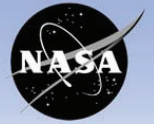


National Aeronautics and Space Administration



# LAGNIAPPE

John C. Stennis Space Center

Volume 17 Issue 9

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

September 2021



## ISS Provides View of Hurricane Ida

See page 7

Hurricane Ida is seen in this image taken aboard the International Space Station. The dangerous hurricane made landfall in Louisiana on Aug. 29, 2021, with maximum sustained winds of 150 miles per hour. The image was shared on European Space Agency astronaut and Expedition 65 crew member Thomas Pesquet's Twitter account as the storm churned in the Gulf of Mexico ahead of its landfall.



It has been a warm and humid summer. I have enjoyed lying on the bank of my favorite creek, with my feet in the murky water, while soaking up the morning sun. Afternoon thundershowers made for spectacular displays, similar to fireworks. Following sunsets, I love spending evenings under my favorite tree, listening to frog songs and watching fireflies dance. In quiet moments, while sipping muscadine wine, my mind wanders to ways that life has recently changed.

It has been quite a while since I have attended large gatherings with friends and family. So much catching up needs doing. I have taken special care to keep a social distance to prevent the spread of COVID-19. Skyping over the internet has given me a chance to interact with others comfortably. Lately, I think back to in-person interacting with everyday folk. It seems so long ago. However, seeing faces in small boxes on my computer screen is starting to feel normal.

The world around us is changing immensely. Speaking of changes, a hurricane named Ida recently hit close to home. This mighty storm brought all-new troubles. Before it arrived, I tried to decide whether to leave the area or stay. Choosing to stay was difficult, while many who lived south and west of me decided to head on out. I kept a keen eye on the storm path.

As the storm approached, store shelves that were already shy of resources because of the pandemic emptied quickly. As a result, I have not been able to find my favorite foods in any of my routine stores, and checkout lines are super long. Good thing there are plenty of bluegill in my secret pond, although their tiny bones often get stuck in my teeth.

Gasoline lines were also lengthy just before and immediately after Ida. Some service centers ran out of gas entirely or only allowed emergency vehicles to fuel. So for a time, gasoline was hard to find.

While power has been restored to many homes, a few still go without. After the storm, lots of good cooking took place on outdoor cookers and fryers to keep freezers full of food from going bad. I could smell the boudin, corn and crab bisque, yummy gumbo, spicy crawfish etouffee, and oh-so-good cornmeal battered catfish. ARK! Propane and charcoal grills still fill the air with delicious smells.

Anyway, when my mind gets overwhelmed, I try to remember good things. I stop and take a moment to think of what I love, and good food and fellowship are what make me happiest. Nana Gator and I are fortunate enough to be in good health. Our hearts go out to folks struggling with storm damage and COVID-19.



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# Stennis Test Team Overcomes SLS Core Stage Green Run Test Challenges

Now one may have verbalized it as such, but members of the Green Run test team for NASA's Space Launch System (SLS) core stage at Stennis Space Center near Bay St. Louis, Mississippi, had to feel they had just won a game of three-dimensional chess as they watched the flight unit depart the site April 22.

For more than one year, the Green Run test team had dealt with a number of complex challenges – including an intricate test campaign, a blended team of operators, a global pandemic, and a record-breaking storm season – in order to complete a series of critical tests to demonstrate the SLS stage was ready to fly. They followed up testing by completing various refurbishment tasks and conducting the intricate process of removing the stage from the B-2 Test Stand.

Now, with the Pegasus barge slipping away from the B-2 Test Stand dock in the early morning darkness, headed for Kennedy Space Center and the upcoming launch of the maiden Artemis program mission, it would have been no surprise to hear someone declare “checkmate.”

The SLS core stage arrived at Stennis in January 2020, to undergo a series of tests to demonstrate flightworthiness and help ensure launch success before the Artemis 1 mission. The so-called Green Run series was critical for NASA's plans to return humans, including the first woman and first person of color, to the Moon through the Artemis program and to prepare for missions to Mars. It would prove that SLS was ready to fly and lay the groundwork for launch of the maiden Artemis I mission.

For Stennis, the test campaign marked yet another chapter in the site's noted history. Stennis tested the Saturn V stages that powered the Apollo missions to the Moon in the late 1960s and early 1970s.

Testing the SLS core stage rivaled those earlier efforts. The concluding hot fire test of the stage's four RS-25 engines, generating a combined 1.6 million pounds of thrust, represented the most powerful test conducted at Stennis since the Apollo years.

Some test team members had been involved with testing space shuttle main engines at Stennis following the Apollo Program. However, working with the SLS core stage was an unprecedented opportunity. “It was truly a career milestone for many of us in the room,” Stennis Green Run Test Conductor Ryan McKibben said. “To have the opportunity to Green Run test NASA's next vehicle with deep space capabilities was awesome.”



The SLS Core stage departs Stennis Space Center aboard the Pegasus barge.

A Green Run test campaign is challenging by design. The testing provides a chance to identify – and mitigate – issues with new test articles. The core stage systems all had been tested individually. Now, it had to be shown they could operate together as needed, which meant turning on each sophisticated system, one by one.

“We had to integrate various components, including software and hardware, so that they can all work together for the first time,” explained Barry Robinson, B-2 Test Stand SLS Core Stage project manager at Stennis. “We knew they worked separately, but can they all operate together, in sequence and so forth? So, we did that. We did the checkouts electronically. ... We made some modifications that would potentially have halted a test or delay the wet dress. We caught a lot of those types of issues.”

