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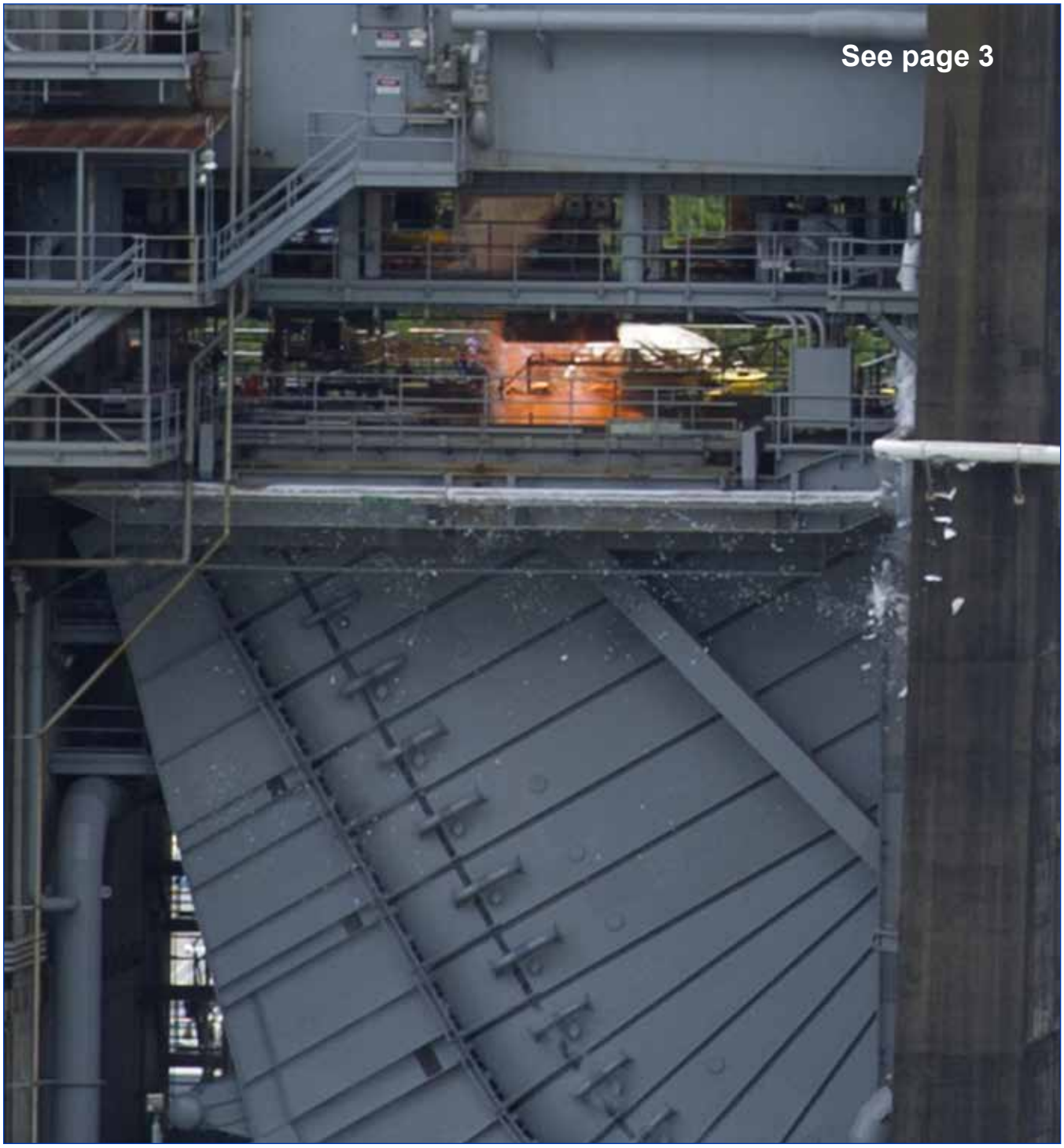
NASA marches on with RS-25 engine test



See page 3

Coming back to Stennis means reacquainting myself with a lot of things I never knew I missed so much. Of course, these would not include the Death Valley temperatures of July and August or the swarm clouds of evening gnats. Ark!

