



KENNEDY SPACE CENTER'S
SPACEPORT
magazine

Mobile Launcher on Test Trek for Exploration Mission-1



KENNEDY SPACE CENTER'S SPACEPORT MAGAZINE CONTENTS

- 5.....Mobile launcher moves toward Exploration Mission-1
- 10.....NASA's Parker Solar Probe begins journey to the Sun
- 12.....NASA Administrator meets Kennedy employees
- 16.....Flight tests to prove commercial systems fit for human spaceflight
- 20.....NASA, SpaceX agree on plans for crew launch day operations
- 24.....Heat shield install brings Orion closer to space
- 26.....Successful test proves important step toward safeguarding astronauts
- 29.....Orion pressure vessel for Exploration Mission-2 arrives
- 30..... NASA research supported by new program at Kennedy Space Center Visitor Complex
- 32.....First-time event sparks wide range of innovation
- 36.....First Nations launch winners briefed on aerospace careers



NASA's mobile launcher (ML) atop crawler-transporter 2 is at the top of Launch Pad 39B on Aug. 31, 2018, at the agency's Kennedy Space Center in Florida. The ML underwent a fit check, followed by several days of systems testing. The 380-foot-tall mobile launcher is equipped with the crew access arm and several umbilicals that will provide power, environmental control, pneumatics, communication and electrical connections to NASA's Space Launch System (SLS) and Orion spacecraft. Exploration Ground Systems is preparing the ground systems necessary to launch SLS and Orion on Exploration Mission-1, missions to the Moon and on to Mars. Photo credit: NASA/Jamie Peer

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KENNEDY SPACE CENTER

ROBERT STUTE

**Launch Service Task Order Manager
Launch Services Program Business Office**

I've worked here full time since 1991, although I began as a co-op student from The Ohio State University in 1989. For the past two years, I've worked as a Contract Officer's Representative (COR) and Program Integration Manager in the Launch Services Program (LSP). I was recently promoted to the role of Launch Service Task Order (LSTO) manager.

As a COR, I help to manage the execution of LSP's LSTOs from a contract perspective. That means I work with the technical and management team to ensure our launch service contractors meet their contract requirements acceptably and in a timely manner. I have been the COR for our contract with SpaceX as well as our Parker Solar Probe mission, which recently launched.

I started out in Design Engineering and worked on project teams in communications systems. Working in the NASA team environment was awesome. I eventually wanted to help lead a team, so I moved into project management, with responsibility for overall leadership and progress of the team. That led me into budget management and contract management.

This is a very exciting time in the space business. I'm looking forward to the new generation of launch service companies and working with them to help us extend our reach into the solar system. Having more people and companies offering their skills to NASA is a great thing for our agency and our country.

TEST DRIVE

Mobile launcher moves toward Exploration Mission-1

BY LINDA HERRIDGE

When you buy a new car, you take it out for a test drive first. Likewise, as NASA prepares for launch of the Space Launch System rocket and Orion spacecraft, the **mobile launcher** that will be used is going for a test drive to **Launch Pad 39B** and the **Vehicle Assembly Building (VAB)** at the agency's Kennedy Space Center in Florida.

This 9-mile-roundtrip test drive on top the **crawler-transporter 2** isn't a joy ride. **Exploration Ground Systems'** Cliff Lanham, lead project manager for the mobile launcher, said moving it will accomplish several goals.

"The mobile launcher is being moved to begin the next big program phase for verification and validation of all systems when it is connected to the pad and VAB systems," Lanham said.

The mobile launcher will be used to assemble, process and launch the SLS rocket and Orion spacecraft. The nearly 380-foot-tall structure is equipped with the crew access arm and several **umbilicals** that will provide power, environmental control, pneumatics, communication and electrical connections to the rocket and spacecraft during processing and launch. Several other umbilicals will provide fuel and stability to the rocket on the surface of the mobile launcher's deck.

To prepare the 11-million-pound mobile launcher for its move, the access platforms were secured, the umbilical arms on the tower were placed in their retracted positions, and access scaffolding and platforms from the ground were removed.

During move operations, the crawler team, including driver Bob Myers, a mechanical systems engineer with ERC on the Test and Operations Support Contract, positioned the crawler beneath the mobile launcher and picked it up for its journey to the pad and VAB.

Traveling at a top speed of .7-mile-per-hour, the mobile launcher made its inaugural trek along the crawlerway to Launch Pad 39B for a quick fit check on the surface of the pad. NASA Test Director Jeffrey Brink, lead for testing at Pad 39B, checked out key systems over several days to include ensuring the water suppression systems align and the environmental control system that provides air and gaseous nitrogen purges to the SLS through the umbilicals hooks up properly with the mobile launcher's ducts that distribute them. During the fit check, the cryogenic system lines

from the mobile launcher to the pad were checked and remote commanding from the **Young-Crippen Firing Room** at the Launch Control Center was tested.

"The VAB and Pad 39B are a proving ground for our ground systems, and we fully intend to prove they're ready for flight hardware," Brink said.

Performing these checks now will give the team time to fix any issues found during the fit check and before the team gets into testing at Pad 39B next spring in preparation for the first launch of SLS and Orion on **Exploration Mission-1**.

Once pad checks were completed, the mobile launcher departed 39B atop the crawler and traveled back along the crawlerway to the VAB. The crew access arm was rotated just outside of the VAB.

Then the mobile launcher was slowly moved into High Bay 3 to begin testing with the 10 levels of new

work platforms, power systems, air conditioning systems, communication systems, including cameras, and pneumatics systems. Major tests include swinging out the umbilicals on the tower. Then test conductors will operate the umbilical arms remotely from inside the firing room.

"This testing is necessary to ensure the systems will function as designed and to validate the systems operate as expected under the test conditions," Lanham said.

Performing these tests now will give NASA the confidence that the ground systems can safely and effectively support integration, processing and launch of SLS and **Orion** on missions to the Moon and future missions to Mars.

