASA's Marshall Space Flight Center in Huntsville, Alabama.

During the subsequent fail-safe test, conducted the week of July 6, engineers simulated various potential test scenarios to check out all of the safety systems designed to shut down operations during testing, if conditions necessitate.

The comprehensive Green Run test series marks the first time SLS core stage systems all operate together, as needed during launch. The series is one of the final milestones before the rocket launches America's Artemis missions to return humans to the Moon and establish a sustainable presence.

The name for the series derives from the nature of the testing. "Green" refers to the new, untested hardware (AKA the SLS core stage), and "run" represents the succession of tests the core stage paces through.

One by one, the series will bring together several "firsts" for the rocket stage as the flight hardware undergoes eight different tests. Each test is designed to gradually bring the rocket's core stage and all its systems to life.

The Green Run series is a collaborative effort between the SLS program, the Stennis test team, core stage manufacturer Boeing and engine manufacturer Aerojet Rocketdyne.

With the pair of recent activities, engineers have completed three of the eight series tests: the modal test, the avionics power up and check-out, and the safety systems checkout. (See accompanying checklist).

The world's tallest rocket stage is tested in an equally giant test stand. For the SLS test series, NASA upgraded the B-2 stand that was used for the Saturn V rocket stages during the Apollo Program and, later, for the Space Shuttle Program. The stand now is customized for testing the SLS core stage.

When all four core stage engines fire up, they can generate some serious heat. The B-2 Test Stand will use roughly 100,000 gallons of water every 18 seconds to protect the stand and the hardware.

The core stage also will really show what it is capable of during the grand finale of Green Run. The goal is for the entire core stage to operate as one for up to 8.5 minutes – and that includes an impressive firing of all four RS-25 engines simultaneously.

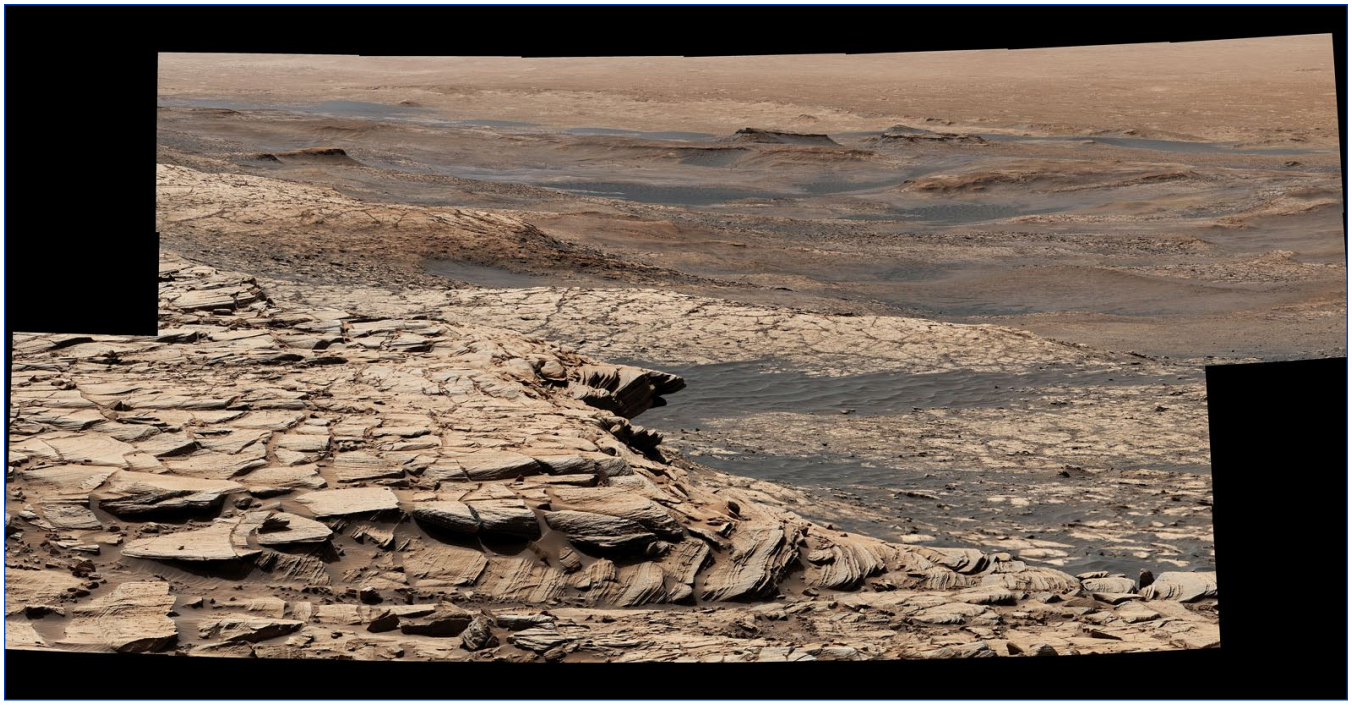
Just like at launch, more than 733,000 gallons of liquid propellant will flow from the two propellant tanks through the fuel lines to feed the RS-25 engines.