However, they would include a host of other things, such as the beauty of the land, the delight of the food and the more relaxed pace of life in general. Folks in this part of the world know how to enjoy themselves and make sure they take time away from work to do so.

One of the nicest things to find once again is the way folks here see one another as family. People greet each other, wave to each other across the parking lot, hold doors open for each other and stop to ask each other if they can help when you are standing alone and looking like help is exactly what you need at that moment.

Sure, sometimes we do it better than other times, and few of us do it well all of the time – just like in a real blood family. However, most of the time, when we do fail at it, we take a deep breath and figure out how to give it another try – just like in a real family again.

That may sound a tad sentimental, but I think about that idea every year about this time. It has something to do with the season and the history of this place.

August ushers in the most dreaded and anxious time of the year along this beautiful coast – the heart of the annual hurricane season. The threat of those slashing storms spans from June to November, but it is August and September that always seem to hold the most peril.

It was in August when Hurricane Camille smashed the Gulf Coast area in 1969, and August again when Hurricane Katrina swirled ashore in 2005. Anyone who experienced either of those – and some folk lived through both – has a story to tell. A lot of those stories are about sad losses.

At the same time, though, all of those stories offer a testimony – of how others showed up, stepped up and helped those of us who had been knocked down to get back up. That is what family does – and it is in doing just that for one another that we become family. There is something special about that, more special than can be written. But it is real, and it is here, and it is what makes Stennis such a great place to call home.

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FULFILLING NASA'S EXPLORATION MISSION

NASA conducts 650-second test of RS-25 engine

NASA engineers conducted a successful developmental test of RS-25 rocket engine No. 0528 on July 29, 2016, to collect critical performance data for the most powerful rocket in the world – the Space Launch System (SLS). The engine roared to life for a full 650-second test on the A-1 Test Stand at NASA's Stennis Space Center, near Bay St. Louis, Mississippi, marking another step forward in development of the SLS, which will launch humans deeper into space than ever before, including on the journey to Mars. Four RS-25 engines, joined with a pair of solid rocket boosters, will power the SLS core stage at launch. The RS-25 engines used on the first four SLS flights are former space shuttle main engines, modified to operate at a higher performance level and with a new engine controller, which allows communication between the vehicle and engine. NASA conducted a series of developmental tests on the engine last year before testing a flight engine that will be used on the second SLS test flight, known as Exploration Mission-2 (EM-2). EM-2 will be the first crewed flight of NASA's Orion spacecraft, launching on the SLS. A second series of developmental tests began July 14. The test was conducted by a team of NASA, Aerojet Rocketdyne and Syncom Space Services engineers and operators. Aerojet Rocketdyne is the prime contractor for the RS-25 engines. Syncom Space Services is the prime contractor for Stennis facilities and operations. The July 29 test and four future scheduled firings in the current series are focused on the new engine controller and higher operating parameters. While RS-25 engines are among the most tested – and proven – in the world, they have been modernized for SLS. The developmental tests are designed to show they will meet the new parameters of the rocket. During the firings, the test team will put the engine through a variety of adaptations, starting it at different temperatures and pressures, for instance. The team also will watch closely to ensure the new engine controller functions as needed. In addition to the existing RS-25 engines, NASA has contracted with Aerojet Rocketdyne to build additional engines for use on SLS missions. All flight testing for SLS take place at Stennis, as will the actual core stage testing for the first integrated mission of SLS and NASA's Orion spacecraft, Exploration Mission-1. The next scheduled RS-25 developmental test at Stennis is set for Aug. 18.

FULFILLING NASA'S EXPLORATION MISSION

Stennis engineer leads in development of revolutionary camera for viewing test firings

While thousands turned out to watch NASA's Space Launch System (SLS) recently complete a full-scale test of its booster, few were aware of the other major test occurring simultaneously. NASA's High Dynamic Range Stereo X (HiDyRS-X) project, a revolutionary high-speed, high dynamic range camera, filmed the test, recording propulsion video data in never before seen detail.