However, the testing did not proceed exactly as planned. Stennis teams had just installed the core stage on the B-2 Test Stand and completed the initial test of the Green Run series when the COVID-19 virus established a foothold in the United States.

Work was temporarily halted in mid-March. The outbreak of COVID-19 caused “55 days of test operation inactivity,” Robinson said. In those early days of the pandemic, site and test complex leaders worked to design and implement safe-work protocols that would allow test team members to

return to on-site testing activities.

“The team had to adapt to pandemic requirements for PPE (personal protection equipment), which included face masking and social distancing,” Robinson said. “We had to bring the team back with awareness of their environment, hand sanitizing and so forth. ... It was an experience that was a little different atmosphere than what we're accustomed to.”

Among other actions, leaders installed additional air filters in high-use facilities. Facemasks were required, as was social distancing, when possible. The test team was divided into two 12-hour shifts, and procedures were established to ensure there was no contact between the shifts. “We used everything that was at our disposal, ...” Robinson said. “Our personnel were well-protected. We thought out as much as we could on ... (protocol) activities, considering that the test control center for us is a major activity area.”

Following the initial halt to operations, test team members returned



Engineers monitor SLS Core Stage Green Run test operations from the High Pressure Gas Facility control room.



The second Green Run hot fire test begins with a roar as a cloud of water vapor rushes out of the B-2 Test Stand flame deflector bucket.

See **TEST TEAM**, Page 4



## TEST TEAM

### Continued from Page 3

on site with COVID-19 protocol in place to resume Green Run operations. The safe-at-work protocol was critical, since test team personnel hailed from several states, including Mississippi, Florida, Louisiana, Texas, Alabama, Colorado, California and Washington.

“There was a potential of spreading or exposing these different individuals or team members, and that was the major concern,” Robinson said. “So, we did go above and beyond what was required to make sure that we had safe personnel.”

However, as the team resumed to work through the list of eight core stage tests, a second major obstacle arose from the Gulf of Mexico. A series of storm systems approached the Stennis area in 2020, forcing test crews to cease operations and prepare for adverse weather impacts several times.

“We had seven hurricanes and tropical storms that impacted us in one way or another,” Robinson said. “We had to shut down operations, secure (the site), batten down the hatches, if you will. ... We know this is a critical asset, and we monitored and protected it as such.”

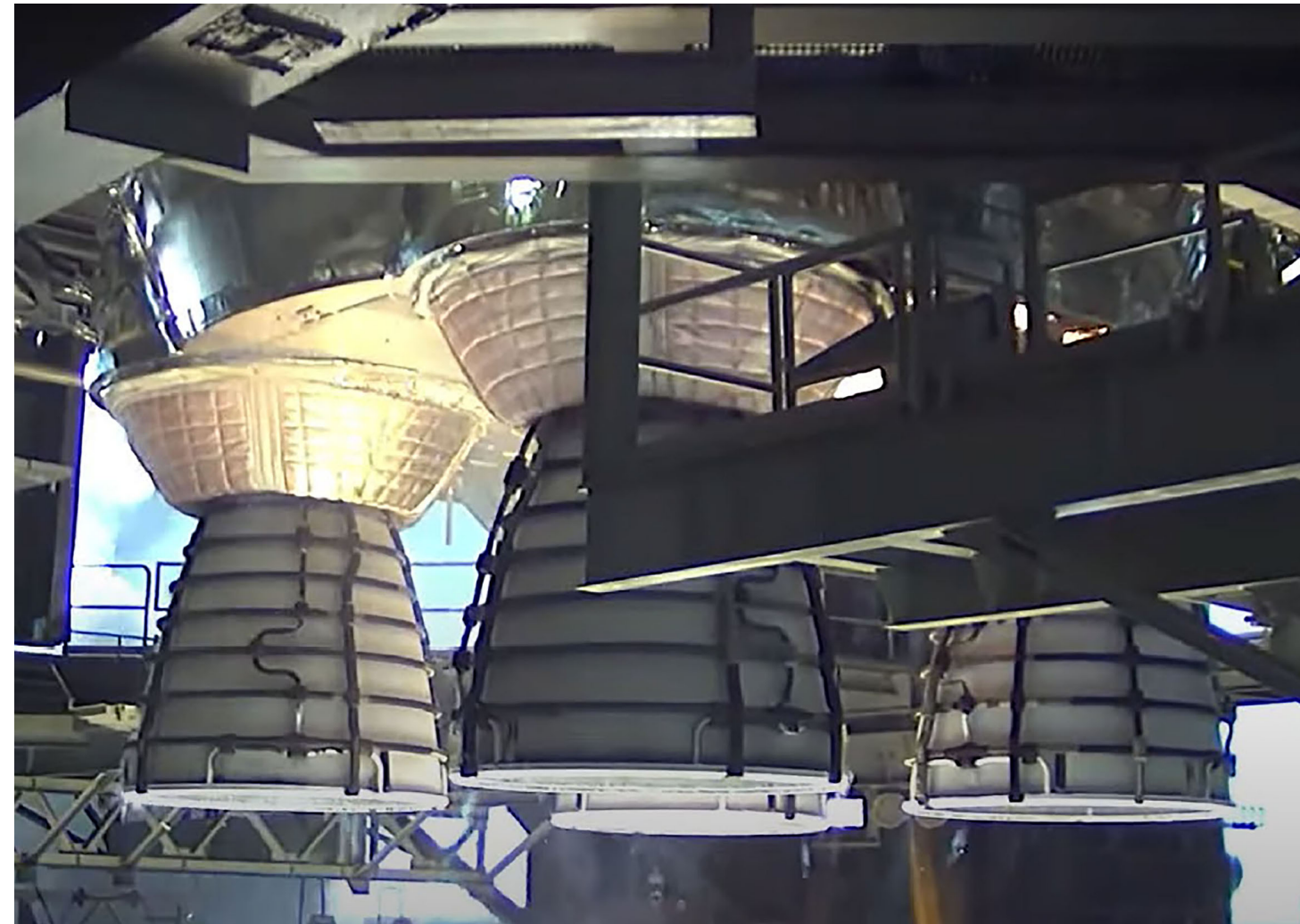
Despite such delays, by mid-September, the team had worked its way through the first five Green Run tests. All that remained was a simulated countdown, a wet dress rehearsal, and a concluding hot fire test of the stage just as during an actual launch.

