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Ready!

See pages 3 and 4

Theopolis Turkey and I were sitting out by the Pearl River the other night. You remember how Theo visits me this time every year to spend a roasting-pan-free Thanksgiving. As usual, we got to talking and ended up swapping lists of all the many things we were thankful for in our lives.

"You know, Theo," I said, "one of the things folks here should be thankful for is the circumstances that brought them to Stennis in the first place and the really good people they found here as a result."

Theo nodded. "It is amazing how simple circumstances can bring wonderful people into our lives," he said. "Look at us. We met years ago when I stopped on the road to help you fix a flat on your old '63 Plymouth convertible and have been best of friends since."

"And I still have the same car," I said. "Ark!"

Theo continued, "It is one thing for you and I to sit here and talk about how thankful we are for the people we know, Gator. It is a whole other thing to let those people know. Maybe we should do more of that."

Both of us were quiet a bit. I thought of all the people at Stennis (and elsewhere) who have helped and befriended me, sometimes in big ways and sometimes in small, everyday sort of ways with just a kind word or smile. I wondered if they even knew the difference they made and how grateful I was for them. Theo was right – it was long past time to start telling them.

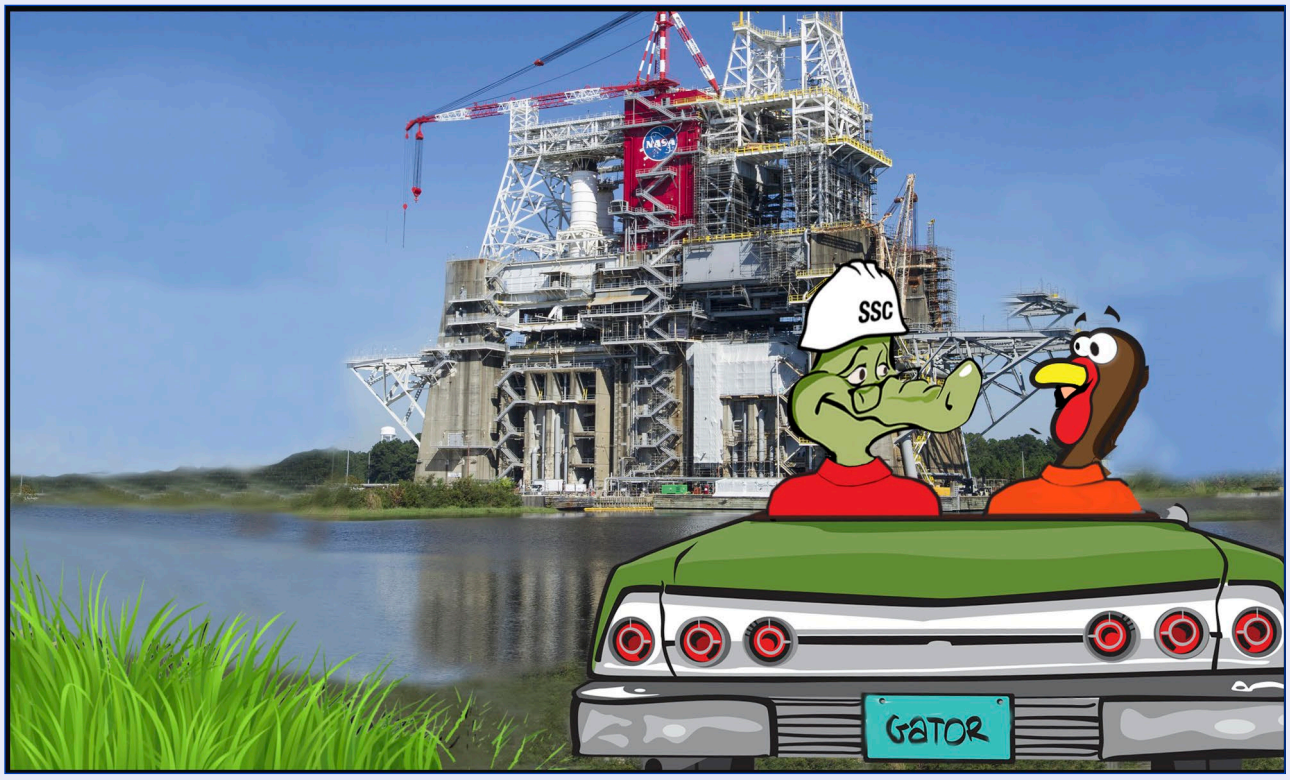
"You know, Theo, I sure am glad you stopped that day to help me," I began. "You have been a real gift to me."

"Likewise," Theo said. "You are a delightful friend."

We were quiet a bit longer before I turned to Theo again. "There is something I have been meaning to ask you, though, just out of curiosity," I said. "I know wild turkeys like yourself can fly, but can a turkey fly higher than, say, the B-2 Test Stand?"

"Of course," Theo responded without hesitation. "The B-2 Test Stand cannot fly at all, Gator."

Ark! Happy Thanksgiving from Theo and Gator – and tell someone today how grateful you are for them.



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Contact info – (phone) 228-688-3749; (email) ssc-pao@mail.nasa.gov; (mail) NASA OFFICE OF COMMUNICATIONS, Attn: LAGNIAPPE, Mail code IA00, Building 1100 Room 304, Stennis Space Center, MS 39529
Managing Editor – Valerie Buckingham
Editor – Lacy Thompson Staff Photographer – Danny Nowlin

FULFILLING NASA'S EXPLORATION MISSION

NASA achieves B-2 Test Stand readiness for SLS testing

NASA effectively capped a six-year process this month at Stennis Space Center near Bay St. Louis, Mississippi, reaching an all-but-complete state of readiness for testing the core stage of the agency's new Space Launch System (SLS) rocket.

With a pair of propellant cold flows, a key gaseous nitrogen test and completion of all but a handful of rescheduled tasks, B-2 Project Manager Barry Robinson declared the last major steps of B-2 Test Stand activation for SLS core stage testing have been completed.

"This is a great accomplishment and the culmination of a six-year effort by an incredible team of people," Stennis Director Rick Gilbrech said. "With this step, we move even closer to seeing the first launch of the rocket and era of space exploration."

With 98 percent of the stand activated, the facility shifts to active standby mode as systems are maintained for readiness. Robinson indicated all that is left is a final water flow check, special test equipment to be installed upon arrival and some tasks to be completed just prior to arrival of the actual SLS "pathfinder," a simulator that will allow technicians to practice core stage manuevers.

Arrival of the pathfinder marks the next big step for the stand. A structural replica of the SLS core stage, the pathfinder will be installed on the B-2 stand as a "fit" test to prove facility modifications will match and handle the actual flight stage.

The final cold flow tests demonstrated that renovated test stand systems had been built and installed correctly, Robinson said. In the first test, liquid oxygen was flowed through the appropriate system piping to ensure there were no leaks and all was working as needed. The second test involved flowing liquid and gaseous hydrogen all the way through the new system and burning it off via one of two flare stacks since hydrogen cannot be released safely into the atmosphere.