A truck sprays water to reduce the dust as NASA's crawler-transporter 2 with the mobile launcher atop slowly moves along the crawlerway on its trek to Launch Pad 39B on Aug. 31, 2018, at the agency's Kennedy Space Center in Florida. Photo credit: NASA/Cory Huston





NASA's mobile launcher (ML) atop crawler-transporter 2 arrives at Launch Pad 39B on Aug. 31, 2018, at the agency's Kennedy Space Center in Florida. The ML will undergo a fit check, followed by several days of systems testing. The 380-foot-tall mobile launcher is equipped with the crew access arm and several umbilicals that will provide power, environmental control, pneumatics, communication and electrical connections to NASA's Space Launch System (SLS) and Orion spacecraft. Exploration Ground Systems is preparing the ground systems necessary to launch SLS and Orion on Exploration Mission-1, missions to the Moon and on to Mars. Photo credit: NASA/Jamie Peer



A close-up view of NASA's crawler-transporter 2 with the mobile launcher atop as it slowly moves along the crawlerway on its trek to Launch Pad 39B on Aug. 31, 2018, at the agency's Kennedy Space Center in Florida. Photo credit: NASA/Cory Huston

IN THE DRIVER'S SEAT



Crawler driver takes mobile launcher for trek to Launch Pad 39B, Vehicle Assembly Building

BY LINDA HERRIDGE

What does it take to drive one of NASA's crawler-transporters?

"Patience," says Bob Myers, a mechanical systems engineer on the Test and Operations Support Contract and one of six crawler

drivers at the agency's Kennedy Space Center in Florida.

Recently, Myers sat in the operator cab of the crawler-transporter known as CT-2, picked up the mobile launcher that will be used to launch NASA's new Space Launch System rocket and moved it slowly and carefully along the crawlerway out to Launch Pad 39B for testing and verification, and then back to the Vehicle Assembly Building, marking the first time the modified mobile launcher has taken such a journey.

"It's a big responsibility," Myers said. "There's a lot of weight on my shoulders, so to speak."

And he's not kidding. The crawler itself weighs about 6 million pounds. Add 10.5 million pounds from the weight of the mobile launcher and its launch umbilicals, and that's 16.5 million pounds, traveling along at about .7 miles per hour on a compacted rock bed.

Once all the crawler systems were activated—a process that takes about 30–45 minutes—Myers pushes a button to start up the crawler and begin moving. The steering wheel is about six to seven inches wide, a far cry from the steering wheel in the supercharged truck he drives. Myers said he just puts his truck into drive and it's already moving faster than the crawler. The crawler uses air brakes to slow or stop, but engineers usually allow it to roll gently to a stop on its own so they do not jerk the payload abruptly.

During the drive, Myers is not alone. At least 30 engineers and technicians are inside or outside the crawler, performing a multitude of tasks to make sure the crawler and mobile launcher are level and everything is operating as it should during the trek to the pad and the Vehicle Assembly Building.

Engineers, construction workers and technicians prepared the crawler for the increased weight of the SLS by upgrading power generators, electrical controls, and the jacking, equalization and leveling cylinders. Manual controls were previously replaced with programmable logic controllers, or computerized controls.

"The crawler has longevity," Myers said. "Upgrades have brought the crawler into the 21st century and made it much easier to drive, but it still feels like a ship on land."

As the center prepares for Exploration Mission-1, and many missions beyond, Myers is looking forward to seeing the SLS and Orion spacecraft stacked on the mobile launcher.

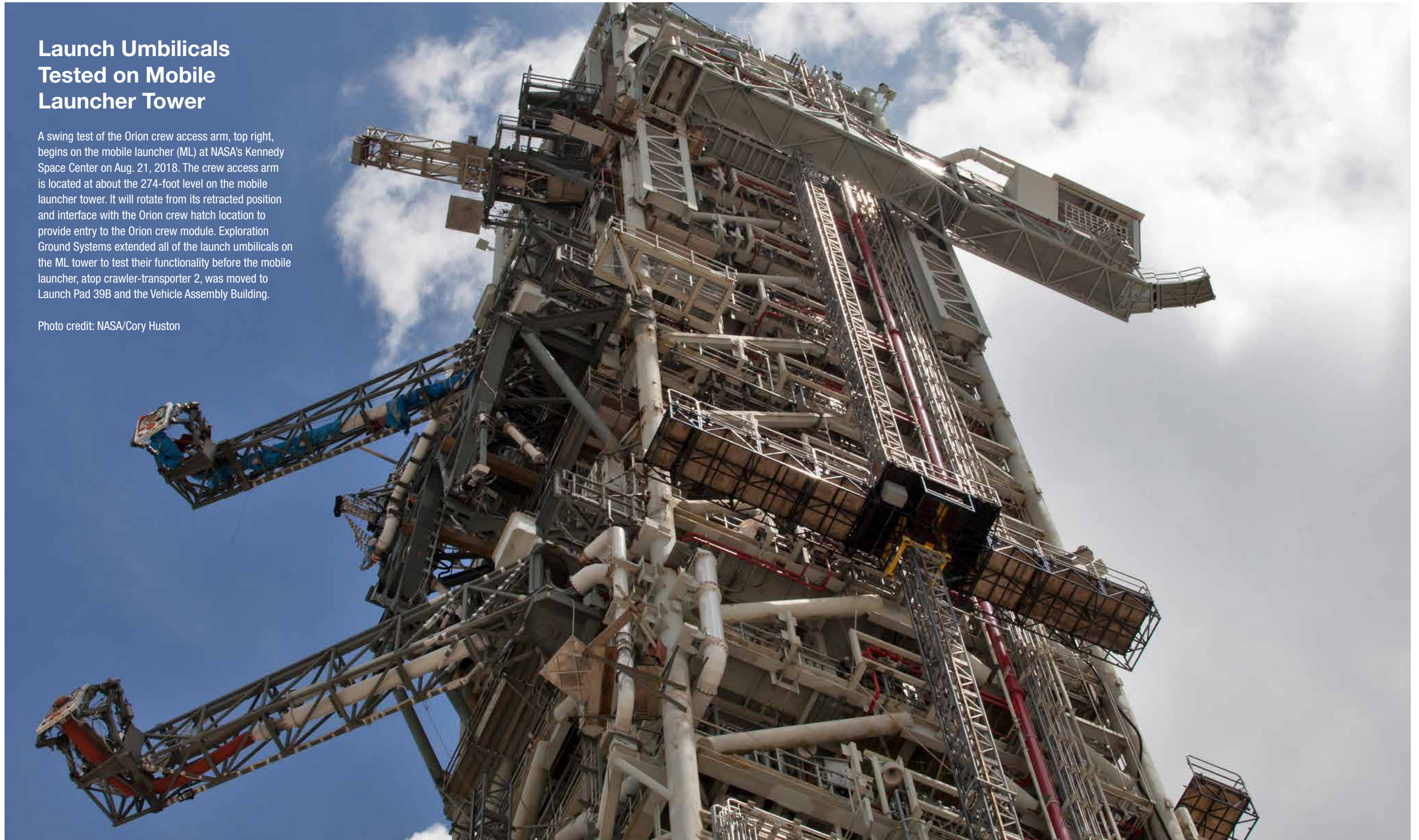
"It will be an honor carrying America's rocket," Myers said. "In a sense, we're carrying America's future."