Simulating the hot fire countdown “made sure that our team’s communication and procedures were synchronized before the vehicle is loaded with propellants since we had Boeing, Aerojet Rocketdyne, S3 (Syncom Space Services), and NASA all working together for the test,” McKibben explained. “A lot of it was confirmation of how long processes would take to ensure a proper timeline. Additionally, we practiced some red cards, which were simulated issues that could crop up during a countdown.”

Wet dress rehearsal involved the loading of propellants. After an unsuccessful first effort, the loading procedures were tweaked and ground systems adjusted. A second rehearsal with the new adjustments succeeded in fully loading the vehicle.

By early 2021, the stage was set for the concluding hot fire. On Jan. 16, all four RS-25 engines ignited as planned to begin a scheduled 500-second test. Unfortunately, the test experienced an automatic shutdown after about a minute, triggered by test parameters that were intentionally conservative to ensure the safety of the core stage during the test.

As engineers began review of test data, the test team prepared for a possible second hot fire attempt. “We went back, looked at the data and reviewed that information and continued on with preparations for potential hot fire number 2, ...” Robinson said. “We learned a few lessons ... and we had to make some



Four RS-25 engines fire in unison, generating a combined 1.6 million pounds of thrust during a second Green Run hot fire test of the SLS core stage on the historic B-2 Test Stand at Stennis Space Center on March 18.

adjustments, which is why we do the hot fire testing, so we can make the adjustments and finalize any procedures that we may have.”

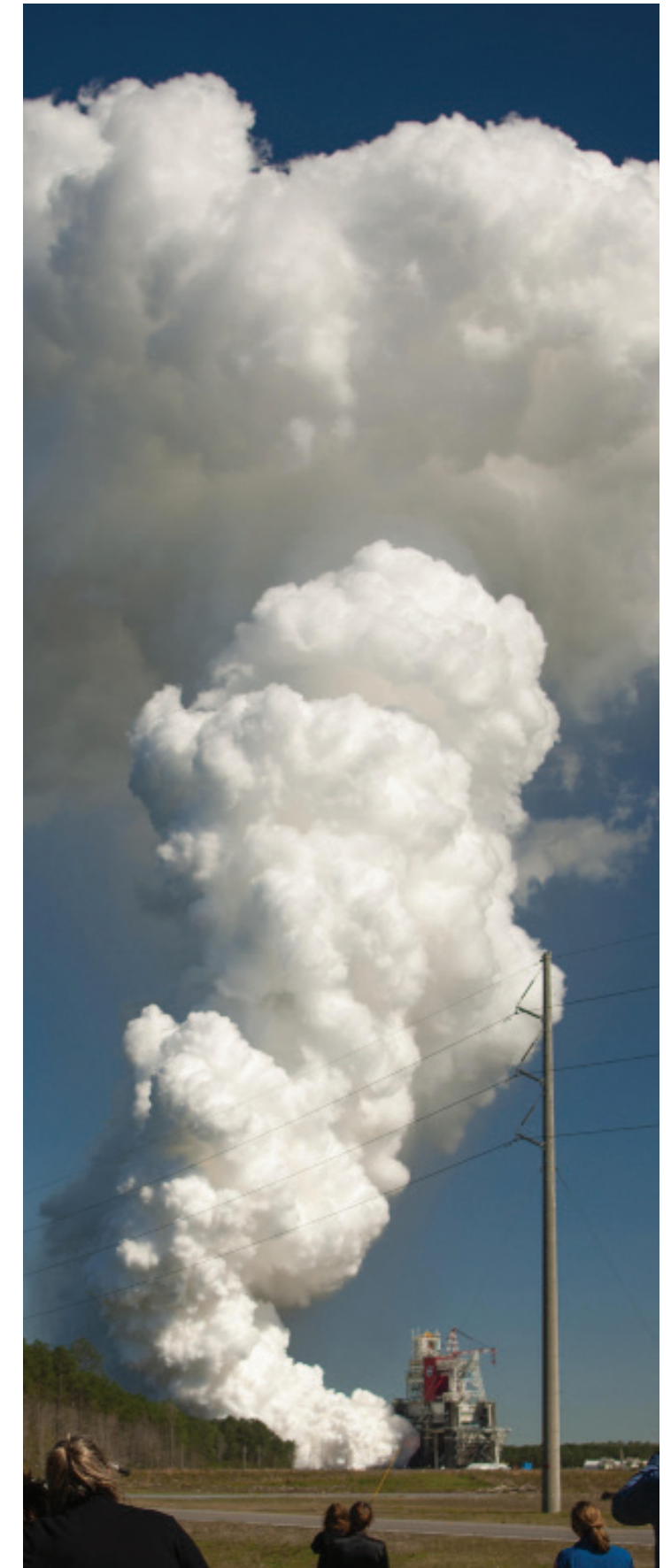
Although the first hot fire met or partially met many of the test objectives, NASA determined a second hot fire would be beneficial. For one thing, it would allow the team to obtain data on how the core stage and its engines would perform over a longer period of time, as they must do during a launch. Crews began preparing the stage for a Feb. 25 test, only to discover an issue with a liquid oxygen prevalue that was not opening correctly.