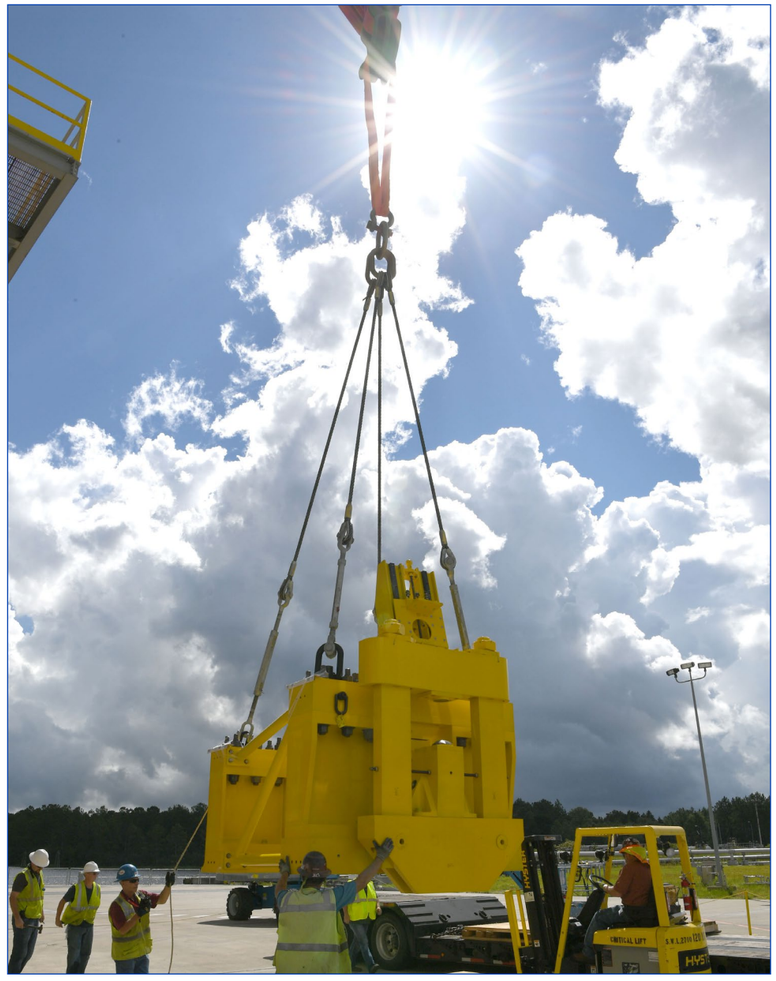
On another front, the high-pressure gas facility at Stennis conducted a "stress test" that showed its readiness to support gaseous nitrogen needs for SLS testing. (See accompanying article)

Meanwhile, the last large equipment work at the B-2 stand involved the arrival and installation of the so-called "yellow boxes," which essentially work as huge clamps to hold the SLS core stage in place on the stand during testing.

Testing of the core stage to be used on the SLS Exploration Mission-1, the first integrated flight of the SLS and the Orion spacecraft, involves installing the stage on the B-2 stand and firing its four RS-25 engines simultaneously, just as during an actual launch. This final test before launch is called a "green run." Instead of actual launching, however, the yellow boxes and struts will anchor the stage in place as the engine thrust is directed out of the stand via the flame deflector.

Reaching the stand readiness point has been an ongoing – and challenging – process. Engineers spent 18 months in the formulation phase, evaluating all B-2 facility structures and systems and identifying work needed for restoration of the stand, as well as for core stage testing. Six years of design, construction and activation work followed.

As soon as NASA announced its decision to use the stand for core stage testing, engineers transferred hand-drawn blueprints to computer models so design work could be completed. The project then was divided into three distinct phases – restoring the stand to original condition after years without use, building the facility out as needed to accommodate the SLS stage and installing all special test equipment needed.



B-2 Test Stand team members prepare to lift one of two so-called "yellow boxes" onto the stand for installation. The yellow boxes will help anchor NASA's Space Launch System core stage in place during testing.

Liquid hydrogen is burned out through a flare stack at the B-2 Test Stand during a propellant cold flow test. The successful cold flow test marked a major milestone in activation of the stand for testing NASA's SLS core stage.

The build out stage was significant and featured upgrades of every major system on the stand, as well as the high-pressure system that provides hundreds of thousands of gallons of water needed during a test. It also involved extending the large derrick crane atop the stand, which will be used to lift the SLS stage into place.

The most visible work featured repositioning of the existing Main Propulsion Test Article framework, which was used to test the space shuttle propulsion system in the 1970s. The shuttle framework stood 61 feet tall and included about 1.2 million pounds of fabricated steel. After it was repositioned 20 feet horizontally, an additional 1 million pounds of steel was added to extend the framework 100 feet to house the larger, taller SLS stage.

The stand now towers more than 300 feet high when the facility lightning rods are factored into the equation, offering a lofty view of the surrounding landscape and ranking as one of the tallest structures in Mississippi, Robinson noted.

Robinson praised the work of the entire B-2 team, noting they addressed every need and issue. "A lot of people put in a lot of hard, focused work, day after day," he said. "Everyone involved should be proud of their effort."

SLS core stage testing will mark a new chapter in Stennis history, which tested Saturn V stages and engines that carried humans to the Moon during the Apollo Program, as well as engines used to power 135 space shuttle missions. The site already is testing RS-25 engines that will help power the new SLS rocket, which is designed to carry humans deeper into space than ever, including on a return to the Moon and eventually to Mars.

FULFILLING NASA'S EXPLORATION MISSION

High-pressure gas facility passes critical SLS 'stress test'

As Stennis Space Center prepared to conduct a major "dress rehearsal" of its upgraded high-pressure gas capabilities, engineer Barry Robinson emphasized the importance of the activity for planned testing of NASA's Space Launch System (SLS) core stage.

"We're going to stress the system out," said Robinson, manager of the effort to prepare the B-2 Test Stand at Stennis for SLS testing. "When it passes, we'll confidently say, 'We're ready for SLS core stage!'"

Consider it said.

Over a 24-hour period spanning Oct. 18-19, a team of high-pressure gas facility operators culminated years of planning and work to demonstrate the facility is prepared to produce the gases needed for SLS core stage testing, including unprecedented volumes of gaseous nitrogen.

"This was a big deal," High-Pressure Gas Facility Manager Craig Chandler said. "There were a number of upgrades in preparation for SLS, and this test demonstrated they were complete. Both the facility and the team performed excellently throughout the exercise."

SLS core stage testing is a major milestone in NASA's plans to return humans to deep space exploration. As designed, SLS will evolve to be the most powerful rocket ever built and will carry humans to various deep space destinations, including the Moon and Mars. Before the maiden flight of the new rocket, NASA will test its core stage at Stennis.

Stennis has been preparing its B-2 Test Stand for six years to conduct testing of both the SLS core stage and upper exploration stage. Core stage testing comes first and will involve installing a flight stage on the B-2 stand and firing its four RS-25 engines simultaneously, just as during an actual launch.