Bob Myers, a mechanical systems engineer with ERC on the Test and Operations Support Contract, is inside the operator cab of crawler-transporter 2 on the crawlerway at NASA's Kennedy Space Center on Aug. 27, 2018. Photo credit: NASA/Cory Huston

Launch Umbilicals Tested on Mobile Launcher Tower

A swing test of the Orion crew access arm, top right, begins on the mobile launcher (ML) at NASA's Kennedy Space Center on Aug. 21, 2018. The crew access arm is located at about the 274-foot level on the mobile launcher tower. It will rotate from its retracted position and interface with the Orion crew hatch location to provide entry to the Orion crew module. Exploration Ground Systems extended all of the launch umbilicals on the ML tower to test their functionality before the mobile launcher, atop crawler-transporter 2, was moved to Launch Pad 39B and the Vehicle Assembly Building.

Photo credit: NASA/Cory Huston



Heating Up

NASA's Parker Solar Probe begins journey to the Sun

BY LINDA HERRIDGE

NASA's **Parker Solar Probe** is on its way for a rendezvous with the Sun. A United Launch Alliance Delta IV Heavy rocket, carrying the spacecraft, lifted off at 3:31 a.m. EDT, on Aug. 12, 2018, from Space Launch Complex 37 on Cape Canaveral Air Force Station in Florida, its engines blazing golden in the clear night sky during ascent.

"It was a very quiet launch countdown, it went off like clockwork," said Omar Baez, NASA Launch Director. "Parker Solar Probe has been one of our most challenging missions to date. I'm very proud of the team that worked to make this happen. We at NASA and the Launch Services Program are thrilled to be part of this mission."

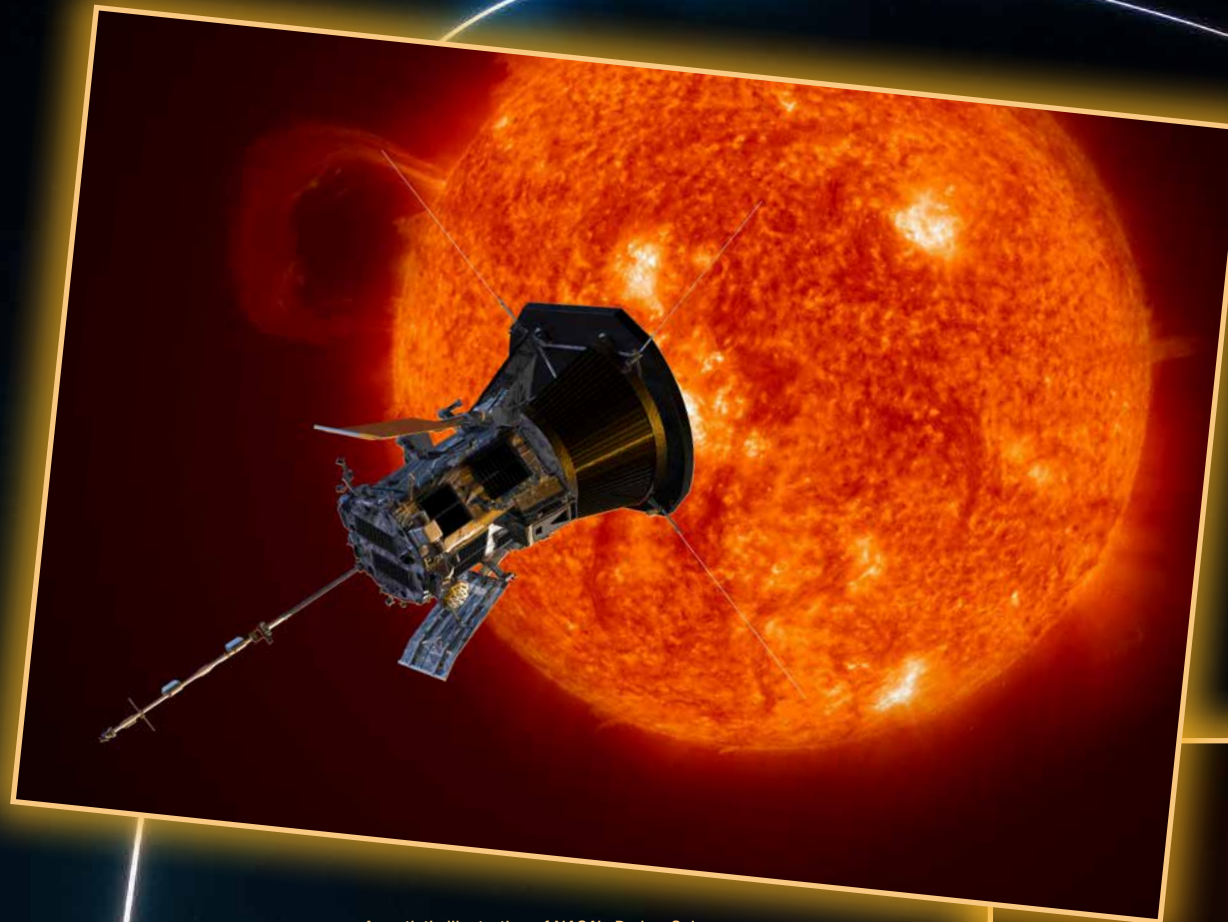
During its mission to "touch" the Sun, Parker Solar Probe will use gravity assists from Venus seven times over nearly seven years to gradually bring its orbit closer to the Sun. It will fly directly through the Sun's atmosphere, as close as 3.8 million miles from its surface, closer to the surface than any spacecraft before it. The spacecraft will hurtle around the Sun at speeds up to 430,000 miles per hour. That's about 210 times faster than a speeding bullet.