“The valve manufacturer worked along with Boeing and NASA to troubleshoot, replace the valves, and perform checkouts,” McKibben said. The repair effort set the stage for a mid-March hot fire.

The second hotfire attempt proceeded as planned, with all four engines firing for 500 seconds. Robinson and other test team members conducted and monitored the operation from the B-2 Test Stand Test Control Center, safely located a distance from the test structure.

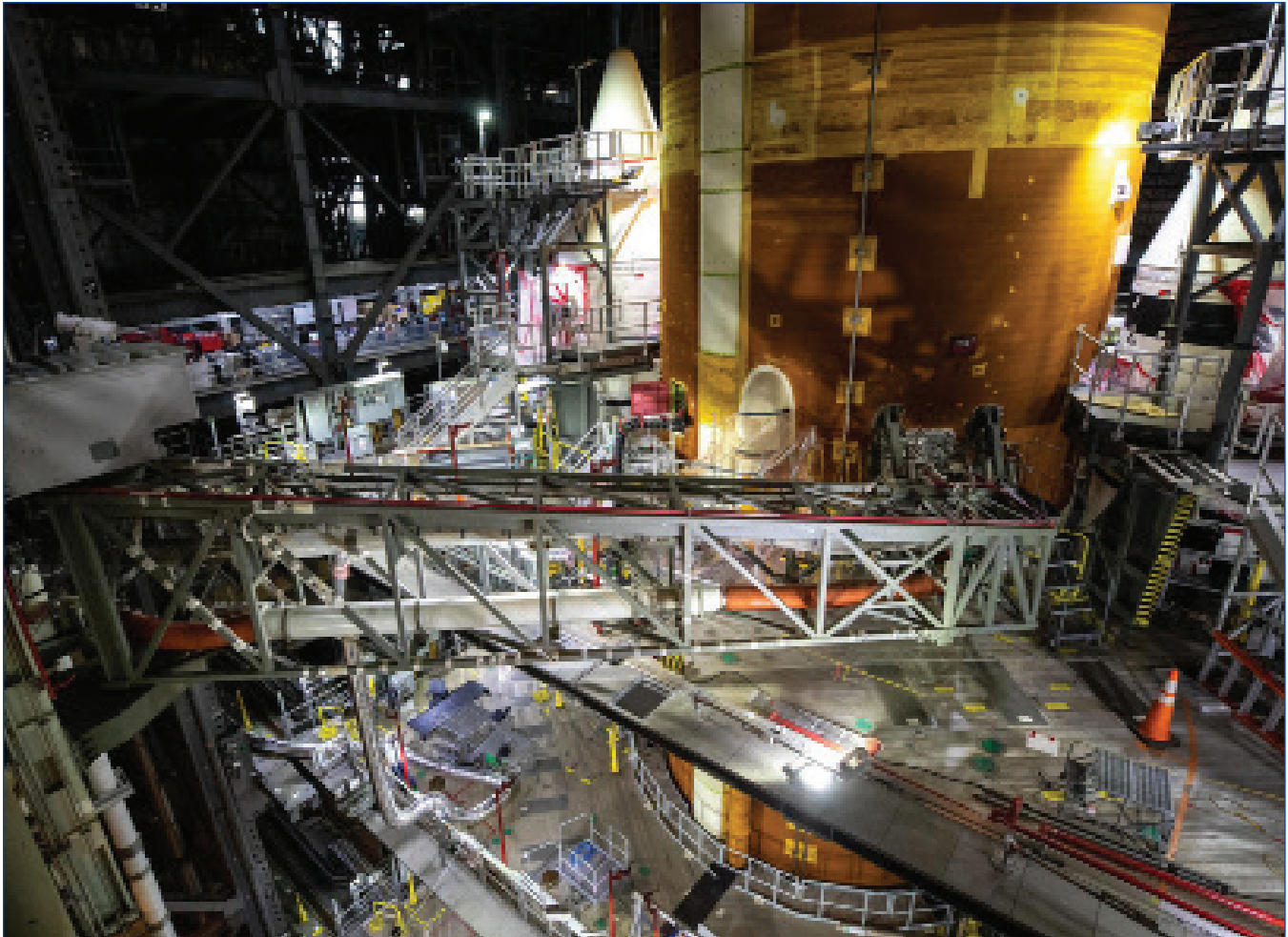
“That hot fire was one of the most exhilarating and most exciting activities that most of personnel at Stennis have experienced, ...” Robinson said. “It was phenomenal – the work that went into it, the activities that supported it, the people who supported it, the integration and collaboration of the teams. ... Everyone was gung ho on making sure that we can get this accomplished and get it accomplished safely. ... We knew we were making history. We knew the importance of this particular task. We knew the milestone was within reach, and all we had to do was implement and execute safely. ... So, kudos to the team, kudos to everyone that supported that effort.”