When operating at sea level on the test stand, the cluster of four RS-25 engines will produce just over 1.6 million pounds of thrust – the same amount it will produce during the early phase of launch. During launch, as the core stage ascends in altitude to near vacuum conditions, the cluster will then produce over 2 million pounds of thrust.

All the Green Run tests, check outs and the 100 terabytes of collected data will certify the core stage design and help verify the stage is ready for launch. To put the sheer amount of data collected during Green Run into perspective, just one terabyte is the equivalent of roughly 500 hours of movies. Even the Library of Congress's collection only amounts to a total of 15 terabytes!

The test data also will be used by core stage engineers at Marshall and the Boeing Company as they prepare for the rocket's first uncrewed flight and build future stages for Artemis missions that will carry astronauts to the Moon.

Following Green Run hot fire, the next time the SLS rocket's core stage fires up will be on the launch pad at NASA's Kennedy Space Center for the debut of the Artemis program. This inaugural SLS flight will be just the beginning of increasingly complex missions that will enable human exploration to the Moon and, ultimately, Mars.



Curiosity rover begins its summer Mars trip

NASA's Curiosity Mars rover has started a road trip that will continue through the summer across roughly a mile of terrain. By trip's end, the rover will be able to ascend to the next section of the 3-mile-tall Martian mountain it has been exploring since 2014, searching for conditions that may have supported ancient microbial life. Located on the floor of Gale Crater, Mount Sharp is composed of sedimentary layers that built up over time. Each layer helps tell the story about how Mars changed from being more Earth-like – with lakes, streams and a thicker atmosphere – to the nearly-airless, freezing desert it is today. Stitched together from 28 images, the above panorama from April 9, 2020 shows the sandstone cap near the foot of the slop. At center is the "clay-bearing unit"; the floor of Gale Crater is in the distance. For more about Curiosity, visit here and here.

NASA in the News

Agencies offer global view of COVID-19

In response to the global coronavirus (COVID-19) pandemic, NASA, ESA (European Space Agency), and JAXA (Japan Aerospace Exploration Agency) have joined forces to use the collective scientific power of their Earth-observing satellite data to document planet-wide changes in the environment and human society. The wealth of the collective information now is available at the touch of a finger. In an unprecedented collaboration, the three space agencies have created the joint COVID-19 Earth Observation Dashboard, which integrates multiple satellite data records with analytical tools to allow user-friendly tracking of changes in air and water quality, climate change, economic activity, and agriculture. This tri-agency data resource gives the public and policymakers a unique tool to probe the short-term and long-term impacts of pandemic-related restrictions implemented around the world. The dashboard will continue to grow with new observations added over the coming months as the global economy gradually reopens. For more information on NASA's response to the COVID-19 pandemic, visit here. For more on NASA's Earth science programs, visit here.

NASA plans for more SLS boosters

NASA has taken the next steps toward building Space Launch System (SLS) solid rocket boosters to support as many as six additional flights, for a total of up to nine Artemis missions. The agency is continuing to work with Northrop Grumman of Brigham City, Utah, the current lead contractor for the solid rocket boosters that will launch the first three Artemis missions, including the mission that will land the first woman and next man on the Moon in 2024. Under the new letter contract, with a potential value of $49.5 million, NASA will provide initial funding and authorization to Northrop Grumman to order long-lead items to support building the twin boosters for the next six SLS flights. Northrop Grumman will be able to make these item purchases as the details of the full contract are finalized within the next year. The full Boosters Production and Operations Contract is expected to support booster production and operations for SLS flights 4 through 9. The period of performance for the letter contract is 150 days; the definitized contract will extend through Dec. 31, 2030. For more information on SLS, visit here.