The HiDyRS-X project originated from a problem that exists when trying to film rocket motor tests. Rocket motor plumes, in addition to being extremely loud, are also extremely bright, making them difficult to record without drastically cutting down the exposure settings on the camera. Doing so, however, darkens the rest of the image, obscuring other important components on the motor.

Traditionally, video cameras record using one exposure at a time, but HiDyRS-X records multiple, slow motion video exposures at once, combining them into a high dynamic range video that perfectly exposes all areas of the video image.

The HiDyRS-X project began as part of NASA Space Technology Mission Directorate's Early Career Initiative (ECI), designed to give young engineers the opportunity to lead projects and develop hardware alongside leading innovators in industry. Howard Conyers, a structural dynamist at NASA's Stennis Space Center, was awarded as an ECI grant in 2015. After initial proof of concept and a preliminary design review, the HiDyRS-X project was placed within NASA's Game Changing Development program to complete its first prototype. Created in partnership with Innovative Imaging and Research Corporation, the project was tested on small rocket nozzle plumes at Stennis.

The massive booster test served as a rare opportunity to test the HiDyRS-X hardware in a full-scale environment. The Qualification Motor 2, or QM-2, test was held at Orbital ATK's test facility in Promontory, Utah, and was the second and final booster test before SLS's first test flight in late 2018. SLS will be the most powerful rocket in the world, and will take our astronauts farther into deep space than ever before.

In moving from the smaller-scale tests to QM-2, Conyers says the most difficult challenges were seen in compensating for brightness of the booster plume, which is several orders of magnitude brighter than what they had tested before. They were also faced with transporting and assembling the equipment at the QM-2 test site located in the desert of Utah — a remote environment requiring the HiDyRS-X team to be self-sufficient, as well as deliberate and methodical in their preparation and set up. Unlike the smaller scale rocket engine tests at Stennis, boosters are extremely powerful and, once ignited, cannot be turned off or restarted. The HiDyRS-X team had one shot at getting good footage.

In the days prior to the test of QM-2, the HiDyRS-X team double- and triple-checked their connections and start procedures to allow the camera to collect as much footage as possible. Leading up to the day of the test, the team performed several more dry runs using the camera to ensure that everything was working perfectly, Conyers says.

With thousands of people assembled over a mile away to watch the fiery plume of the solid rocket booster, Conyers and his team monitored the camera from a safe distance, ready to act in case something went wrong. As the countdown clock ticked down to zero, the booster ignited and the HiDyRS-X team watched the camera's automatic timer fail to go off. Luckily, they were quick to hit the manual override, allowing the camera to turn on just moments after ignition.

Once engaged, the camera recorded several seconds of the two-minute test before the power source was suddenly disconnected. In an unanticipated series of events, the sheer power of the booster shook the ground enough for the power cable to be removed from the power box.

Having had two unexpected camera outages during the test, Conyers described being disappointed.

"I was bummed," Conyers said. "Especially because we did not experience any failures during the dry runs."

When the team reviewed the camera footage, they saw a level of detail on par with the other successful HiDyRS-X tests. The team saw several elements never before caught on film in an engine test, including some of the booster's components being shot through the plume.

"I was amazed to see the mirror bracket tumbling, a few birds flying by, and the vortices shedding in the plume," Conyers said. The team was able to gather interesting data from the slow motion footage, and Conyers also discovered something else by speeding up the playback.

"I was able to clearly see the exhaust plume, nozzle and the nozzle fabric go through its gimbaling patterns, which are typically unobservable in slow motion or normal playback rates."

Although initially disappointed with the test anomalies, Conyers and the HiDyRS-X team came out of QM-2 with proof that their technology worked and that it had the ability to provide unprecedented views of high exposure rocket motor tests. The test experience also left Conyers with two major lessons learned for the future. First, to start the camera a full ten seconds before ignition to allow the ground team time to start the camera manually in the event of a timer failure. The second lesson, Conyers added, is to understand just how powerful the engine tests are to properly protect and secure the electronics hardware from damage or disconnection.

The top image shows the exhaust of a Space Launch System Qualification Motor 2 test (QM-2), without using HiDyRS-X camera. The second image shows the same exhaust, using the HiDyRS-X camera.