(Left photo) Heavy condensation early on the morning of Oct. 19 signals the transfer of super-cold liquid nitrogen into large vaporizers used to convert the liquid to a gaseous state at the Stennis Space Center high-pressure gas facility. Operators conducted a critical "stress test' of gas house capabilities Oct. 18-19 to demonstrate its readiness for upcoming testing of the core stage of NASA's new Space Launch System rocket.

(Top photo) Liquid nitrogen is pumped from a tanker truck during a recent Stennis high-pressure gas facility "stress test."

The Stennis high-pressure gas facility produces four high-pressure gases for testing and maintaining test systems. Compressors pump low-pressure helium and atmospheric air up to high-pressure levels. Vaporizers convert liquid nitrogen and liquid hydrogen to high-pressure gases. All four are needed for SLS testing.

Early on, engineers realized an especially large and steady flow of gaseous nitrogen would be needed to conduct SLS testing. The gas can be used for several purposes during a typical engine test, including pressurizing propellant tanks, maintaining a clean system before and after testing, and actuating valves.

For core stage testing, the bulk of the gaseous nitrogen will be used in another way, said Nick Nugent, a Stennis engineer who has worked on the gaseous nitrogen issue from the outset. For core stage testing, gaseous nitrogen will travel from the gas facility to the B-2 Test Stand through a 1.5-mile-long pipeline, then through five heaters. The stand heaters have a combined heating capacity of 880 kilowatts, equivalent to the energy needed to light 6,000 New Orleans streetlights – or more than 11 percent of the city's total number.

The heated gas will be piped into the forward skirt, inner tank and engine sections of the core stage 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 in unison.

"The SLS core stage testing is just a gaseous nitrogen hog," Robinson said. "We had to make very sure we were prepared to meet the testing demand."

Upon examining the issue, engineers found Stennis was capable of providing the gaseous helium, gaseous hydrogen and high-pressure air needed. However, gaseous nitrogen capabilities fell short.

Engineers began working to meet the need in 2014. Their subsequent plan called for changes in standard operating procedures. Engineers also planned to use the 15k psi ultra-high-pressure system capabilities at the nearby E Test Complex as a resource to help the gas facility meet the heightened demand.

The plan called for upgrades to existing gas facility equipment as well. New installations at the gas facility included:

- Six new vaporizers to convert liquid nitrogen pumped from storage tanks and trucks into gas.
- New truck off-loading stations.
- New storage capabilities that significantly reduced the number of actual truck deliveries that would be needed on test day.
- A new automated system for transferring liquid nitrogen from storage tanks to pumps.

On paper, the changes and upgrades more than doubled the output capacity of the gaseous nitrogen system. However, to prove the upgrades were indeed ready, operators planned their dress rehearsal exercise. The "day-in-the-life" activity involved executing the designed plan and operating the gas facility exactly as would be done for a core stage test.

Beginning just before 8 p.m. on Oct. 18, two teams of operators in 12-hour shifts conducted the successful exercise. For 24 hours, the facility pumped 100 gallons per minute of liquid nitrogen from onsite storage tanks and 10 delivery trucks for a grand total of 144,000 gallons of liquid nitrogen to support the test.

"That translates to 24 eighteen wheeler loads of liquid nitrogen converted from a liquid to a gas and pushed through the cross-country piping system to the B-2 test stand," Chandler pointed out.

Nugent and others are now reviewing data from the extended test. "We learned a lot," he said. "We're comparing our models to the data now and will refine the set points as needed."

Refinements notwithstanding, the outcome of the test was positive, Chandler said. "Overall, everything went smoothly, and it shows we can meet the SLS requirement," he said. "We're ready."

FULFILLING NASA'S EXPLORATION MISSION

NASA follows 'BOO-tiful' RS-25 test with a second autumn hot fire

NASA delivered a treat with a full-duration RS-25 engine test Oct. 31 (above, left), and the shake, rattle and roar of the hot fire kept away any eerie creaks and frightful sounds the Halloween day might have had to offer. A team of NASA, Aerojet Rocketdyne and Syncom Space Services operators conducted the 500-second RS-25 test on the A-1 Test Stand at Stennis Space Center, the fifth hot fire in an engine test series that began in mid-August. The test marked an acceptance hot fire of another RS-25 engine controller for use on a future flight of NASA's new Space Launch System (SLS) rocket, which is being built now to carry humans deeper into space than ever before. The new flight controller serves as the RS-25 "brain," helping the engine communicate with the rocket and controlling engine operation and internal health diagnostics. Four RS-25 engines, firing simultaneously, will help power SLS at launch, supplying a combined 2 million pounds of thrust and working in conjunction with a pair of solid rocket boosters to provide more than 8 million pounds of thrust. Two weeks after the Halloween test, NASA ushered in the Gulf Coast autumn season with force, conducting a full-power, full-duration 650-second RS-25 engine test (above, right) Nov. 15 on the A-1 Test Stand. Operators fired development engine No. 0525 to a 113 percent thrust level for 60 seconds during the test, marking only the second time they have achieved the highest RS-25 power level. Engineers first fired development engine No. 0528 to that level during a February test at Stennis. RS-25 engines for initial missions are former space shuttle engines, designed to provide a specific power level, categorized as 100 percent thrust. Through the space shuttle years, the engines were modernized to provide additional thrust up to 109 percent of the original level. For SLS, they have been modified again to provide up to 111 percent of original thrust, with the 113 percent hot fires at Stennis allowing operators to test a margin of safety. The test also marked the third time an RS-25 engine has been fired for the longer duration. Typical tests run 500 seconds (8 minutes, 20 seconds), the amount of time the engine must fire to power the rocket from launch into space. The 650-second duration represents the time three RS-25 engines would have to fire to burn up propellant and power the rocket into orbit, if the fourth shut down early during an SLS launch. The longer time also allows operators to schedule and meet more performance objectives during a test. In addition to higher power and duration levels, the Nov. 15 hot fire was the sixth on this engine in the current series of acceptance tests for RS-25 engine flight controllers. Both recent hot fires featured continued testing of two innovative engine components – a 3D-printed pogo accumulator to dampen pressure oscillations that can cause flight instability and a main combustion chamber fabricated using a new hot isostatic pressing (HIP) bonding technique that saves considerable time and money. Aerojet Rocketdyne, prime contractor for the RS-25 engine, recently announced it has received all 16 engine controllers to be used on the first four SLS flights. All are slated for acceptance testing at Stennis.

Space station image shows Earth enveloped in afterglow

A photo taken aboard the International Space Station (ISS) on Oct. 7, 2018, shows the Earth enveloped in an orange glow. The phenomenon is known as airglow – diffuse bands of light that stretch 50 to 400 miles into the atmosphere. It typically occurs when molecules (mostly nitrogen and oxygen) are energized by ultraviolet radiation from sunlight. To release that energy, atoms in the lower atmosphere bump into each other and lose energy in the collision. The result is colorful airglow. Airglow reveals some of the workings of the upper reaches of our atmosphere. It can help scientists learn about the movement of particles near the interface of Earth and space, including the connections between space weather and Earth weather.