Parker Solar Probe will revolutionize our understanding of the Sun's corona. Facing brutal heat and radiation, the spacecraft will fly close enough to watch the solar wind speed up from subsonic to supersonic, and fly through the birthplace of the highest-energy solar particles. Parker Solar Probe and its instruments will be protected from the Sun's heat by a 4.5-inch-thick, carbon-carbon composite heat shield. The shield's front surface will be able to withstand temperatures outside the spacecraft up to 2,500 degrees Fahrenheit. While the inside, or back surface of the shield will withstand temperatures up to 650 degrees Fahrenheit.

For more than 60 years, scientist have wondered how energy and heat move through the solar corona and what accelerates the solar wind as well as solar energetic particles.

Now, with the help of cutting-edge thermal technology that can protect the mission on its dangerous journey, the spacecraft's four instrument suites will study magnetic fields, plasma and energetic particles, and image the solar wind.

In 2017, the mission was renamed for Eugene Parker, the S Chandrasekhar Distinguished Service Professor Emeritus, Department of Astronomy and Astrophysics at the University of Chicago. In the 1950s, Parker, a solar astrophysicist, proposed a number of concepts about how stars—including our Sun—give off energy. He called this cascade of energy the solar wind, and he described an entire complex system of plasmas, magnetic fields, and energetic particles that make up this phenomenon. Parker also theorized an explanation for the superheated solar atmosphere, the corona, which is—contrary to what was expected by



An artist's illustration of NASA's Parker Solar Probe observing the Sun. Image credit: NASA/Johns Hopkins APL/Steve Gribben

(Background) A United Launch Alliance Delta IV Heavy rocket carrying NASA's Parker Solar Probe is seen in this long-exposure photograph taken during launch on Aug. 12, 2018. The rocket lifted off from Space Launch Complex 37 at Cape Canaveral Air Force Station in Florida. Photo credit: NASA/Johns Hopkins APL/Ed Whitman

physics laws—hotter than the surface of the Sun itself. This is the first NASA mission that has been named for a living individual.

Parker Solar Probe is part of NASA's Living With a Star program to explore aspects of the Sun-Earth system that directly affect life and society. The Living With a Star flight program is managed by the agency's Goddard Space Flight Center in Greenbelt, Maryland, for NASA's Science Mission Directorate in Washington. The Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, manages the mission for NASA. APL designed and built the spacecraft and also will operate it.

Parker Solar Probe is the fourth mission for NASA's **Launch Services Program** (LSP) this year. LSP is responsible for launch service acquisition, integration, analysis and launch management for each mission.

(Below) A United Launch Alliance Delta IV Heavy rocket with NASA's Parker Solar Probe, lifts off at 3:31 a.m. EDT on Aug. 12, 2018, from Space Launch Complex 37 at Cape Canaveral Air Force Station in Florida. The mission will perform the closest-ever observations of a star when it travels through the Sun's atmosphere, called the corona. The probe will rely on measurements and imaging to revolutionize our understanding of the corona and the Sun-Earth connection. Photo credit: NASA/Kim Shiflett





AN UP-CLOSE LOOK

NASA Administrator meets Kennedy Space Center employees

BY BOB GRANATH

NASA Administrator Jim Bridenstine made his first official visit to the agency's Kennedy Space Center on Aug. 6 and 7 for an up-close look at the premier, **multi-user spaceport**.

Bridenstine's visit began with Center Director Bob Cabana giving the administrator a helicopter tour of the bustling Florida spaceport.

During an all hands meeting for Bridenstine to speak with employees, Cabana commented on the spaceport's shift.

"The transition that you all have made in the last seven years since (space shuttle) Atlantis made its final flight has been nothing short of phenomenal," he said. "I've had the privilege the past two days to share the work that you all have accomplished with our new NASA administrator, who is passionate about what we do."

Bridenstine also thanked Kennedy employees for their part in the recent changes.

"You have transitioned splendidly," Bridenstine said. "When you look at how Kennedy has handled the challenge and how you have turned this into a multi-user spaceport with commercial and other partners, I'm inspired and in awe."

For nearly half a century, Kennedy operated as a NASA-only space center. As the **Space Shuttle Program** came to an end,

Kennedy began preparing to support NASA's **Space Launch System (SLS)** rocket and **Orion** spacecraft. Anticipation of an emerging commercial space industry resulted in center leadership developing an innovative concept of a multi-user spaceport to change focus from a big government, NASA-only space center to the agency partnering with other organizations.

The administrator also spoke of the crucial role NASA plays in everyday life around the globe.

"Space is important to our everyday lives," he said. "Look at how space has transformed all of our lives. You look at the way we communicate, the way we navigate, the way we produce food, the way we produce energy, the way we do disaster relief in this country and the world, the way we provide national security and defense, every person in our country and every human on the planet has benefited from what NASA has done."

In addition to touring Kennedy facilities, Bridenstine participated in an Industry Roundtable hosted by the Economic Development Commission of Florida's Space Coast and Space Florida. He later met with members of the news media in the center's Space Florida's Space Life Sciences Lab facility.



(Left) NASA Administrator Jim Bridenstine, in the green safety helmet, tours SpaceX Launch Complex 39A, on Aug. 8, 2018, at the agency's Kennedy Space Center. Bridenstine received updates on SpaceX accomplishments for NASA's Commercial Crew Program. Photo credit: NASA/Kim Shiflett

(Opposite page) NASA Administrator Jim Bridenstine made his first official visit to the agency's Kennedy Space Center on Aug. 6, 2018. His visit began with a helicopter tour over the bustling Florida spaceport that included an up-close view of the iconic Vehicle Assembly Building. Photo credit: NASA/Kim Shiflett

"You have transitioned splendidly. When you look at how Kennedy has handled the challenge and how you have turned this into a multi-user spaceport with commercial and other partners, I'm inspired and in awe."