"Failure during testing is the opportunity to get smarter," Conyers said. "Without failure, technology and innovation is not possible."

HiDyRS-X will continue testing at Stennis, while a second prototype of the camera is built with more advanced high dynamic range capabilities, using data gathered from the past few years of experimentation. The second HiDyRS-X prototype will be made with an improved manufacturing process to enhance the alignment capabilities of multiple exposure settings – a challenge overcome in the first prototype.

HiDyRS-X not only stands as a game changing technology expected to revolutionize propulsion video analysis, but it also stands as a testament to ECI and the power of determined young engineers within NASA. Seasoned NASA employees and recent hires alike have the capacity to significantly contribute to NASA's research and development goals. ECI's emphasis on pairing young engineers with innovative industry partners enables technological leaps that would otherwise be impossible.

"The `Stennis HiDyRS-X ECI project continues to be an exciting and challenging public-private collaboration of which we are proud to be a part," said Mary Pagnutti, president of the Innovative Imaging and Research Corporation. "It's giving us the chance to mentor early career technologists and advance the way we image and assess rocket motor firings."

FULFILLING NASA'S EXPLORATION MISSION

NASA's Curiosity Mars rover began close-up investigation of a target called "Marimba," on lower Mount Sharp, during the week preceding the fourth anniversary of the mission's dramatic sky-crane landing on the planet. The Navigation Camera (Navcam) on Curiosity's mast took this image on Aug. 2, 2016, during the 1,418th Martian day, or sol, since Curiosity landed inside Gale Crater on Aug. 6, 2012. In this scene, the rover has extended its arm over a patch of bedrock selected as the target for rover's next drilling operation. The drilling collects rock powder for onboard laboratory analysis. More information about Curiosity is online at http://www.nasa.gov/msl.

NASA in the News

NASA to study green technology

NASA has selected five green technology concepts that have the potential to transform the aviation industry in the next decade by reducing aircraft fuel use and emissions. The concepts were selected under NASA's Transformative Aeronautics Concepts Program for a two-year study. The topics, including three specifically targeted at electrically-propelled aircraft, are: alternative fuel cells; using 3-D printing to increase electric motor output; the use of lithium-air batteries for energy storage; new mechanisms for changing the shape of an aircraft wing in flight; and the use of a lightweight material called aerogel in the design and development of aircraft antenna. These five concepts address NASA's green aviation initiatives to cut fuel use by half, lower harmful emissions by 75 percent and significantly reduce aircraft noise. Though there can be no guarantee the studies will result in deployable technologies, researchers are confident much critical data and information will be gleaned from the studies. For more information about the selections, visit online at: http://go.nasa.gov/2aWongE. For more on NASA's aeronautics research, visit: http://aeronautics.nasa.gov.

NASA awards suborbital contract

In September, NASA will bring its online audience inside the world of human spaceflight as never before, from its Johnson Space Center in Houston. New and unique stories from the International Space Station (ISS), Orion spacecraft program and other spaceflight projects will take viewers behind the scenes of the groundbreaking science taking place off the Earth and the technology NASA is developing for its journey to Mars. The programming will be available on various NASA social media accounts, including YouTube. NASA Television's Space Station Live program will be discontinued Sept. 1. However, NASA TV will continue to air live coverage of dynamic space station operations and weekly highlights of life onboard station in the short-format Space to Ground program, available on YouTube and via podcast. Daily updates on space station research and operations will continue to be posted to the ISS blog. Digital audiences may receive weekly video highlights by subscribing to Johnson's news release email list. Email jsc-news-request@lists.nasa.gov with "subscribe" in the subject line.

Access all NASA news releases online at: http://go.usa.gov/3f3KW.

Stennis hosts Take Our Children to Work Day

Some 200 children of employees at Stennis Space Center resident agencies and organizations visited the site July 21 to participate in annual Take Our Children to Work Day activities. Participants enjoyed various presentations, such as a demonstration of cryogenics and a discussion of online security. They also participated in several hands-on activities, including constructing model test stands as well as creating and flying paper airplanes as a way of better understanding aerodynamic principles. Participating children also had an opportunity to visit site facilities and learn about various work performed at the NASA rocket engine test center. Event sponsors included resident agencies Aerojet Rocketdyne, ISS Action, Lockheed Martin and Syncom Space Services.