Engineer does not take NASA career for granted

Ryan Roberts grew up in the very shadow of NASA and the American space program without even realizing it for much of his younger life. Born in New Orleans, Roberts grew up in neighboring St. Bernard Parish, just across the Intracoastal Waterway from NASA's Michoud Assembly Facility.

At the time, Michoud manufactured the large external tanks that carried the propellants used by a trio of main engines to launch space shuttle missions. In addition, every main engine that helped power a shuttle launch was tested just a bit up the road at NASA's Stennis Space Center, just inside Mississippi. Roberts recalled his amazement at finally realizing so much space activity was taking place "right in my backyard."

Years later, Roberts has moved even closer to the space program activity. He now is a resident of the Slidell and Pearl River areas, directly between Michoud and Stennis. In addition, he works as the B-2 Test Stand director at Stennis, still amazed at the opportunity to be part of the historic effort underway to launch the next great era of human deep space exploration.

Stennis Space Center Director Rick Gilbrech (r) and NASA Science Mission Directorate Associate Administrator Thomas Zurbuchen (l) present a 2019 NASA Exceptional Achievement Medal for extensive efforts that were critical to the successful activation of the modified B-2 Test Stand.

Roberts has spent 25 years involved with NASA. He worked six years for Lockheed Martin before joining the NASA team in 2001 as an engineer in such areas as mechanical operations, mechanical design, and systems engineering. Roberts' recent work as the B-2 director has provided him a central role in the Green Run core stage testing for NASA's new Space Launch System (SLS) rocket. NASA is building SLS to launch Artemis program missions to the Moon and, eventually, missions to Mars.

Stennis is testing RS-25 engines that will help power SLS on its A-1 Test Stand. NASA also spent several years preparing the B-2 stand to test the first SLS flight core stage, which will launch the Artemis I mission. The stage is now installed on the stand to undergo a series of Green Run tests of its systems. The final test will fire the stage's four RS-25 engines simultaneously to generate 1.6 million pounds of thrust, just as during an actual launch.

As B-2 director, Roberts is in the forefront of the Green Run effort, "coordinating all the stand activities that have to happen every day to keep work progressing – with a lot of help from a lot of hardworking great people."

Green Run is the largest test project at Stennis in 40 years, and Roberts said he is honored to have the opportunity to be involved. "The anticipation is awesome, and having the opportunity not only to watch that test happen, but to be on the front lines involved in the test execution is enough to justify a career," he said.

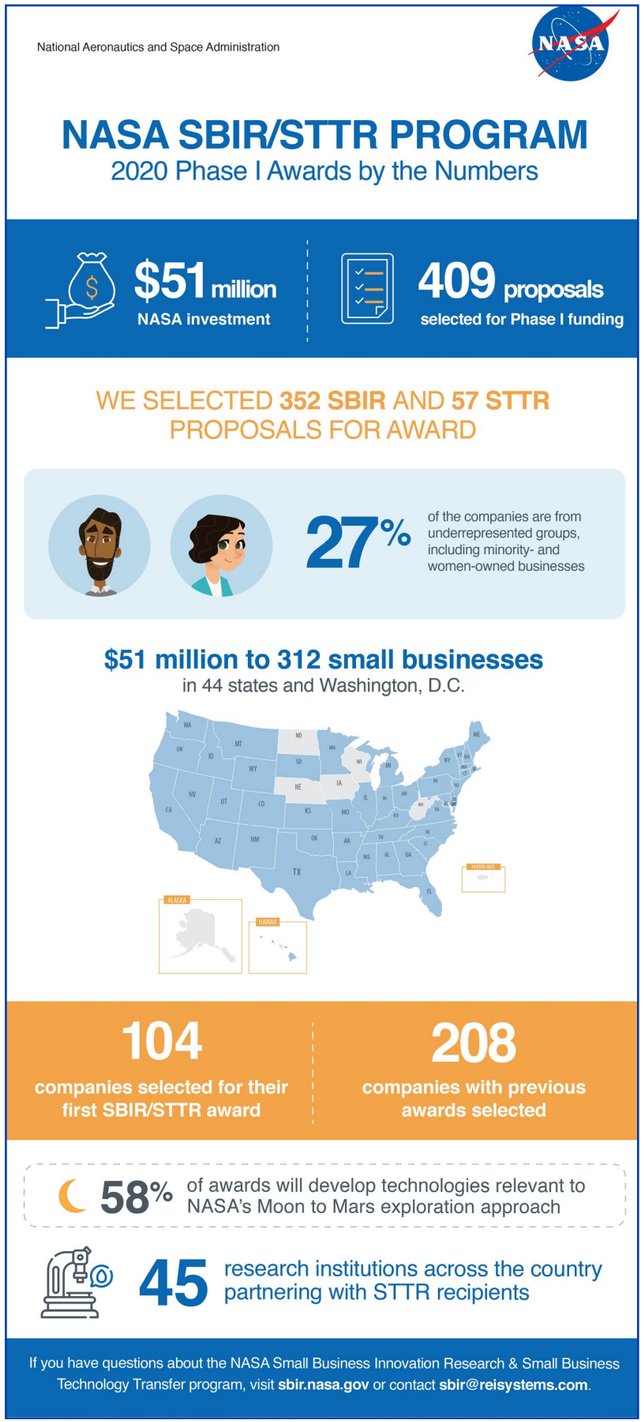
At the same time, Green Run is also the latest in a string of exciting projects he has been involved with at the NASA site. "We get to do some really cool and interesting things at Stennis," he said. "I never miss an opportunity to watch a rocket engine test. Knowing how much time, energy, and attention to technical detail is required by a lot of great people to be able to accomplish one makes it that much more satisfying."