For McKibben and other test team members, there still remained work to do following hot fire. This included some refurbishment tasks and also removing the core stage from the B-2 Test Stand for transport to Kennedy. “The Stennis team really felt like the job was done once the vehicle was lifted off of the test stand and placed inside the Pegasus barge for transport to Kennedy Space Center,” McKibben explained. “We know that Stennis Space Center was just one stop on its way to a journey around the Moon.”



Social distanced guests view the initial SLS core stage hot fire on the B-2 Test Stand on January 16. The test experienced an automatic shutdown after about one minute of fire.





The core stage inter-tank umbilical – one of multiple connections on the mobile launcher that will provide power, communications, and pressurized gases to the rocket – is attached to the Space Launch System (SLS) core stage inside the Vehicle Assembly Building at NASA's Kennedy Space Center in Florida on Aug. 12, 2021.

## NASA in the News

### December Launch Planned for Webb

NASA plans to launch the James Webb Space Telescope into orbit Dec. 18, 2021, to serve as the premier deep space observatory for the next decade. The agency set the new target launch date in coordination with Ariane-space after the James Webb Space Telescope recently and successfully completed its rigorous testing regimen – a major turning point for the mission. The new date also follows Ariane-space successfully launching of an Ariane 5 rocket in late July and scheduling a launch that will precede Webb. The July launch was the first for an Ariane 5 since August 2020. Webb, an international program led by NASA with its partners ESA (European Space Agency) and the Canadian Space Agency, will launch on an Ariane 5 from Europe's Spaceport in French Guiana on the northeastern coast of South America. ESA is providing the Ariane 5 launch vehicle. For more on the James Webb Space Telescope Program click [here](#).

### NASA's Perseverance Cores Its First Rock

NASA's Perseverance rover today completed the collection of the first sample of Martian rock, a core from Jezero Crater slightly thicker than a pencil. Mission controllers at NASA's Jet Propulsion Laboratory (JPL) in Southern California received data that confirmed the historic milestone. The core is now enclosed in an airtight titanium sample tube, making it available for retrieval in the future. Through the Mars Sample Return campaign, NASA and ESA (European Space Agency) are planning a series of future missions to return the rover's sample tubes to Earth for closer study. These samples would be the first set of scientifically identified and selected materials returned to our planet from another. "NASA has a history of setting ambitious goals and then accomplishing them, reflecting our nation's commitment to discovery and innovation," said NASA Administrator Bill Nelson. For more information click [here](#).



# HBCU Graduate Returns Home to Fill NASA Safety and Mission Assurance Role at Stennis

Grant Tregre's earliest space memory is learning about the Apollo Program that sent humans to the Moon in the late 1960s and early 1970s. He could only imagine the engineering efforts it took to enable those missions.

Years later, Tregre has a much better understanding of the challenge, having worked as a NASA engineer on projects ranging from robotic spacecraft to human space systems. Tregre now serves as associate director of the NASA Safety and Mission Assurance Directorate at Stennis Space Center.

In that role, he most recently helped to lead an organization that was involved in testing the core stage of NASA's new Space Launch System (SLS) at Stennis Space Center. It marked the largest test project conducted at the south Mississippi site in more than 40 years and is one of the most significant projects in Tregre's aerospace career that spans 20-plus years.

A New Orleans native and resident, Tregre credited his experience at his hometown Xavier University of Louisiana, a Historically Black College and University (HBCU), with setting the stage for his career success. The U.S. celebrates the 170 HBCU schools located across the nation each year in September.

Tregre explained that HBCUs offer an invaluable opportunity for African American students to learn in an environment that is more in line with their cultural norms and sensitivities. In addition, his initial degree at Xavier helped prepare him to earn a second undergraduate degree in electrical engineering from Tulane University in New Orleans. It also laid the groundwork for his two graduate degrees – in systems engineering from Johns Hopkins University in Baltimore and in pastoral studies from Loyola University in New Orleans.

“My degree in physics prepared me for all the other degrees I subsequently pursued in ways that were foundational and sustaining,” Tregre said. “At Xavier, I learned the ‘why’ behind the ‘what,’ which enhanced the critical thinking and higher approaches necessary for understanding. ... I wouldn’t change (the experience) for anything.”

Tregre began his aerospace career as a systems engineer in the Applied Physics Laboratory at Johns Hopkins University.

He also worked as an aerospace consultant, program manager and business development manager for commercial companies before joining the NASA team as a software safety subject matter expert and chief safety and mission assurance officer at Goddard Space Flight Center in Greenbelt,

focused on safety, quality, and management systems. “We ensure that test facilities are constructed and operated with safety and quality as high priorities,” he said. “We also ensure that test program hazards are identified and mitigated, which reduces risk to personnel, facilities, and test articles.”

The sheer scope of the test campaign was challenging as well. SLS testing involved installing the 212-foot-tall core stage on the B-2 Test Stand at Stennis and performing a series of tests of its sophisticated systems. The series culminated with a hot fire of the stage's four RS-25 engines just as during an actual launch, generating a combined 1.6 million pounds of thrust.

“Having had previous experiences developing robotic spacecrafts, human space systems and ground control systems, rocket propulsion testing on the scale of SLS was something quite new to me,” Tregre acknowledged. “It offered many rewarding experiences.”