NASA Administrator Jim Bridenstine



(Above) NASA Administrator Jim Bridenstine talks with workers during an All Hands meeting on Aug. 7, 2018, in the Training Auditorium at the agency's Kennedy Space Center. Photo credit: NASA/Kim Shiflett



(Left) NASA Administrator Jim Bridenstine, center, tours a plant research laboratory inside the Space Station Processing Facility (SSPF) at NASA's Kennedy Space Center on Aug. 7, 2018. To the right of Bridenstine is Matt Romeyn, project scientist. Behind him, second from left is Josie Burnett, director of Exploration Research and Technology. To Burnett's right is Ronnie Lawson, deputy director of Exploration Research and Technology. Behind Bridenstine is Barbara Brown, chief technologist. Bridenstine received updates on research and technology accomplishments during his visit to the SSPF. Photo credit: NASA/Kim Shiflett



Boeing astronaut Chris Ferguson participates in water survival training Aug. 15, 2018, at the Neutral Buoyancy Laboratory near NASA's Johnson Space Center in Houston. Ferguson will fly on Boeing's Crew Flight Test with NASA astronauts Eric Boe and Nicole Mann. Photo credit: NASA-JSC/Norah Moran

Flight tests to prove commercial systems fit for human spaceflight

BY MARIE LEWIS AND STEPHANIE MARTIN

The first test flights for new spacecraft designed by commercial companies in collaboration with NASA to carry astronauts to and from the International Space Station from the United States are known as Demo-1 for SpaceX and Orbital Flight Test for Boeing.

NASA's goal in collaborating with Boeing and SpaceX is to achieve safe, reliable and cost-effective transportation to and from station on the companies' spacecraft. Both companies have matured their designs, are making significant progress through their extensive testing campaigns, and are headed toward flight tests to validate their systems.

An uncrewed flight test was not a NASA requirement for certifying these systems for human spaceflight. Boeing and SpaceX volunteered to perform these tests to demonstrate their systems are safe for crew.

"This was above and beyond the NASA requirement in the contract," said Kathy Lueders, Commercial Crew Program manager at NASA Kennedy. "Both partners said they really wanted to have an uncrewed flight test to make sure the integrated rockets, spacecraft and re-entry systems are all working as designed to be able to ensure the integrated system is functioning."

Each test flight will provide data on the performance of the rockets, spacecraft, ground systems, and operations to ensure the systems are safe to fly astronauts. Boeing's CST-100 Starliner spacecraft will be launched atop a United Launch Alliance Atlas V rocket from Space Launch Complex 41 on Cape Canaveral Air Force Station in Florida.

"Our commitment has always been to provide NASA and the crews the highest level of mission assurance," said John Mulholland, vice president and program manager for Boeing's Commercial Crew effort. "We believe the earliest time we can confidently do that will be in mid-2019 after flying an uncrewed flight test late this year or early next year. I'm incredibly proud of the progress our team has made, and it has been inspiring to watch them work through challenges quickly, while developing

a brand new human-rated spacecraft that Boeing, NASA and the nation can be proud of."

SpaceX designed its Crew Dragon spacecraft to launch atop the company's Falcon 9 rocket from historic Launch Complex 39A at NASA's Kennedy Space Center in Florida.

"Safely and reliably flying commercial crew missions for NASA remains the highest priority for SpaceX," said Benji Reed, director of Crew Mission Management at SpaceX. "We look forward to launching Crew Dragon—designed to be one of the safest, most-advanced human spaceflight systems ever built—and returning human spaceflight capabilities to the United States for the first time since the Space Shuttle Program retired in 2011. SpaceX is targeting



The SpaceX Crew Dragon spacecraft that will be used for the company's uncrewed flight test, known as Demonstration Mission 1, arrived at Cape Canaveral Air Force Station in Florida on July 10, 2018. The spacecraft recently underwent thermal vacuum and acoustic testing at NASA's Plum Brook Station in Ohio. The Demonstration Mission 1 flight test is part of NASA's Commercial Crew Transportation Capability contract with the goal of returning human spaceflight launch capabilities to the United States. Photo credit: SpaceX

November 2018 for Crew Dragon's first demonstration mission and April 2019 for Crew Dragon's second demonstration mission, which will carry two NASA astronauts to and from the International Space Station."

NASA is making crew assignments now for the Boeing Crew Flight Test and SpaceX Demo-2 to support flight training as we return to launching our astronauts from American soil. As a partner approaches its target readiness date, NASA will work with the company and the Eastern Range to identify launch dates within the busy International Space Station schedule to ensure science investigations, as well as logistics activities and critical operations continue while these new spacecraft are tested.

Many of the team members leading the unique public-private partnership believe the agency is on the cusp of something life changing with its Commercial Crew Program.

"I'm excited to be part of the future of space travel," said Jon Cowart, acting deputy manager for the Commercial Crew Program's Mission Management and Integration office at NASA's Kennedy Space Center in Florida. "When we get to this point the companies will have tested every piece of the spacecraft individually, but there is so much more learning that occurs when the spacecraft actually is operated in space. The systems will be operated in the actual environment to test it and ensure it's ready for crew."

The hardware for these uncrewed missions is being prepared for launch. Boeing's Starliner spacecraft is being outfitted at the Commercial Crew and Cargo Processing Facility at Kennedy, and the United Launch Alliance Atlas V dual engine Centaur that will launch Starliner will be shipped to Cape Canaveral Air Force Station in Florida in November to prepare for the upcoming flight. Separately, SpaceX's Crew Dragon spacecraft for Demo-1 arrived to the Cape in July for final processing. Falcon 9's first and second stages for the Demo-1 mission shipped from SpaceX's headquarters in Hawthorne, California to the company's rocket testing facility in McGregor, Texas for additional testing in August.

Once the uncrewed flight tests are complete and the data reviews have validated the spacecraft systems, NASA astronauts will have their first opportunity to fly in the spacecraft. Crew for Boeing's Crew Flight Test and SpaceX's Demo-2 flights each will include at least a flight commander and pilot aboard to test out the systems.

These flight tests will have similar configurations to the

uncrewed tests, but the crew will have the ability to interface with spacecraft displays, communicate with mission control, and practice manual controls during flight. Starliner and Crew Dragon will dock and undock autonomously to the space station before returning the crew safely home.

"The crew right now actually is working on integrated crew simulations on the flight systems," said Lueders. "They are providing input to the partners to help ensure the interior of the cabin is appropriately located and set up so crew can function and conduct key activities. They're verifying crew layout, doing simulations where they're actually practicing their maneuvers, and also checking out the software and the display systems, and everything else for the crew to be functioning safely in the spacecraft."



Boeing lifts a service module into its shipping container inside the Commercial Crew and Cargo Processing Facility at NASA's Kennedy Space Center in preparation for its trek to El Segundo, California, on September 8. The service module will be used for environmental testing and then the company's Crew Flight Test to the International Space Station. The service module stores the Starliner system's batteries, solar panels, propellant tanks and engines used for on-orbit maneuvering and emergency abort scenarios. Boeing is preparing the Starliner for crew transportation to and from the station in partnership with NASA's Commercial Crew Program. Photo credit: Boeing

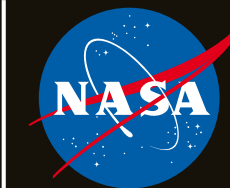
After successful completion of the flight tests with crew, NASA will review flight data to verify the systems meet the agency's safety and performance certification requirements and are ready to begin regular servicing missions to the space station.