Roberts is proud to be a member of the Stennis family. "Stennis Space Center is a great place to work, and that is mainly due to the work culture, " he said. "Stennis is on the cutting edge of fostering a very diverse workplace."

He also considers it a blessing to be a part of the space industry through the last quarter century. "It is impossible to say what to be more proud of," Roberts said, citing the opportunity to watch shuttle launches, be involved in human space flight efforts, watch the emergence of cutting-edge commercial space programs, participate in the Green Run series and, hopefully, watch a future mission to Mars. "To be able to experience all of these in one career is epic and certainly not to be taken for granted."

Roberts has been recognized for his work, including with a NASA Exceptional Achievement Medal. He said he appreciates the honor but also understands they are not single-handed efforts. "There are a lot of people deserving of individual awards, and I feel like the recognition I get should be shared to the greatest extent," he said.

NASA invests in innovative technologies from U.S. small businesses



NASA has selected 409 technology proposals for the first phase of funding from the agency's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) program. The contracts will provide about $51 million to 312 small businesses in 44 states and Washington, D.C.

The selections include seven projects managed by Stennis Space Center.

"NASA depends on America's small businesses for innovative technology development that helps us achieve our wide variety of missions," said Jim Reuter, associate administrator for NASA's Space Technology Mission Directorate. "Whether we're landing Artemis astronauts on the Moon, sending rovers to Mars, or developing next-generation aircraft our small business partners play an important role."

More than 100 of the selected companies will be first-time recipients of a NASA SBIR or STTR contract. Additionally, 27 percent of the small businesses are from underrepresented groups, including minority and women-owned businesses.

Companies will receive up to $125,000 for each of the Phase I selections. SBIR awards are made to only a small business, while STTR awards are made to a small business in partnership with a non-profit research institution.

The selected proposals represent a range of technologies that aim to benefit human exploration, including NASA's Artemis program, as well as science, technology, and aeronautics. Many also have potential applications on Earth.

The seven selected projects to be managed by Stennis include five SBIR and two STTR selections. The SBIR projects are:

- "Composite Facility Components," Gloyer-Taylor Laboratories, LLC in Tullahoma, Tennessee. Gloyer-Taylor has developed a novel composite system for cryogen storage and transfer. This project seeks to demonstrate the use of a novel composite system for cryogen storage and transfer, with the potential of use in various NASA test and space-related systems.

- "Advanced Propulsion Systems Ground Test Technology," M4 Engineering Inc. in Long Beach, California. The project seeks to develop a thermal conditioning retrofit "kit" for cryogenic shaker systems, designed to prevent freeze-up of system accelerometers during cryogenic testing at Stennis and other NASA facilities.

- "Adaptive Venturi for Surge Pressure Mitigation," Physical Services Inc. in Andover, Maryland. The project seeks to develop a venturi for propellant feed systems that uses a passively controlled throat area to adjust flow rate. The adaptive venturi would be useful in a variety of oxygen systems at NASA facilities.