1971: Stennis named to test shuttle engines

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.

On March 1, 1971, NASA sent out a press release naming the Mississippi Test Facility as the site to test a new, reusable, high-performance engine to carry something called the space shuttle into orbit. The space shuttle, the release explained, is a "reusable vehicle to carry people and payload between Earth and low Earth orbit."

With this press release, the era of the space shuttle began. It would last 30 years, from 1981 – 2011, and Stennis Space Center, or as it was known back then, Mississippi Test Facility, was an integral part of the Space Shuttle Program.

The very first ignition of a space shuttle main engine (SSME) happened in 1975, four years after that press release. The firing was no more than a one-second burst, but it began the journey for the facility to develop a premier rocket test program.

The three engines that would carry space shuttle Columbia into orbit were engine Nos. 2005, 2006 and 2007. All three were tested at Stennis Space Center. Space shuttle Columbia launched on April 12, 1981, from Kennedy Space Center in Florida with those three engines blasting it off. It was in low-Earth orbit for a little over two days, orbiting the Earth 37 times. It landed on April 14, 1981 at Edwards Air Force Base in California.

In that cluster of engines tested for the first flight was a fourth engine, engine No. 2004. It was never meant to leave Earth; instead, it was a research-and-development engine for any changes that may have needed to be made to the three main engines. It was fired numerous times for a total of 13,000 seconds, which is equivalent to 25 launches of the shuttle.

On September 2, 1982, NASA issued a press release stating that a successful 1.5-second run of the first of the three engines that would launch space shuttle Challenger, engine No. 2012, had occurred. The other Challenger engines, Nos. 2011, 2015 and 2016 (a spare engine) followed after that successful test. Challenger's maiden voyage was on April 4, 1983.

Discovery's first engines, Nos. 2019, 2022 and 2028, were tested and proven flightworthy at Stennis Space Center, as well as those for Atlantis, which would become a backup craft for the remaining shuttle missions, and Endeavor, the fifth and final space shuttle in the program.

The last planned space shuttle engine test was held on July 29, 2009, almost two years to the day before the final touchdown of Atlantis and the end of the space shuttle program on July 21, 2011. With its completion, Stennis Space Center had tested and proven flightworthy not only every single engine used to power the crewed Apollo missions but those that launched all 135 space shuttle missions.

The center now is moving into the future by testing engines to carry men and woman to Mars and possibly beyond. And it all started with no more than a "sneeze" of an engine test back in 1975.

Office of Diversity and Equal Opportunity

Technology looks to enable users with disabilities

Parts of this article were taken from NPR Mississippi Public Broadcasting

There are some amazing things happening in the world of technology for individuals with disabilities. For most of us, eye-tracking technology sounds interesting. But it's not life changing. Eye tracking allows users to move a cursor around a computer or mobile device simply by moving your eyes and head.

Oded Ben Dov initially used eye tracking technology to develop a video game that he showed off on Israeli TV. The next day, he says, he received a phone call from a man who told him he could not move his hands or legs, and wanted to know if he could make him a smartphone that he could use. That is when Oded realized that his eye tracking technology could change lives. It was an opportunity to put his skills and knowledge to good use.

He went on to found Sesame Enable, a company that sells smartphones for people who cannot use their hands. Sesame Enable, which is based in Israel, was in Mountain View, California, for the annual conference for developers who make products using Google technologies. Taking existing technology and making it useful for a disabled person often requires new designs. Tomglobal.org, a nonprofit organization, brings together technologists who want to solve problems for people with disabilities.

One of the products generated at a tomglobal.org hackathon was on display at the conference. It is a special sensor device for people in wheelchairs who face the problem of pressure sores. It was developed by Paul Herzlich and some of his colleagues. Pressure sores happen when someone is sitting in the same position for too long. It decreases blood circulation to that area and eventually leads to a breakdown of the skin in that area. The sensor device he developed fits easily on a wheelchair seat and it is connected to a smartphone app via Bluetooth.