NASA in the News

NASA retires Kepler Space Telescope

After nine years in deep space collecting data that indicate the sky is filled with billions of hidden planets – more planets even than stars – NASA's Kepler space telescope has run out of fuel needed for further science operations. NASA has decided to retire the spacecraft within its current, safe orbit away from Earth. Kepler leaves a legacy of more than 2,600 planet discoveries from outside the solar system, many of which could be promising places for life. During its mission, Kepler revealed the diversity of planets that exist in the galaxy. The most recent analysis of Kepler's discoveries concludes that 20 to 50 percent of the stars visible in the sky are likely to have small, possibly rocky, planets similar in size to Earth and located within the habitable zone of their parent stars. That means they are located at distances where liquid water – a vital ingredient to known life – might pool on the planet surface. NASA's planet-hunting mission now falls to the Transiting Exoplanet Survey Satellite launched in April. For more on Kepler, visit: https://www.nasa.gov/kepler/presskit or https://www.nasa.gov/kepler.

Dust storms spotted on Saturn moon

NASA's Dawn spacecraft has gone silent, ending a historic mission that studied time capsules from the solar system's earliest chapter. Mission managers recently concluded that the spacecraft finally has run out of hydrazine, the fuel that enables it to keep antennas trained on Earth to communicate with mission control or to turn its solar panels to the Sun to recharge. Dawn launched 11 years ago to visit the two largest objects in the main asteroid belt. It now is in orbit around the dwarf planet Ceres, where it will remain for decades. Dawn achieved many firsts – the first spacecraft to orbit a body in the region between Mars and Jupiter, the first to visit a dwarf planet and the first to go into orbit around two destinations beyond Earth. Dawn showed how important location was to the way objects in the early solar system formed and evolved. Dawn also reinforced the idea that dwarf planets could have hosted oceans over a significant part of their history – and potentially still do. To learn more about Dawn, visit online at: https://dawn.jpl.nasa.gov/mission/toolkit or https://www.youtube.com/watch?v=JrafypeEhTM.

NASA outlines sustainable campaign to return to Moon, on to Mars

In December 2017, President Donald Trump signed Space Policy Directive-1, in which he directed NASA "to lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and to bring back to Earth new knowledge and opportunities."

In answer to that bold call, and consistent with the NASA Transition Authorization Act of 2017, NASA recently submitted to Congress a plan to revitalize and add direction to NASA's enduring purpose. The National Space Exploration Campaign calls for human and robotic exploration missions to expand the frontiers of human experience and scientific discovery of the natural phenomena of Earth, other worlds and the cosmos.

The Exploration Campaign builds on 18 continuous years of Americans and our international partners living and working together on the International Space Station. It leverages advances in the commercial space sector, robotics and other technologies, and accelerates in the next few years with the launch of NASA's Orion spacecraft and Space Launch System (SLS) rocket.

The Exploration Campaign has five strategic goals:

1. Transition U.S. human spaceflight activities in low-Earth orbit to commercial operations that support NASA and the needs of an emerging private sector market.
2. Lead the emplacement of capabilities that support lunar surface operations and facilitate missions beyond cislunar space.
3. Foster scientific discovery and characterization of lunar resources through a series of robotic missions.
4. Return U.S. astronauts to the surface of the Moon for a sustained campaign of exploration and use.
5. Demonstrate the capabilities required for human missions to Mars and other destinations.

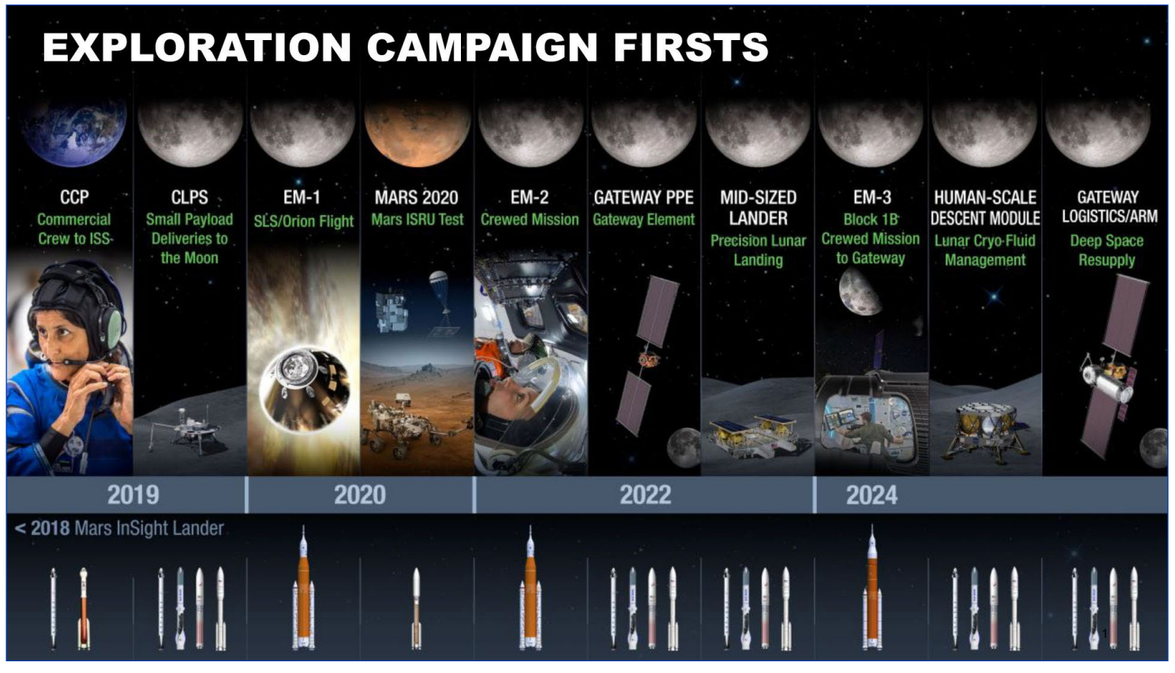
Transition Low-Earth Orbit Activities

NASA intends to transition from the current model of human space activities in low-Earth orbit to a model where the government is only one customer for commercial services.

Based on inputs from current partners, commercial and other stakeholders, NASA will shape the plan for the transition of low-Earth orbit activities from direct government funding to commercial services and partnerships, with new, independent commercial platforms or a non-NASA operating model for some form or elements of the International Space Station by 2025. In addition, NASA will expand public-private partnerships to develop and demonstrate technologies and capabilities to enable new commercial space products and services.

The International Space Station will continue to serve as a core long-duration human spaceflight platform through at least 2024, which will mark almost 25 years of continuous human occupancy and successful international cooperation in space. NASA leverages the space station to learn how to keep crews healthy and productive on deep space missions, and as a testbed to develop technologies to support those missions. It is an experiential testing ground that enables discovery and development of advanced robotics, communications, medicine, agriculture and environmental science.