Tregre's entire Stennis experience has offered the same. “The people in the Safety and Mission Directorate have become like family,” Tregre said. “Working with them for a number of years has offered me an opportunity to learn and grow with the team. I really respect and value the people in our directorate. Also, ... knowing what we do keeps others out of harm's way ... is very fulfilling.”

Tregre also cited his experience with a work team that is the most diverse at Stennis in terms of such factors as race, gender, age, cultural backgrounds, education. The center itself is developing programs and policies to help advance diversity, equity, and inclusion as well, he added.

Tregre has received several achievement recognitions, both group and individual, for his work. He cited a pair of projects as his proudest of his career to date – his work on a successful robotic spacecraft mission to Pluto and his involvement in enabling a constellation of spacecrafts that provides atmospheric data to help scientists better understand such things as global warming, polar ice levels, and ozone conditions.

Looking ahead, Tregre is eager to see how NASA and Stennis grow in terms of embracing and enabling commercial space and test partnerships. “I'm excited about the new ways that Stennis will adapt,” he said.

In the meanwhile, he will continue in his current safety and mission assurance role and remain involved in ministry efforts with his hometown Archdiocese of New Orleans. Among other things, Tregre serves on the Archbishop's Committee for Racial Justice and leads the Social Justice Ministry at his local church.



Grant Tregre returned to his hometown New Orleans area about eight years ago to work as associate director of the NASA Safety and Mission Assurance Directorate at nearby Stennis Space Center.

Maryland, and Johnson Space Center in Houston.

A little more than eight years ago, an advertised position offered Tregre a chance to return to his home area. He had hoped for a way to return to New Orleans – and the nearby Stennis position proved a “really good fit for my skill sets and experiences,” Tregre said.

In his current role at Stennis, Tregre leads a diverse group of civil servants, subject matter experts and contractors, all

The work was critical during the Green run test campaign, which involved a team of people from across NASA. Tregre and his team helped ensure all of the blended team members worked safely, while also managing safety risks related to the test project.

In the midst of a global pandemic and largely telework environment, managing the safety team's work schedules proved a challenge at times, Tregre said. “However, our team was always willing to step up and do whatever was necessary to ensure a successful test,” he added.



# Hurricane Ida Makes Area Landfall Aug. 29, Impacting Stennis



The eye of Category 4 Hurricane Ida made landfall 90 miles south/southwest of Stennis Space Center at Port Fourchon, Louisiana, on Aug. 29.

Ida's landfall unleashed sustained winds of 150 mph on the Louisiana coast on the day of Hurricane Katrina's 16th anniversary. The time of landfall was around noon.

Stennis reported no on-site injuries related to Hurricane Ida. A ride-out crew of 51 personnel, including security and fire crews, remained on location to monitor site impacts during the storm. Site roads were opened and onsite power restored soon after the storm passed. Early damage assessments have identified some external and internal damage to site facilities.

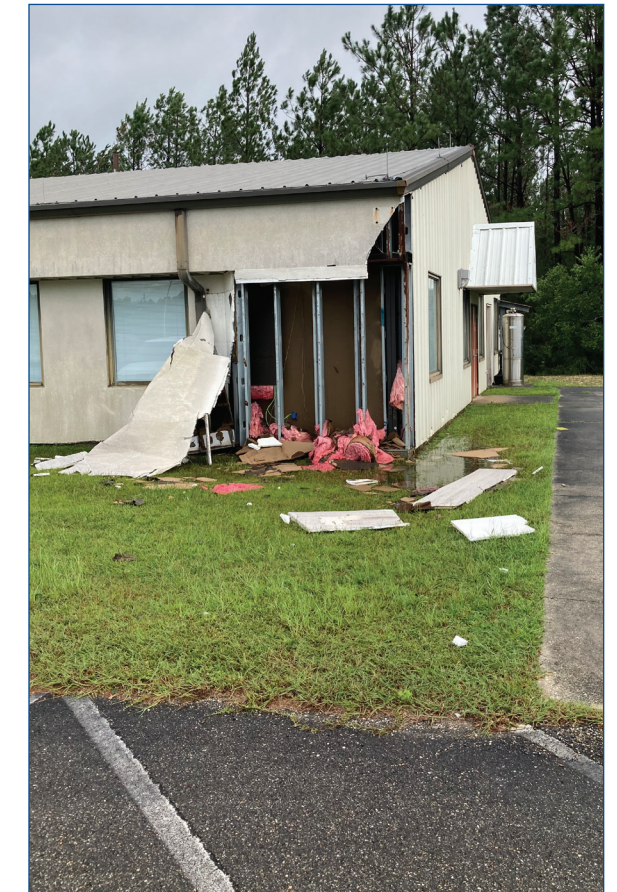
A team of employees continued detailed damage assessments of onsite facilities and infrastructure even as Stennis reopened for normal operations.

Stennis also supplied resources after the storm to assist recovery efforts at NASA's Michoud Assembly Facility. The Michoud facility is located in Louisiana, closer to the center path taken by Hurricane Ida.



A road intersection sign lies separated from its post, one of many area road markers affected by recent Hurricane Ida.

A small tree lies uprooted in front of the Roy S. Estess Building at Stennis Space Center in the wake of recent Hurricane Ida.



Stennis work crews examine a broken glass door following the arrival of Hurricane Ida in the area Aug. 29.

Stennis Space Center employees wait in line to buy fuel from the on-site Navy Exchange in the aftermath of Hurricane Ida.