If the app notices that the pressure has not changed in a certain period of time, it will notify the user as a reminder to move. It is raising that awareness for the user because they are often paying attention to other things throughout our day and do not remember to move. Herzlich and his colleagues hope to bring the product to market and develop a version for hospitals where many patients face health problems related to bedsores.

In the tech world, Apple led the way by making its smartphones accessible. Things like magnifiers and screen readers were built into the product. Yahoo has an accessibility team, which works and trains engineers throughout the company to design all Yahoo products to be accessible. It has been found that when you give designers and engineers an opportunity to do that, they have such a positive experience they want to keep doing it.

A lot of tech companies realize that the market for products that have a variety of accessibility features is large. The World Health Organization estimates that more than 1 billion, out of the about 7 billion people in the world, experience a disability. But, as much as disabled people often benefit from technology developed for regular consumers, it also works the other way around. It was discovered that when Yahoo focused on users with disabilities, their products became better for everybody. For example, Yahoo has been working on closed captioning for live events streamed on the Web. Of course, more people than those with hearing problems use closed captioning. Try watching a TV screen in a loud airport or sports bars.

While it is great news for disabled people that tech companies are increasing their interest in making products for them, there is still a long way to go. It is still rare for companies to have an accessibility team, and that is especially true with startups. Dedicated space at the Google I/O annual developer conference appears to show a real commitment on the part of one of the world's largest and most influential tech companies to using technology to make life better for people with disabilities. Most people are likely to discover that accessible technology will become more important to them as they age.

Hail & Farewell

NASA bids farewell to the following:

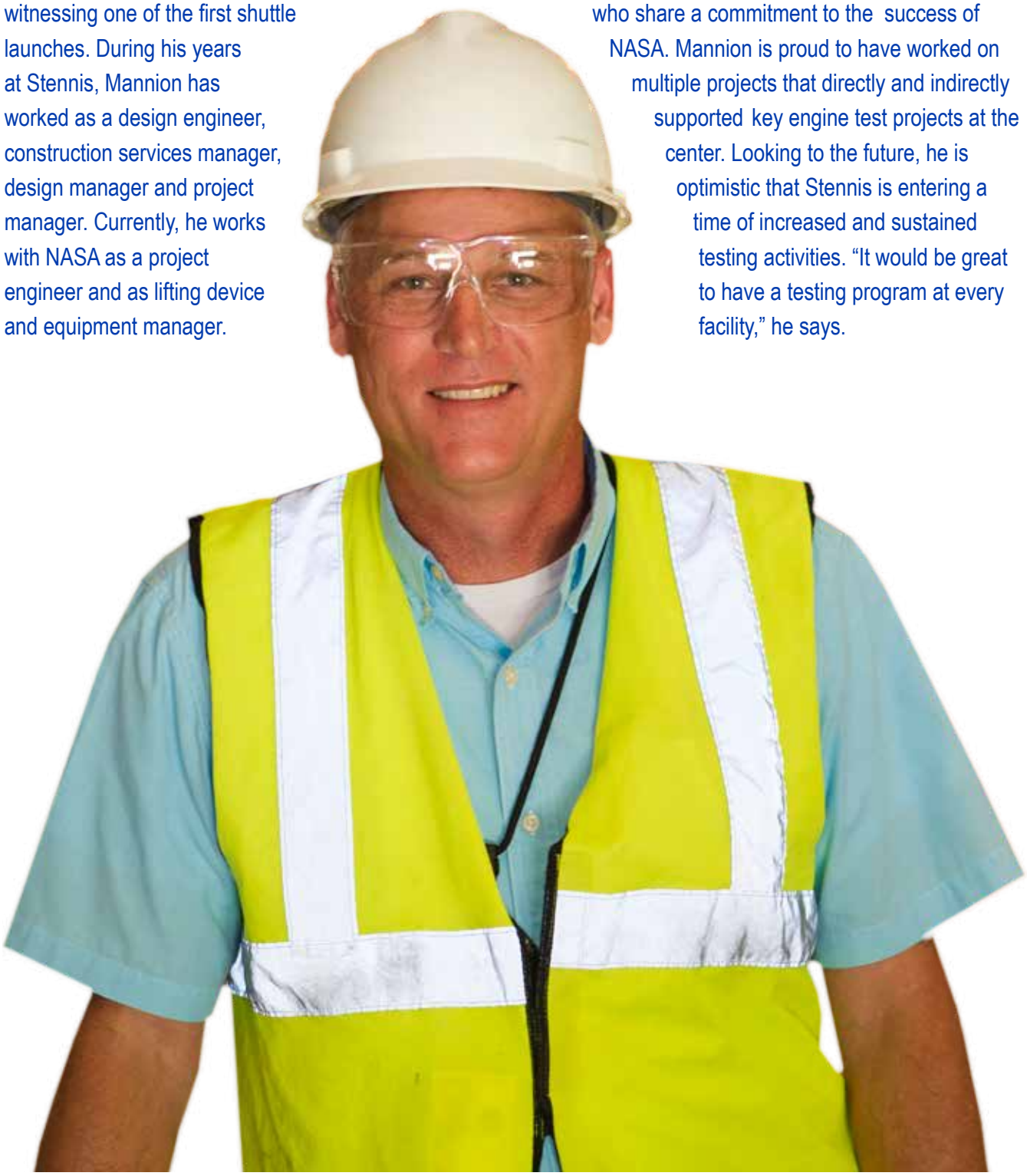
Firesola Akinbuli	Student Trainee (Engineering)	Engineering and Test Directorate
Asean Davis	Student Trainee (Engineering)	Engineering and Test Directorate
Brian Douglass	Student Trainee (Engineering)	Engineering and Test Directorate
Justin Urban	Student Trainee (Engineering)	Engineering and Test Directorate