The space station also can help enable the transition to commercial activities in low-Earth orbit. NASA recently awarded 12 contracts to industry to investigate the best way to use the space station to engage the U.S. commercial industry to take a lead role in low-Earth orbit. The portfolio of selected studies will include specific industry concepts detailing business plans and the viability of habitable platforms, using the space station or separate free-flying structures.



To the Moon

The Moon is a fundamental part of Earth's past and future – an off-world continent that may hold valuable resources to support space activity and scientific treasures that may tell us more about our own planet. Although Americans first walked on its surface almost 50 years ago, during the Apollo 11 mission in July 1969, explorers left footprints at only six sites, during a total of 16 days on the surface. The next wave of lunar exploration will be fundamentally different.

NASA is building a plan for Americans to orbit the Moon starting in 2023, and land astronauts on the surface no later than the late 2020s. This will be the first chance for the majority of people alive today to witness a Moon landing – a moment when, in awe and wonder, the world holds its breath. However, America will not stop there.

A key component of establishing the first permanent American presence and infrastructure on and around the Moon is the Gateway, a lunar orbiting platform to host astronauts farther from Earth than ever before.

On the Gateway, America and its partners will prepare to transit deep space, testing new technologies and systems as they build the infrastructure to support missions to the surface of the Moon and prepare for the mission to Mars. NASA also will study the effects of the deep space environment of the Gateway, learning how living organisms react to the radiation and microgravity of a deep space environment over long periods.

The Gateway also will be assessed as a platform for the assembly of payloads and systems; a reusable command module for lunar vicinity and surface exploration; and a way station for the development of refueling depots, servicing platforms, and a sample return facility.

Some elements of the Gateway already are under construction at NASA centers across the United States – including facilities in Ohio, Texas and Alabama – and at commercial partner facilities. The Gateway will be assembled in space, incrementally, using the Orion spacecraft and SLS, as well as commercial launch vehicles. The first element, providing power and propulsion, will launch from Florida in 2022.

The lunar surface will serve as a crucial training ground and technology demonstration test site where we will prepare for future human missions to Mars and other destinations. Through an innovative combination of missions involving commercial and international partners, robotic lunar surface missions will begin as early as 2020, focus on scientific exploration of lunar resources, and prepare the lunar surface for a sustained human presence.

By the late 2020s, a lunar lander capable of transporting crews and cargo will begin trips to the surface of the Moon. The sustainable, long-term lunar surface activities enabled by these efforts, in tandem with the Gateway, will expand and diversify over time, taking advantage of the Moon and near space for scientific exploration in the broadest sense.

On to Mars

The first human landing on Mars – audacious in its complexity – will be an achievement recalled with awe far into humanity's future. Key components of the Exploration Campaign already are underway and include long-duration human spaceflight on the space station, development of advanced life support systems, and continuing to lead and advance the world in deep space science missions.

Overall, the Exploration Campaign focuses on a transformative approach that includes the development of technologies and systems that enable a series of human and robotic lunar missions that are extensible to Mars.

NASA continues to maintain leadership in robotic exploration on and around Mars. The agency's InSight mission now is on its way to Mars and will land in November to study the interior of the Red Planet. Development of NASA's next rover to Mars continues to make excellent progress and is scheduled to launch in July 2020.

The Mars 2020 rover will aid our search for past life and demonstrate the production of fuel and other resources that enable human exploration. We also will use this mission as a building block for a subsequent roundtrip robotic mission with the historic first rocket launch off another planet and a sample return. That mission will serve as a critical precursor to an eventual series of crewed missions to Mars planned to start in the 2030's and culminating in a surface landing, which will be supported by the work we'll do on the Moon in the coming years.

The priorities laid out in the National Space Exploration Campaign ensure the United States will maintain leadership in space science and exploration. To read the complete Exploration Campaign, visit oneline at: https://go.nasa.gov/2pyqmMD.

Stennis develops autonomous systems toolkit

Earlier this year, Stennis Space Center rolled out a remote sensing "toolkit" with a myriad of Earth science data sets and resources that put the world at one's fingertips. Now, they are doing the same with autonomous systems.

Stennis has developed the NASA Platform for Autonomous Systems (NPAS), an innovative, user-friendly software platform to efficiently implement autonomous operations and thinking capabilities for virtually any type of system.

"This is a very powerful package," said Duane Armstrong, chief of the Test Technology Branch at Stennis. "It greatly enhances the capabilities of G2, the commercial software upon which it is based, and significantly reduces the time and effort required to design, test and deploy robust, safety-critical autonomous systems."

NPAS is a Stennis creation and has roots in Integrated System Health Management (ISHM) work led by Dr. Fernando Figueroa over the past decade. However, NPAS is more than an ISHM tool.

Many systems use what is known as "brute-force autonomy." In that approach, humans must anticipate every possible action a system can take and every possible issue a system can face. If the developers miss something, the system has no idea what to do in that situation.

NPAS' big advantage is enabling "thinking autonomy". NPAS capitalizes on many different types of knowledge to enable a system to respond to issues. "In other words, you do not have to anticipate every possible scenario," Figueroa explained. "NPAS will use its models and capabilities to come up with its own solutions."

Another leap forward for NPAS is its adaptability. It is built on a commercial platform, but Stennis operators have augmented the platform to be much more comprehensive. As a brief definition of the approach explains, "The platform can provide information on the health of every element of the system … (and) combines autonomous sequence control, hardware component commanding and health monitoring in one application."

NPAS has been funded by NASA's Advanced Exploration Systems, which promotes development of prototype and advanced capabilities for future space exploration efforts. Initial focus is on using the platform for autonomous operations of space habitats and autonomous propellant loading for ground test and launch systems. NPAS is being used to implement autonomous operation of the nitrogen system at the high-pressure gas facility at Stennis.

However, the platform design and adaptability makes it applicable across a range of industries. "It is not limited to propulsion testing," Armstrong said. "We are building autonomous systems for industrial control systems, power systems, and space vehicle management as part of NASA's Exploration program."

Enough interest so that Stennis has partnered with Fed Tech in an effort to introduce the NPAS toolkit into the wider market. Fed Tech works with a range of research-and-development institutions and agencies such as NASA to help commercialize new technologies.

Under the Fed Tech approach, teams of entrepreneurs spend eight weeks identifying areas in which a technology can be used, building possible business models to promote such usage and pursuing funding to launch a startup.

Armstrong said he is hopeful the effort will lead to a commercial partnership that makes NPAS widely available. FedTech teams are scheduled to report out on their work regarding NPAS at the end of November.

In the meanwhile, work on NPAS is ongoing, Figueroa said. "We are constantly expanding the concept to add new capabilities that help companies develop and implement customized autonomous systems."

NASA selects additional small business development project

NASA has selected an additional 10 research and technology proposals – valued at $7.5 million – for Phase II of its competitive Small Business Technology Transfer (STTR) program. One project supporting Stennis Space Center is included.

STTR supports NASA's future missions into deep space and benefits the U.S. economy. Selected proposals will support the development of technologies in the areas of aeronautics, science, human exploration and operations, and space technology. In each instance, small businesses have partnered with research institutions for their projects.