EMCS personnel located in the Stennis Emergency Operations Center, monitor Stennis Building Systems on Aug 29 during the height of Hurricane Ida.

A Stennis Space Center facility bears evidence of the force of Hurricane Ida, which moved through the area Aug. 29.



# Stennis News

## Stennis Interns Create New App

Jason Carignan from Idaho City, Idaho, and Travis Baylor from Houston made the most of their 10-week NASA summer internship at Stennis Space Center this year.

The two students worked to create the “SSC Proposal App” for the Stennis Office of the Chief Technologist. The app is a user-friendly database for submitting and reviewing project proposals. It has embedded automated features, such as exporting and emailing data to personnel reviewing the information.

Stennis Chief Technologist Ramona Travis served jointly with Lauren Underwood as mentor for the two interns. Travis describes the achievement as an “impressive amount of work in that short period of time.” Carignan is scheduled to continue his work during a fall internship at Stennis. Both interns started with little to no prior experience in the software they used for development of the app.

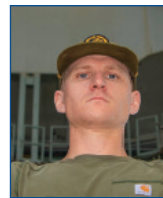
The SSC Proposal App is getting attention. “We’ve received feedback from both other offices at SSC, as well as other centers, who desire the ability to use the application for their own processes,” Travis said. “The vision now is to open the app up to the whole agency.”

The SSC Proposal App is currently in “development and test mode” and can only be viewed by selected individuals.

Travis described the new app as “one way of engaging our researchers and technology developers from across not only the center but across the agency.” The app is designed to work well with the agencywide Office 365 environment. A goal of the Office of the Chief Technologist is to better enable a culture of greater innovation in the agency through an increased diversity of collaboration efforts.

## NASA Honors Stennis Employees

To mark progress in NASA’s Artemis program that will return humans, including the first woman and person of color, to the Moon, the space agency’s Human Exploration and Operations (HEO) Mission Directorate has been recognizing HErOes performing necessary and critical work. Overall, 23 Stennis Space Center employees have been cited by the NASA directorate for their Artemis-related efforts.



John “Briou” Bourgeois, a mechanical operations engineer at Stennis, was recognized Aug. 27 for his instrumental work in preparing and activating the stand to support Green Run testing of NASA’s Space Launch System core stage. His

overall knowledge of the liquid oxygen process proved invaluable as the test team filled the vehicle’s propellant tank during wet dress rehearsals and hot fires of the Artemis I stage.

## Stennis Celebrates HBCU Graduates

Graduates of Historically Black Colleges and Universities (HBCUs) work in a variety of key areas at NASA’s Stennis Space Center, from aerospace engineering to procurement to legal counsel to diversity and equal opportunity to safety and mission assurance. Stennis joined a White House Initiative to observe this month’s annual HBCU emphasis. During a virtual program on Sept. 9, Katrina Emery, director of the NASA Office of Diversity and Equal Opportunity for Stennis and the NASA Shared Services Center, highlighted a few Stennis employees representative of many other HBCU alumni on site who are “working diligently to support the Artemis mission as we reach for new heights in space exploration.” A video featuring the Stennis employees can be viewed [here](#). For more information click [here](#).

## Hail & Farewell

### NASA welcomes the following:

Delenn Cooper

Law Clerk

Office of the General Counsel

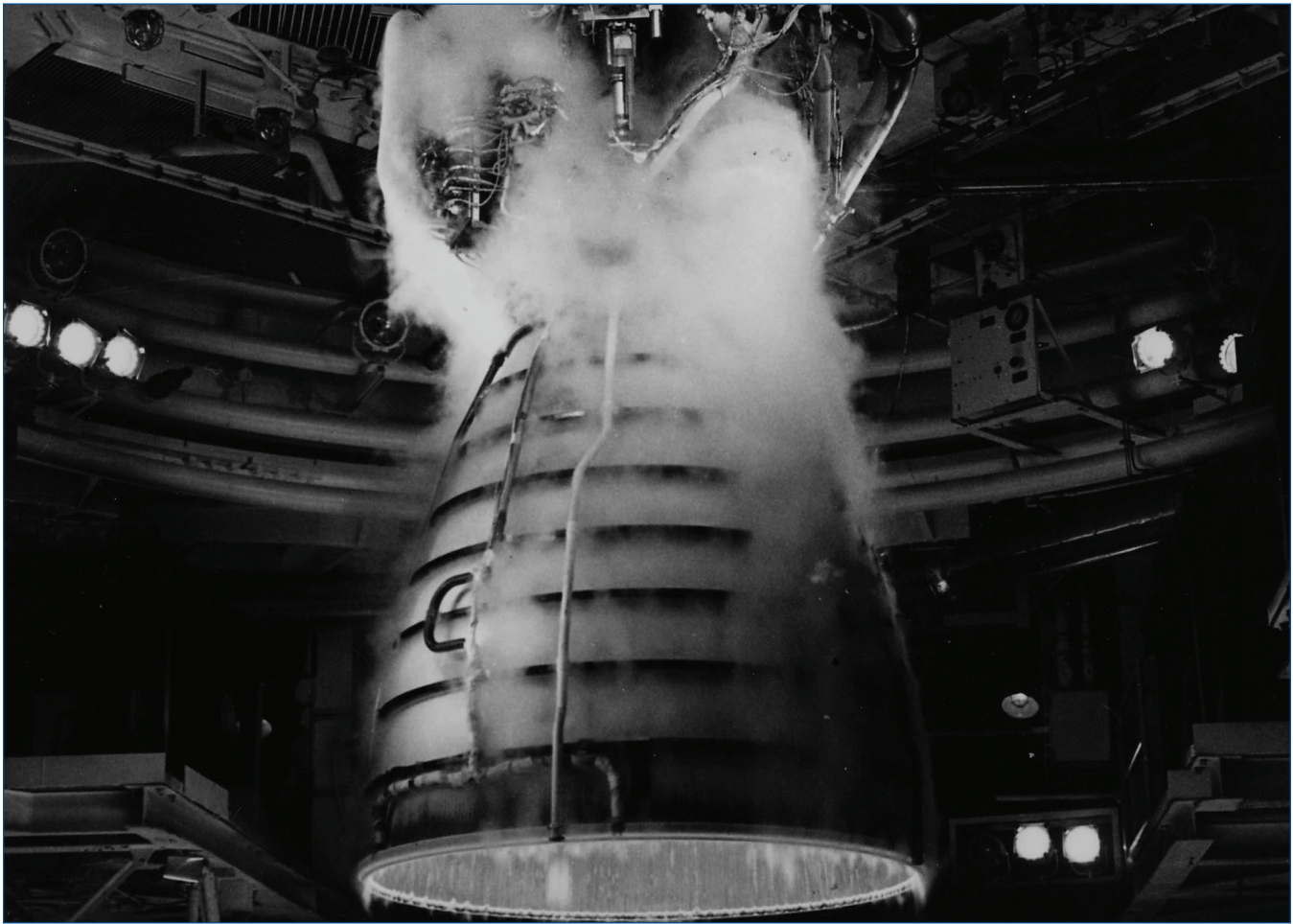
### NASA bids farewell to the following:

David Coote

AST, Technical Management

Engineering and Test Directorate





NASA conducts a space shuttle main engine test at Stennis Space Center following completion of the agency's Apollo Program.

## NASA Selects Mississippi Site for Shuttle Testing

*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. As the center celebrates its 60th anniversary later this fall, Lagniappe is looking back at the history of the site.*

The then-Mississippi Test Facility (MTF) made progress in becoming a multiagency space and environmental center. Jackson Balch wanted MTF to be a “scientific utopia,” a place where state and federal agencies work together on projects that would benefit not only each other but the scientific community. At the same time, a new program was forming, a reusable space shuttle.

Roy Estess, then working as an engineer at Stennis, was assigned to put together a presentation to convince NASA to select MTF to perform tests on the space shuttle main engines. In December 1970, he had the presentation ready for NASA Headquarters. He spoke of the low cost of facility modifications needed for the space shuttle main engine tests, the test experience already at the facility due to Apollo testing, and the local

communities' willingness to support the program. The board was very impressed with Estess and his knowledge of the program. One of the board members told him that his presentation was “the best we've had out of all three places,” seeking the testing assignment.

Unknown to Estess, a now-familiar name to the installation, Jerry Hlass was in the camp for MTF to have the space shuttle engine tests. He was working on his master's thesis at George Washington University. It was titled “Search for a Role for a Large Government Facility,” focusing on the Space Shuttle Program and the use of MTF.

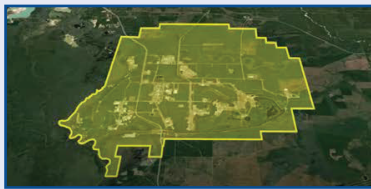
Hlass, who later led the Mississippi facility as director, had the ear of the Site Evaluation Board. When asked his opinion, he gave his case for MTF. On March 1, 1971, NASA selected the Mississippi Test Facility for the “sea-level testing of the rocket engines to power the space shuttle.” The roar of rockets engines, tested to take human explorers, orbiting laboratories, and high tech satellites into space, would be heard again throughout south Mississippi and Louisiana.



# Online Resources

**SuperTalk Mississippi  
Good Things Interview  
with Stennis Engineer  
Nyla Trumbach**

Click [here](#) to listen to Sept. 8 program



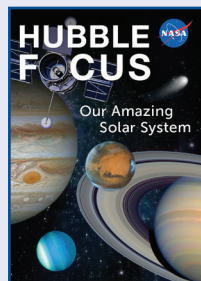
**Stennis Virtual Tour**

**Stennis Emergency Management**

**NASA Coronavirus Response**



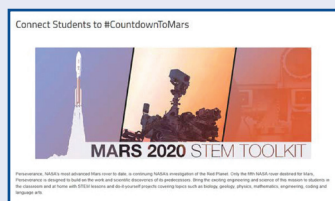
**Stennis Fact Sheets**



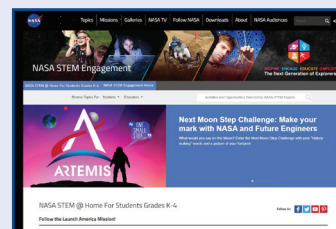
**NASA E-Book Downloads**



**Stennis Artemis Resources page**



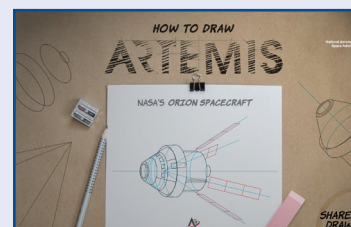
**MARS 2020 STEM Toolkit**



**NASA STEM@Home for Students**



**NASA at Home**



**How to Draw Artemis**