- "A Fact and Robust PIMPLE-Based Algebraic VOF (Volume of Fluid) Method for Two-Phase Compressible Flows," Streamline Numerics Inc. in Gainesville, Florida. The project seeks to develop an efficient, robust computational fluid dynamics tool that could be used in various NASA ground and launch systems.

- "Advanced Computational Tools for thermal and Acoustic Analysis of Rocket Ground Test Facilities," Tetra Research Corp. in Cornwall, Vermont. The project seeks to develop a liquid injection analysis tool that could be employed on NASA test facilities, which use water suppression systems to protect test articles and structures during testing.

The STTR projects to be managed by Stennis are:

- "Intelligent Sensor Systems - 2020," Geocent, LLC in Metairie, Louisiana, and the University of Southern Mississippi in Hattiesburg, Mississippi. The project seeks to develop a comprehensive end-to-end architecture, using wireless technology, to help collect instrumentation data during propulsion testing.

- "Intelligent Sensor Systems for Rocket Propulsion Testing" by Physical Sciences Inc. in Andover, Maryland, and Auburn University in Auburn, Alabama. The project seeks to develop a smart sensor module to enable wireless sensing capabilities in liquid propulsion systems. The development could be used by NASA in both ground test and flight activities.

Phase I awards are made to small businesses to establish the merit and feasibility of their innovations. Phase I SBIR contracts last for six months and Phase I STTR contracts last for 13 months. Based on their progress during Phase I, companies may submit proposals to subsequent SBIR/STTR opportunities and receive additional funding.

"A Phase I award is just the first step in helping these small businesses bring their technologies and ideas to market," said NASA SBIR/STTR Program Executive Jenn Gustetic. "We know these companies not only need funding, but business guidance and industry expertise to help them develop better products and grow. Our program aims to help each of them in their journeys to commercialization."

The structure of NASA's SBIR/STTR program allows the agency to continuously invest in small businesses as their technologies reach different maturity stages. The program encourages small businesses to develop innovative ideas that meet the federal government's specific needs with the potential for commercialization.

To view the NASA SBIR 2020 Phase I selections, visit here.

To view the NASA STTR 2020 Phase I selections, visit here.

For more information about NASA's investment in space technology, visit here.

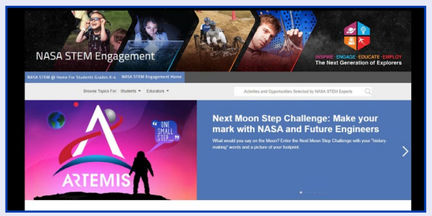
For the latest on NASA/Stennis Space Center status, please access:

Stennis Emergency Management web page

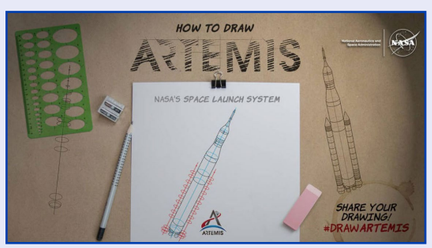
NASA Coronavirus Response Information web page

Other online resources:

NASA at Home



NASA STEM@Home for Students



How to Draw Artemis

1968 – Enabling missions in space and on Earth

Note: NASA's John C. Stennis Space Center has played a pivotal role in the nation's space program. The following offers a glimpse into the history of the space program and the rocket engine test center.

In 1968, the then Mississippi Test Facility (MTF) was not only looking in the sky toward the Moon but also out over the horizon at the ocean.

The Apollo program was going strong, but a meteorological and oceanographic project was planned, BOMEX – the Barbados Oceanographic and Meteorological Experiment.

The mission of BOMEX was to better understand how the atmosphere and the ocean react to each other. MTF was tapped to design, install, maintain, and operate the computerized data management system for the ambitious BOMEX project.

While the BOMEX project was being planned, Apollo 4, the first unmanned Saturn V flight, took place Nov. 9, 1967, followed by Apollo 6 in April 1968. The first human Apollo missions launched Oct. 11, 1968, with Apollo 7. Apollo 8, the first mission to orbit the Moon, launched in December 1968.