The newly selected STTR project supporting Stennis Space Center is: *Electrical Power from Thermal Energy Scavenging in High Temperature Environments*, developed by Physical Sciences, Inc. of Andover, Maryland, and Purdue University of West Lafayette, Indiana.

NASA selected an initial 20 proposals for Phase II development in August, two of which supported Stennis.

Stennis finalizes, posts new Strategic Plan

Stennis Space Center leaders have finalized a strategic plan for the future, focusing on exploring and advancing two keys areas – propulsion testing, as well as innovation and partnerships.

The plan vision statement reads – "Stennis Space Center leads propulsion testing and enables partner mission success." A site mission statement follows – "Stennis Space Center is the partner of choice for providing propulsion test capabilities to the nation. Stennis utilizes its unique location and assets to collaborate with other agencies, academia and industry to develop and test autonomous systems, enhance national security and increase knowledge of the Earth and its oceans."

The vision and mission statement are supported by a pair of strategic goals:

- By 2025, Stennis Space Center will be home to a modern, sustainable propulsion test enterprise providing world-class test services to NASA, other government agencies and commercial customers, as well as fostering an entrepreneur-friendly environment where commercial providers design, manufacture, assemble and test space launch hardware.
- Stennis Space Center will continue to provide an environment that enable efficient and effective support of NASA and tenant missions, while providing growth opportunities for development, test and operations of unmanned autonomous systems by NASA, other governmental agencies and industry.

Both goals include specific objectives for moving forward. The plan – and supporting objectives – can be viewed at: https://go.usa.gov/xPGxp.

NASA official leads Stennis anti-harassment sessions

Steve Shih, NASA associate administrator for diversity and equal opportunity, leads an anti-harassment training session during his visit to the site Nov. 8-9. During his two-day stop, Shih received overviews of work under way at Stennis and the NASA Shared Services Center. Shih also led a trio of anti-harassment training sessions for managers and supervisors of each center, as well as for employees. Shih toured several Stennis facilities during his visit as well.

Mississippi officials tour site facilities

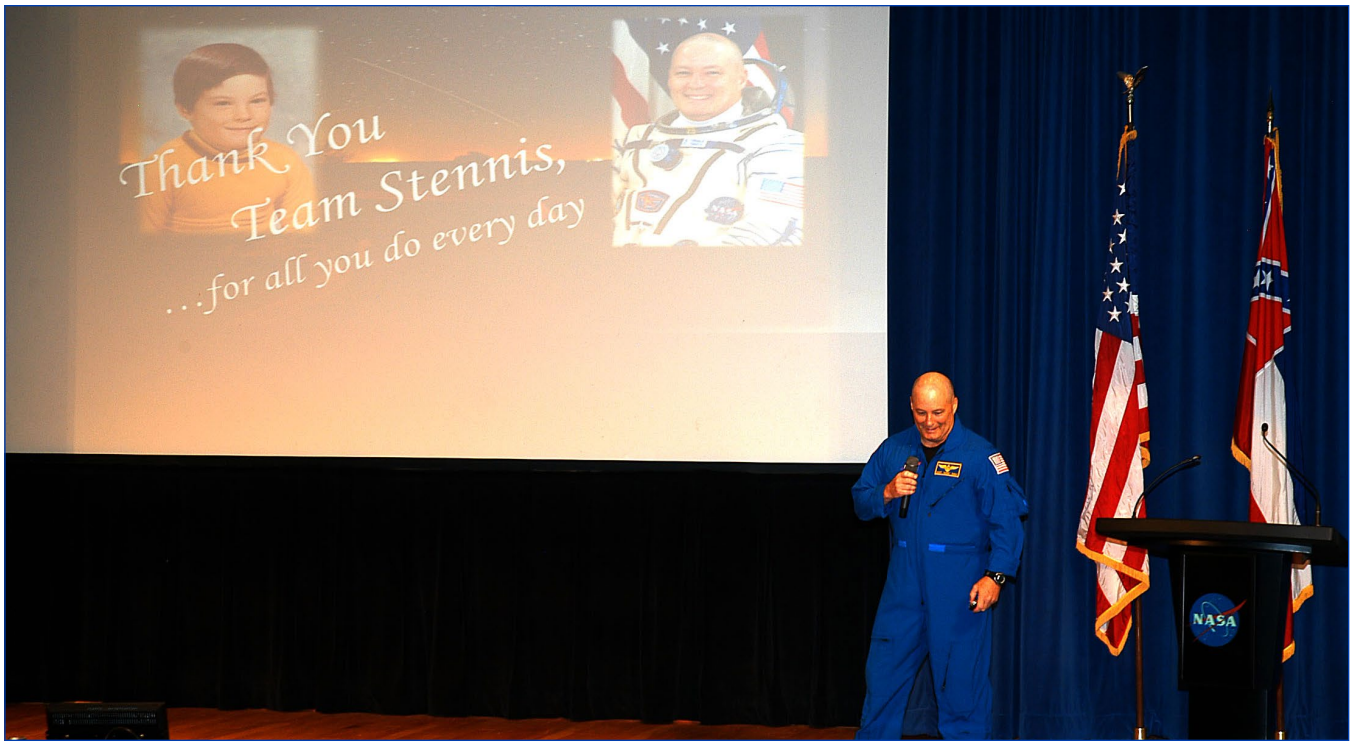
Mississippi and Mississippi Enterprise for Technology (MSET) representatives stand on the B-2 Test Stand during a group visit and tour of Stennis facilities Oct. 17. Participants included (l to r): Cameron Nuzzo (MSET), Robert Ingram (MSET), Christopher Johnson (Mississippi Legislature) Melissa McGee (Mississippi Legislature), Anna Kate Baygents (MSET) and Toby Barker (mayor of Hattiesburg).

Stennis kicks off 2019 Combined Federal Campaign

Stennis Space Center employees launched their annual Combined Federal Campaign (CFC) effort Nov. 1 with a kickoff that featured visits by area service organizations. During the day, employees were able to gather information about various services supported by CFC gifts. Exhibitors included such groups as Basket of Hope, A Child's Wish, Heifer International, Make-a-Wish Mississippi, the Animal Adoption Society Inc., Boys and Girls Clubs and Hope Haven. CFC is the largest annual workplace charity effort in the nation, with almost 200 campaigns throughout the country and overseas raising millions of dollars each year. Pledges made by federal civilian, postal and military donors during the campaign season support eligible non-profit organizations that provide health and human service benefits throughout the world. For 2018, Stennis Space Center leaders have set a $145,000 goals for sitewide donations. The theme of this year's campaign is "Show Some Love."

Stennis Space Center
Sitewide Giving Goal
$145,000

Astronaut shares mission highlights at Stennis



(Top photo) Astronaut Scott Tingle shares highlights of his recent Expedition 54/55 mission to the International Space Station during a visit to Stennis Space Center on Oct. 17. Tingle recounted experiences of his 168-day mission to the space station, which featured a seven-and-a-half-hour spacewalk. Tingle said spacewalking is the "coolest" thing astronauts do and the "hardest thing I've ever done."