Faces of Stennis

Each month, Lagniappe will feature employees at Stennis Space Center whose work enables the center to fulfillits mission as the nation's largest rocket engine test center. This month's employees are highlighted on the following two pages.

Aaron 'Todd' Mannion

Todd Mannion grew up in Bay St. Louis and resides in Waveland now. He has worked 20 years at Stennis Space Center, which is a natural career choice to follow in his father's footsteps. His father worked for Lockheed Martin on the space shuttle external tank, and one of Mannion's earliest space-related memory is witnessing one of the first shuttle launches. During his years at Stennis, Mannion has worked as a design engineer, construction services manager, design manager and project manager. Currently, he works with NASA as a project engineer and as lifting device and equipment manager.



In that role, he is responsible for supporting multiple design and construction projects at the high-pressure gas facility, the high-pressure industrial water facility, the A-2 Test Stand and the E Test Complex. He believes the best thing about Stennis is the chance to work with a diverse, dedicated group of people who share a commitment to the success of NASA. Mannion is proud to have worked on multiple projects that directly and indirectly supported key engine test projects at the center. Looking to the future, he is optimistic that Stennis is entering a time of increased and sustained testing activities. "It would be great to have a testing program at every facility," he says.

Christine Grapusa

For Christine Grapusa, there is no place like home. Born in Bay St. Louis, Mississippi, she moved as a teenager to Tennessee, returning to the Gulf Coast after college to live in Waveland. Grapusa knew Stennis Space Center would be the best place to begin her career, and that is the direction she pursued. She began working as a receptionist at the center in 1987 but quickly moved into the accounting world, providing contractor support to the National Data Buoy Center and NASA.

She joined the NASA team in 2006, serving in several roles within the Office of the Chief Financial Officer. Currently, she works as the office's lead management and program analyst, directing a team that provides analysis and budget support for all all Stennis test activities. She also serves as a resource analyst for RS-25 engine testing and as business manager for the Space Launch System work on the B-2 Test Stand. Grapusa enjoys the family atmosphere at the site – and sees Stennis as the best place to work in the federal government. A self-described space junkie, she remembers visiting the center with her elementary school class. "I have always loved what NASA stood for and am excited about the possibility of us going to Mars," she says. "There is nothing more exciting than going to watch a rocket engine test, knowing that I had a part in making that happen."

Grapusa says she looks forward to the challenges that lie ahead in NASA's journey to Mars and in sharing them with her two sons. "I get excited knowing I am helping to make a better future for them."