On Christmas Eve 1968, the Apollo 8 crew got the first look of the "Earthrise" above the Moonscape. The American people saw the Earth as they had never seen it before, making the United States more curious about its home than ever before, giving momentum to projects like BOMEX to discover more about the environment and to explore the planet's greatest mystery – the ocean.

Apollo 8 offered humans the first images of "Earthrise" as astronauts documented their orbit around the far side of the Moon in December 1968. The breahttaking photo became one of the most famous images not only of 1968 but of all time.

Hail & Farewell

NASA bids farewell to the following:

Mary Horne	Accountant	Office of the Chief Financial Officer

Office of Diversity and Equal Opportunity

Organizations can take positive steps to eliminate racism

There is a disturbing paradox in the American workplace. As organizations look to reap the benefits of a diverse, multicultural, and inclusive workforce, the counter force of racism often under-mines the effort, creating challenges to overcome.

Binna Kandola, a business psychologist and author of *Racism at Work: The Danger of Indifference*, likens racism to a virus that lingers because people have internalized racist stereotypes. "Unless we are prepared to have a discussion about the impact of stereotypes and how they affect decisions that are made within organizations, we are not going to make any more progress toward eradicating racism" Kandola said.

In the workplace, racism most often manifests through microaggressions – indirect, subtle or even unintentional acts of discrimination against members of a marginalized group. They may take the form of stereotyping, "othering" or avoidance. "Microaggression is the modern form of racism," said Jonathan Kanter, director of the Center for the Science of Connection in Seattle. "To reduce racism, we need to decrease microaggression."

Seemingly innocuous questions or comments, such as asking black individuals where they are from or complimenting U.S.-born Latinos on how well they speak English, are considered microaggressions. "It's the surprise factor that makes these comments microaggressions," Kanter said. "They reveal stereotypical assumptions that [minorities] must be from some other country or may not be well-educated."

Often, an event that generates negative publicity is a signal that an organization has a racism problem. Starbucks faced a public relations nightmare when two black patrons were videotaped being arrested at a Philadelphia store, ostensibly for trespassing. Their only "crime" was sitting at a table without making a purchase while waiting for a friend.

For Starbucks, training was part of its immediate response to the crisis. Within days, Starbucks announced it would close all its stores for a one-day racial bias training program to create awareness of unconscious biases, foster empathy, and build social connections. It used a 7-minute video titled *The Story of Access* that features first-person accounts, primarily of black individuals, describing the emotional and psychological toll of dealing with racism on a daily basis. After watching the video, managers and employees talked as a group about their experiences with racism and theories about race relations.

Organizational leaders, human resources professionals and diversity and inclusion advocates are encouraged to work together to create an inclusive environment where people feel safe to speak up and share their concerns. Research by the NeuroLeadership Institute (NLI) in New York found that when team members feel safe discussing racism openly and exploring whether unconscious racial biases are negatively impacting their decisions, the conversations are likely to have a more lasting and sustainable impact.

"People often are scared to say anything because they worry that if they say anything wrong, they might get fired," said Angela Nino, a human resources consultant and founder of Empathic Workplace in Chicago. "It is important to create a space where people feel safe to have honest conversations where nobody feels singled out or different."

Research from New York's Center for Talent Innovation showed that 38 percent of black professionals felt it was unacceptable to speak out at their companies about their experiences of bias. Their silence made them more vulnerable to feeling isolated and alienated and fostered greater turnover and disengagement. Leaders who responded to racist incidents were viewed more positively by black, white, Hispanic, and Asian professionals. The ensuing discussions between team leaders and team members led to stronger bonds and greater understanding.

Joan Williams, founding director of the Center for WorkLife Law at the University of California, recommends that organizations conduct internal research to identify areas of possible bias, determine what metrics can be used to measure change, and then make small changes (called "bias interrupters") to curb the effects of unconscious bias.

Bias interrupters are tweaks to existing business systems, such as hiring practices, performance evaluations, work assignments, promotions, and compensation decisions, that stop and correct implicit workplace biases. These may include rewriting job descriptions, using software (rather than human judgment) to screen applicants, or rethinking criteria for performance evaluations.

To facilitate better decision-making, NLI recommends scenario ("if-then") planning around racially charged situations. Setting objective criteria for decision-making helps eliminate racial profiling and other racist behaviors. Had the Starbucks manager relied less on personal judgment and more on formal rules about when to call the police, for example, the incident could have been avoided altogether.