(Bottom left photo) Astronaut Scott Tingle stands with Stennis Deputy Director Randy Galloway (l) and engineer Ryan Roberts atop the B-2 Test Stand during a tour of the facility Oct. 17.
(Bottom right photo) Astronaut Scott Tingle presents Stennis Director Rick Gilbrech with a "flown flag" photo collage of his recent Expedition 54/55 mission to the International Space Station.

Hail & Farewell

NASA welcomes the following:

Alexander Chew	Electrical Engineer	Engineering and Test Directorate
Robert Goluba Jr.	Electrical Engineer	Engineering and Test Directorate

Stennis Astro Camp® supports New Orleans STEM events

The Stennis Office of STEM Engagement supported a pair of recent New Orleans-area events, providing students hands-on Astro Camp® activities designed to promote interest in science, technology, engineering and mathematics. On Oct. 13, Stennis representatives hosted activities at the World War II Air, Sea and Land Festival at the New Orleans Lakefront Airport. A week later on Oct. 20, Stennis Office of STEM Engagement representatives joined with Michoud Assembly Facility and Marshall Space Flight Center personnel to host activities during the New Orleans Saints/Pelicans STEM FEST in the Superdome. Activities featured at the events including Moon Phase and Train Like an Astronaut opportunities that focused on current NASA satellite missions; an International Space Station Glove Box activity that gave students a chance to learn what it is like to live and work in space; a Rocket Transportation activity that offered exposure to basic rocketry; a mobile planetarium video presentation focuses on NASA's planned journey to the Moon and Mars; and a Newton's Third Law of Motion in which students were able to "launch" air-powered balloon rockets. The events also featured inflatable models of NASA's new Space Launch System rocket and Mars Curiosity Rover, as well as a visit by Orbie, the inflatable astronaut mascot for Stennis Space Center.

When it comes to safety, everyone is responsible

Note: The following is part of a regular focus on safety and health at Stennis Space Center. It was written by Kevin Gallagher with Syncom Space Services.

The Voluntary Protection Program (VPP) promotes effective worksite-based safety and health. In VPP, management, labor and OSHA establish cooperative relationships at workplaces that have implemented a comprehensive safety and health management system. Approval into VPP is OSHA's official recognition of the outstanding efforts by employers and employees to achieve exemplary occupational safety and health.

As Syncom Space Services (S3) progresses down the path of achieving VPP status, the value and importance of everyone becoming involved and taking ownership of safety cannot be measured.

The Human Performance (HuP) Safety Committees initiative has gone to the next level. The S3 Synergy Achieving Consolidated Operations and Maintenance contract has safety committees representing all areas. Each committee has been tasked with addressing any safety concerns or improvements in their areas. Committees are in place for the A Test Complex, B Test Complex and support areas; the E Test Complex; engineering; the cafeteria, custodial, logistics, and roads and grounds areas; and the operations and maintenance area. This year, the combined closures to concerns or improvements is approaching 24 items with even more items pending.

Healthy personal relationships occur only when employees are actively engaged in improving site performance. An atmosphere of teamwork and collaboration motivates individuals to improve the effectiveness of the organization. A safe atmosphere is cultivated when people treat each other with honesty, fairness and respect while working toward common goals and safety.

Employees at all levels must be involved in decisions that affect employee health and safety. There must be an engine, such as a Human Performance Safety Committee, to help drive involvement. Management involvement and accountability must also be apparent to all employees. Involvement should include establishing a clear line of communication and setting an example of safe and healthful behavior. S3 also has formed a VPP Steering Committee with management leadership. It supports area committees with issues that reach beyond their level.

This avenue of communication and working together has proven itself, and the results have been positive. Showcasing teams and their progress helps employees know they have a voice and an avenue to address any safety concern or to suggest improvements.

As an example of this approach's success, the Operations and Maintenance Safety Committee recently reported on work done to establish a personal protection equipment (PPE) crib stocked with required PPE for employees, retrofitting of streetlight pole fuses that had a possibly exposed energized connector, installation of an electrical disconnect at the Rouchon House for use in case of fire or another emergency and an improved safe plan of action (SPS) initiative to generate a robust safety check process prior to and during a task.

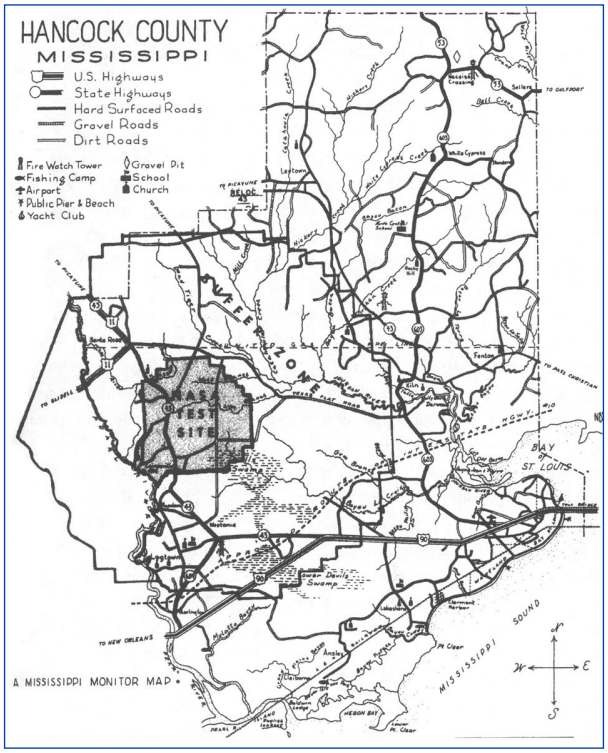
1961 – 'There is always the thorn before the rose'

Note: For more than 50 years, NASA's John C. Stennis Space Center has played a pivotal role in the success of the nation's space program. This month's Lagniappe provides a glimpse into the history of the south Mississippi rocket engine test center.

The history of the area where Stennis Space Center now sits can be traced back well before Mississippi entered statehood in 1817. There were five towns located in what now is the acoustic buffer zone surrounding Stennis: Napoleon, Logtown, Gainesville, Santa Rosa and Westonia.

The town of Napoleon began with 640 acres granted by the British government to John Claudius Favre in 1767. By 1808, Favre had transferred the land to his son, Simon. Simon Favre built the first house and store in what would become the small town of Napoleon. The town's claim to fame was a home named "Parade Rest" that was more than 3,000 square feet, with thousands of azaleas and camellias decorating the landscape.

Logtown, at its peak, had 3,000 residents, most of whom worked for the lumber industry that was very prevalent in the area. The earliest resident of what would become bustling Logtown was Jean Baptiste Rousseve, who was given the land in 1788. The first log mill was built there in 1845, and the town grew until 1930. With the Great Depression and the railroad locating north of the town, by 1961, only 250 residents were left.