"I see parallels between commercial crew and the early aviation industry, when government nurtured that commercial innovation," said Cowart. "In similar fashion, NASA is empowering private industry to gain solid footing in low-Earth orbit, which will allow NASA to explore new frontiers in deep space."



Inside Boeing's Commercial Crew and Cargo Processing Facility at NASA's Kennedy Space Center, NASA astronaut Eric Boe participates in the first full-up acceptance test of Boeing's CST-100 Starliner, on Aug. 22, 2018. The Starliner will be the first to fly astronauts on the company's Crew Flight Test (CFT), following environmental testing in El Segundo, California. Acceptance testing is a critical part of the spacecraft build progression. Generally, it gives the crew module a clean bill of health that it is built correctly, performs to expectations and is ready to fly. Photo credit: Boeing

National Aeronautics and Space Administration



Challenges with Deep Space Travel

Talk with the experts about the various difficulties that deep space travel poses for humans as we attempt to travel off our world. For more information contact bethanne.hull@nasa.gov

Experts speak on Tuesdays at 2:00 p.m. Eastern at: <http://bit.ly/NASASpeakersBureau>

Tweet questions using **#NASADEEP** or use the chat window next to the video player.

- 9/11/18 Aimee Crane, GRC, Habitats
- 9/18/18 Laurie Abadie, Aimee Crane & Amanda VonDeak, GRC, The Human Element of Orion
- 9/25/18 Wes Johnson, GRC, Cryogenics
- 10/2/18 Philip Baldwin, HQ, SCan Communicating in DEEP Space
- 10/9/18 Kurt Leucht, KSC, Using Robots to find Resources
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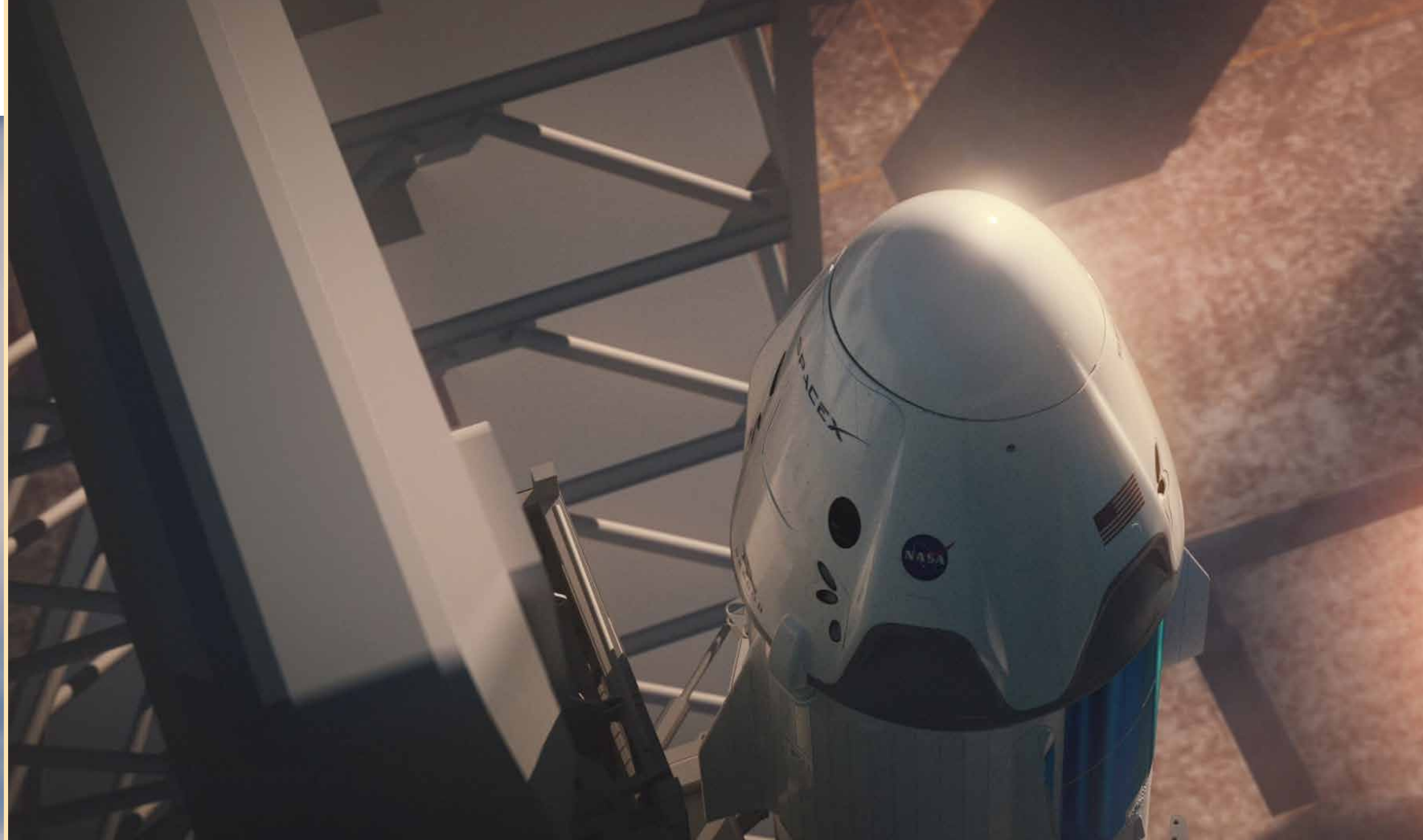
NASA, SpaceX agree on plans for crew launch day operations

NASA's Commercial Crew Program and SpaceX are finalizing plans for launch day operations as they prepare for the company's first flight test with astronauts on board. The teams are working toward a crew test flight to the International Space Station, known as Demo-2, with NASA astronauts **Bob Behnken** and **Doug Hurley** in April 2019. In preparation for this test flight, SpaceX and NASA will continue to complete and review the important analyses and tests leading to launch.