Racism is bad for business on all fronts. Not only does it place a company in legal jeopardy, but it also fosters a divisive work culture that undermines morale, teamwork and productivity. It makes it harder to recruit, engage, and retain diverse talent; and it tarnishes an organization's reputation and brand.

Stennis and NASA Shared Services Center employees should stay tuned for upcoming diversity dialogue discussions and listening sessions to address employee feelings and concerns as a result of the current social unrest.

Information in this article came from www.shrm.org and Taking Steps to Eliminate Racism in the Workplace by Arlene Hirsch.

NASA names headquarters after 'Hidden Figure'

NASA Administrator Jim Bridenstine announced June 24 that the agency's headquarters building in Washington, D.C., will be named after Mary W. Jackson, the first African American female engineer at NASA.

Jackson started her NASA career in the segregated West Area Computing Unit of the agency's Langley Research Center in Hampton, Virginia. Jackson, a mathematician and aerospace engineer, went on to lead programs influencing the hiring and promotion of women in NASA's science, technology, engineering, and mathematics careers. In 2019, she was posthumously awarded the Congressional Gold Medal.

"Mary W. Jackson was part of a group of very important women who helped NASA succeed in getting American astronauts into space," Bridenstine said. "Mary never accepted the status quo, she helped break barriers and open opportunities for African Americans and women in the field of engineering and technology. Today, we proudly announce the Mary W. Jackson NASA Headquarters building. It appropriately sits on 'Hidden Figures Way,' a reminder that Mary is one of many incredible and talented professionals in NASA's history who contributed to this agency's success. Hidden no more, we will continue to recognize the contributions of women, African Americans, and people of all backgrounds who have made NASA's successful history of exploration possible."

Mary Winston Jackson (1921–2005) is recognized as NASA's first African American female engineer.

The work of the West Area Computing Unit caught widespread national attention in the 2016 Margot Lee Shetterly book *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race.* The book also was made into a popular movie that same year.

In 2019, after a bipartisan bill made its way through Congress, the portion of E Street SW in front of NASA Headquarters was renamed Hidden Figures Way.

"We are honored that NASA continues to celebrate the legacy of our mother and grandmother Mary W. Jackson," said, Carolyn Lewis, Jackson's daughter. "She was a scientist, humanitarian, wife, mother, and trailblazer who paved the way for thousands of others to succeed, not only at NASA, but throughout this nation."

Jackson was born and raised in Hampton, Virginia. Educated in math and physical sciences, she was recruited in 1951 by the National Advisory Committee for Aeronautics, which in 1958 was succeeded by NASA. She started as a research mathematician who became known as one of the human computers at Langley. She worked under fellow "Hidden Figure" Dorothy Vaughan in the West Area Computing Unit.

After two years in the computing pool, Jackson received an offer to work in supersonic pressure wind tunnel, where she received hands-on experience conducting experiments. Her supervisor eventually suggested she enter a training program that would allow Jackson to earn a promotion from mathematician to engineer. Because the classes were held at then-segregated Hampton High School, Jackson needed special permission to join her white peers.

Jackson completed the courses, earned the promotion, and in 1958 became NASA's first Black female engineer. For nearly two decades, she authored or co-authored research numerous reports, most focused on the behavior of the boundary layer of air around airplanes. In 1979, she joined Langley's Federal Women's Program, where she worked hard to address the hiring and promotion of the next generation of female mathematicians, engineers and scientists. Mary retired from Langley in 1985.

In 2019, President Donald J. Trump signed the Hidden Figures Congressional Gold Medal Act that posthumously awarded the honor to Jackson, who passed away in 2005, as well as her "Hidden Figures" colleagues Katherine Johnson, Dorothy Vaughan, and Christine Darden.

"NASA facilities across the country are named after people who dedicated their lives to push the frontiers of the aerospace industry," Bridenstine said. "The nation is beginning to awaken to the greater need to honor the full diversity of people who helped pioneer our great nation. Over the years, NASA has worked to honor the work of these Hidden Figures in various ways. ... We know there are many other people of color and diverse backgrounds who have contributed to our success, which is why we're continuing the conversations started about a year ago with the agency's Unity Campaign. NASA is dedicated to advancing diversity, and we will continue to take steps to do so."

For more on Mary W. Jackson, the Hidden Figures, and today's Modern Figures, visit here.