A 1961 map shows the location of the Mississippi rocket engine test site, 45 miles east of New Orleans, along the East Pearl River in Hancock County, Mississippi. (Originally published in the *Mississippi Monitor*)

Gainesville was the only town in what is now Stennis that lay in the so-called "fee" area purchased outright by the government to build its rocket engine test site. It began in 1810 with a land grant by Dr. Ambrose Gaines for more than 500 acres in what was then Spanish territory. Gaines laid out his plan for a new town, naming it Gaines Bluff. Andrew Jackson, just prior to the Battle of New Orleans in 1813, marched his troops through Gainesville so not to be detected by British troops. Gainesville grew due to the shipping and logging industries along the Pearl River, but in 1883, the Southern Railroad Line between New Orleans and Meridian, Mississippi bypassed the town by 10 miles. By 1961, when NASA was looking to build the rocket test facility, Gainesville only had 35 residing families left.

Santa Rosa was one of the more distinctive towns in the buffer zone. At its largest, it only had a handful of homes, but what it lacked in population, it made up for in character. In the town were a couple of stores and churches, a post office, a one-room school house and quite a few bars. These "dens of inequity" were closed and chased out of town many times, but the bars always reopened. There was quite a bit of illegal activity going on at the bars for the time, one being the sale of whiskey. Mississippi was a dry state at the time, and moonshiners populated the area surrounding Stennis until the mid-1960s.

The town of Westonia was named for lumber tycoon Horatio Weston, who founded the H. Weston Lumber Company. Westonia grew up around the timber industry and also housed a repair station for railroad flat cars and steam engines. It was a small town with churches, stores, one hotel, a small school and a couple of wells used for the steam engines that traveled through the town. After 1930 and the Great Depression, the timber industry in the area shut down. By the 1960s, the town was almost nonexistent.

On Nov. 1, 1961, on the grounds of the Logtown Elementary School, U.S. Sen. John Stennis of Mississippi gave a speech to the 1,500 people from the surrounding area. The government planned to build a rocket testing center on their land, and Stennis spoke about the project and what the government was asking the people to do. "There is always the thorn before the rose; … you have got to make some sacrifices, but you will be taking part in greatness," he said. It was a "call to arms" in the space race against the Soviet Union.

Soon, because of sacrifices by the families in the surrounding towns to allow construction of the test site, it was widely said, "If you want to go to the moon, you first have to go through Hancock County, Mississippi."

Office of Diversity and Equal Opportunity

Celebrate Native American Heritage Month

National Native American Heritage Month, also known as National American Indian Heritage Month, is celebrated in America during the month of November. This is a time to celebrate the legacy of the first people to call this land home. Native Americans have fortified this country with their traditions and values, making tremendous contributions to every aspect of national life.

In recognition of this month, we pay tribute to Mary G. Ross, the first American Indian female engineer, whose major contributions to the aerospace industry include the development of concepts for interplanetary space travel, manned and unmanned Earth-orbiting flights, and orbiting satellites. Ross' gender alone made her a hidden figure in the world of early spaceflight.

Her great-great grandfather, John Ross, was the longest-serving chief of the Cherokee Nation. During his tenure, he fought to preserve his nation from white settlers' incursions – and later was forced to lead his people along the march that became known as the Trail of Tears.

That history helped shape the trajectory of Ross's extraordinary career. Born in 1908, Ross grew up in Park Hill, Oklahoma, the Cherokee community where her ancestor and other members of the Cherokee Nation settled after their forced removal.

After graduating from Northeastern State College with a math degree, Ross put her skills to work on behalf of other Native Americans, working first as a statistician for the Bureau of Indian Affairs and then at a Native American boarding school in New Mexico.

Math always called Ross' name, and in 1942, armed with a master's degree, she joined Lockheed Aircraft Corporation. As World War II raged, the company was working on new military aircraft. Ross helped them troubleshoot the P-38 Lightning, a fighter plane that came close to breaking the sound barrier.

After the war ended, Lockheed sent Ross to UCLA to earn a classification in aeronautical engineering, and slowly, she began to progress through the company's male-dominated ranks. "She worked with a lot of guys with slide rules and pocket protectors," said Jeff Rhodes, Lockheed Martin's historian and the editor of *Code One* magazine. "The stereotype was real."

Women had always been a part of Lockheed Martin, Rhodes said. Nonetheless, when Ross was recruited to join Skunk Works, the company's then-top-secret think tank, she was the only woman aside from the secretary.

However, Ross was undaunted – and exhilarated by the chance to use her mathematic and engineering skills to make theory into reality. "I was the pencil pusher, doing a lot of research," she told an interviewer in 1994. "My state of the art tools were a slide rule and a Friden computer."

The tools of the trade may have been primitive, but Ross' sharp intellect quickly earned the respect of her male colleagues. Ross had a heavy-duty workload in the chilliest part of the Cold War and, like so many other aerospace engineers of her day, set to work turning a career in aviation to one in space technology.

Spaceflight made use of missile advances originally developed for military purposes – like the Agena-B, a spacecraft that shot the United States' secret CORONA spy satellite into orbit. Ross helped develop operational requirements for the spacecraft, which later became a vital part of the Apollo Program. Over the years, she helped write NASA's Planetary Flight Handbook, the agency's comprehensive guide to space travel, and worked on preliminary concepts for flights to Mars and Venus, laying the groundwork for missions that have not yet come to fruition.

Here is to Mary G. Ross, a pioneer who reached for the stars and whose legacy continues to inspire others to do the same.

Information from smithsonianmag.com and google.com/doodles

Happy Thanksgiving!

Faces of Stennis

Each month, Lagniappe will feature employees at Stennis Space Center whose work enables the center to fulfill its mission as the nation's largest rocket engine test center. This month's employee is highlighted on the following page.

Mary Horne

Watching space shuttle launches on television as a child in Grand Cane, Louisiana, Mary Horne never envisioned she could someday work for NASA. Indeed, Horne originally worked as a dental hygienist. Anxious for a career change, however, she returned to school to obtain an accounting degree. A resident of Slidell, Louisiana, by that time, Horne soon became aware of a NASA Pathways internship opportunity at Stennis. NASA Pathways Programs provides several avenues for students and recent graduates to experience federal employment and possibly find a career in those ranks. Horne became a Pathways intern in the then-NASA Public Affairs Office at Stennis in 2013. She had a chance to participate in various outreach activities and see firsthand how NASA engages and inspires young people in STEM (science, technology, engineering and mathematics) activities and studies. In 2014, Horne served as an intern in the Stennis Office of the Chief Financial Officer. The following year, she became an accountant in that office and now works as a reimbursable accountant, performing analysis and budgeting funds for Stennis tenants and commercial customers. To Horne, the best things about working at Stennis are the people and family atmosphere, the work-life balance the site provides and the workplace diversity. “I am proud to work for NASA, which is continually recognized as one of the best places to work in the federal government,” she says. “It is truly a blessing.” Horne is excited about ongoing engine and future stage testing for NASA’s new Space Launch System rocket, being built to carry astronauts deeper into space than ever, back to the Moon and eventually to Mars. When not at Stennis, she loves spending time with family.