A key question the program and the company have been assessing is whether the astronauts will climb aboard the Crew Dragon spacecraft before or after SpaceX fuels the Falcon 9 rocket. NASA has made the decision to move forward with SpaceX's plan to fuel the rocket after the astronauts are in place. While the agreement makes this plan the baseline for operations, it is contingent upon NASA's final certification of the operation.

SpaceX is continuing to test and qualify many of the systems and components of the Falcon 9 rocket. NASA teams will review, verify, and evaluate both those individual systems and components as well as the overall SpaceX launch system. NASA teams will continue to conduct independent analysis and testing to ensure all identified risks have been mitigated or accepted.

"To make this decision, our teams conducted an extensive review of the SpaceX ground operations, launch vehicle design, escape systems and operational history," said Kathy Lueders, manager of NASA's Commercial Crew Program. "Safety for our personnel was the driver for this analysis, and the team's assessment was that this plan presents the least risk."



(Background) An artist illustration of the SpaceX Falcon 9 rocket with the Crew Dragon atop launching from Launch Pad 39A at NASA's Kennedy Space Center. Image credit: SpaceX

An artist illustration of the SpaceX Crew Dragon on Launch Pad 39A at NASA's Kennedy Space Center. Image credit: SpaceX

Additional verification and demonstration activities, which include five crew loading demonstrations of the Falcon 9 Block 5, will be critical to final certification of this plan. These loading demonstrations will verify the flight crew configuration and crew loading timeline prior to Demo-2. After these conditions have been met, NASA will assess any remaining risk before determining that the system is certified to fly with crew.

If all goes according to plan, on launch day, the Falcon 9 composite overwrap pressure vessels, known as COPVs, will be loaded with helium and verified to be in a stable configuration prior to astronaut arrival at the launch pad. The astronauts then will board the spacecraft about two hours before launch, when the launch system is in a quiescent state. After the ground crews depart the launch pad, the launch escape systems will be activated

approximately 38 minutes before liftoff, just before fueling begins. SpaceX launch controllers then will begin loading rocket grade kerosene and densified liquid oxygen approximately 35 minutes before launch. The countdown and launch preparations can be stopped automatically up to the last moment before launch. In the unlikely event of an emergency at any point up to and after launch, the launch escape systems will allow the astronauts to evacuate safely.

This timeline is consistent with the fueling procedures SpaceX uses for its commercial resupply missions and satellite launches.

The crew launches of NASA's **Commercial Crew** partners SpaceX and Boeing will return the nation's ability to launch our astronauts from the United States to and from the **International Space Station** on American spacecraft.



SpaceX installed the Crew Access Arm on Launch Pad 39A that NASA astronauts will use when they board the Crew Dragon prior to lifting off from the agency's Kennedy Space Center in Florida. Photo credit: SpaceX

One Giant Step

Heat shield install brings Orion spacecraft closer to space

BY LINDA HERRIDGE

During Exploration Mission-1 (EM-1), an uncrewed Orion spacecraft will launch atop NASA's Space Launch System rocket and begin a three-week voyage in space, taking it about 40,000 miles beyond the Moon and back to Earth. On its return, the spacecraft's heat shield will need to withstand temperatures nearing 5,000 degrees Fahrenheit during its fiery descent and re-entry through the Earth's atmosphere before it splashes down in the Pacific Ocean.

Measuring 16.5 feet in diameter, Orion's new heat shield is the largest of its kind developed for missions that will carry astronauts. Designed and manufactured by Orion prime contractor Lockheed Martin, the heat shield base structure has a titanium truss covered with a composite substrate, or a skin composed of layers of carbon fiber material. After initial assembly in Denver, the heat shield underlying structure was shipped to NASA's Kennedy Space Center in Florida.

Inside the Operations and Checkout (O&C) Building high bay at Kennedy, Lockheed Martin technicians recently secured the heat shield to the bottom of the crew module, using 68 bolts. Like an intricate puzzle, all of the pieces had to fit together perfectly. Before the final installation, a fit check was performed to ensure all of the bolt fittings lined up.

"Installation of the EM-1 crew module heat shield is a significant milestone representing the beginning of closing out the crew module assembly," said Jules Schneider, Lockheed Martin Orion KSC Operations senior manager. "When the heat shield is installed, access to components becomes more difficult, and in some cases there is no more access. So by installing the heat shield you are declaring that a certain percentage of the spacecraft is finished."

In a new process, several large blocks of an ablative material called Avcoat, licensed from Boston-based Textron Systems, were produced at Michoud Assembly Facility in New Orleans by Lockheed Martin. They were shipped to the O&C at Kennedy, where Lockheed Martin technicians machined them into more than 180 unique blocks and bonded them to the heat shield's surface.

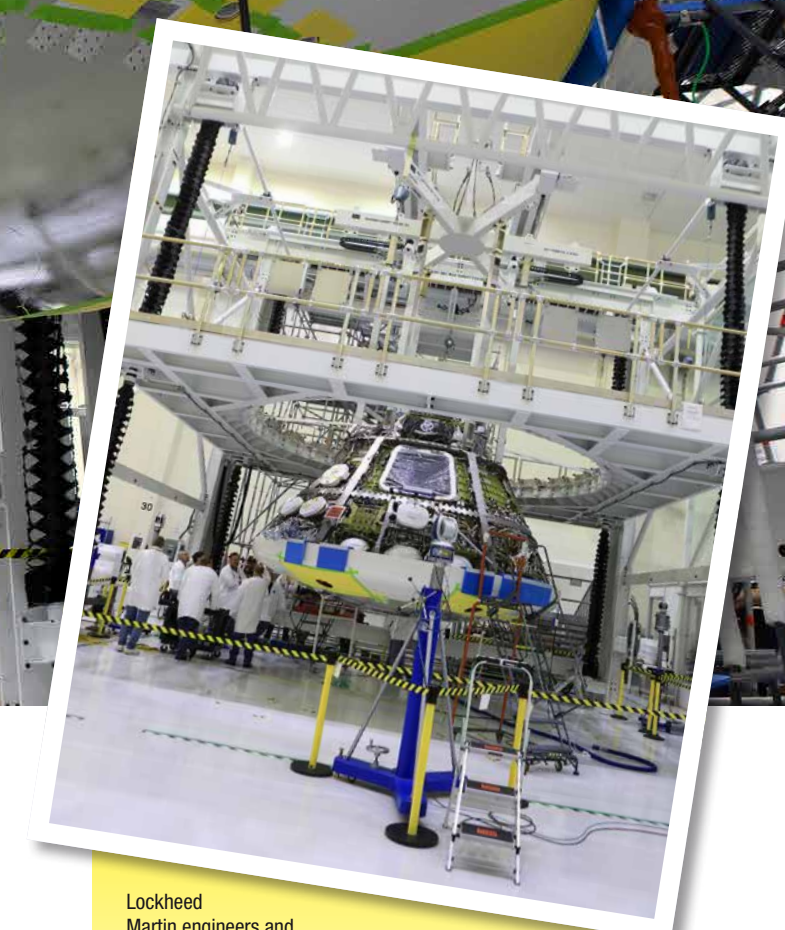
To fill tiny gaps between the blocks, the seams were filled with a room-temperature vulcanizing (RTV) mixture that over time will become solid. Technicians applied a coat of white epoxy paint to the heat shield's surface and then applied aluminized tape after the painted surface dried. The tape provides surface resistivity, and absorbs solar heat and infrared emissions.

"Witnessing assembly, test and installation of the EM-1 crew module heat shield brought an appreciation for its innovative design and assembly techniques," said Amy Marasia, the Crew Module Assembly operations lead in NASA's Orion Production Operations.

While Avcoat isn't new to spacecraft – it was used on the heat shields of Apollo and the Orion EFT-1 test flight – the technique of using blocks instead



Preparations are underway to install the heat shield to the Orion crew module July 25, 2018, inside the Neil Armstrong Operations and Checkout Building high bay at NASA's Kennedy Space Center in Florida. Orion is being prepared for Exploration Mission-1 (EM-1), the first uncrewed integrated flight test atop NASA's Space Launch System rocket. The heat shield will need to withstand temperatures of up to 5,000 degrees Fahrenheit during Orion's descent and re-entry through the Earth's atmosphere before it splashes down in the Pacific Ocean. Photo credit: NASA/Kim Shiflett



Lockheed Martin engineers and technicians install the heat shield to the Orion crew module July 25, 2018, inside the Neil Armstrong Operations and Checkout Building high bay at NASA's Kennedy Space Center in Florida. Photo credit: NASA/Kim Shiflett

of injecting the ablative material is proving to be a real production time-saver.

"A benefit of switching from the honeycomb system to the blocks is we now can make the Avcoat blocks at the same time that the Orion structure is being made, and when the module is ready we can secure the blocks, which saves time," said John Kowal, NASA Multi-Purpose Crew Vehicle Thermal Protection System manager at Johnson Space Center in Houston. "Before, with EFT-1, we had to wait for the carrier portion to be done, and then apply the Avcoat directly to the crew module."

During EM-1, engineers will monitor how Orion's systems perform in the environment of deep space and its return to Earth. During re-entry the ablative material of the Avcoat blocks will burn away, essentially carrying the heat away from Orion because of the gases created during the ablative process.

Orion is the exploration spacecraft that will carry astronauts to deep-space destinations, including the Moon and on to Mars. Orion will be equipped with power, communications and life support systems to sustain space travelers during their long-duration missions and return them safely to Earth.

Dropping In

Successful test proves important step toward safeguarding astronauts

BY JIM CAWLEY

NASA just successfully tested the approach to collect and retrieve valuable data in support of an upcoming test of the abort system for the agency's Orion spacecraft.

Engineers developed ejectable data recorders that will collect data for the abort test, which is meant to evaluate Orion's ability to get astronauts safely away from the rocket if there is a problem during their climb to space. By ejecting the recorders before the Orion test article hits the water, the team can quickly and efficiently recover the recorders for faster access to the data without having to recover the spacecraft and extract the recorders.

During a recent drop test, the recorders were released from a helicopter 5,000 feet in the air and splashed into the Atlantic Ocean off the coast of NASA's Kennedy Space Center. The floating devices were then located through beacons transmitting GPS coordinates and scooped up with fishing nets by NASA personnel operating marine boats.

Recovery of the six recorders took less than an hour, which is about two hours shorter than predicted, according to the drop test conductor David Petri, from NASA's Johnson Space Center in Houston, where the Orion program is based.

"The test was fantastic," Petri said. "We met all of our test objectives, which were to verify that the recorders survived the water impact and salt water environment, functioned as intended and broadcast their location so that they could be retrieved, and ultimately verify that the data could be downloaded from the recorders with no losses or errors."

The drop test is a precursor to the **Ascent Abort-2** flight test planned for April 2019 at Cape Canaveral Air Force Station. During this uncrewed event, **12 data recorders** will be ejected from an Orion test article and will provide NASA engineers with information about g-forces, temperatures and pressures that astronauts would experience if the LAS was activated.

Ascent Abort-2 will test the launch abort system during ascent, where it will encounter the greatest structural stress. A previous test, called Pad Abort-1, tested an abort scenario from the launch pad.

AA-2 will be the final test of the fully active launch abort system before crewed missions.

"The data is going to tell us the forces the astronauts will encounter if they do go through an abort during ascent," said Carlos Garcia, the LAS Orion production lead and Flight Test Management Office representative for Kennedy. "The test that we just did ensures our confidence that we can obtain and retrieve that data."

In the AA-2 flight test, the abort sequence will initiate 55 seconds after launch at 31,000 feet. After the abort motor fires to pull the crew module away from the launch vehicle, the altitude control motor will reorient the LAS to safely separate from the crew module. The LAS will then separate from the crew module using its jettison motor. The data recorders will then be ejected from the crew module, concluding the test.

Assembly operations for the abort test are ongoing at Kennedy, and the **Orion** test crew module that will be used will arrive at Kennedy in December. It will undergo final integration and checkout and then be mated with the Launch Abort System. Finally, the vehicle will be transported to the launch pad and mated with the booster for the AA-2 flight test.

NASA is leading the next steps of human exploration into deep space with its Orion spacecraft that will be launched atop the Space Launch System (SLS) rocket. Together, Orion and SLS will be the critical backbone capabilities that will carry humans to the Moon and extend human exploration farther into space than ever before.

"It's a huge undertaking," Garcia said. "A lot of us don't realize how important this is because we do the day-to-day work. But when you take a step back and look ... I think our country realizes how important it is to get back flying again."

Data recording devices float in the Atlantic Ocean about 10 miles off the coast of NASA's Kennedy Space Center in Florida on Aug. 8, 2018. They were tossed out of a helicopter hovering 5,000 feet over the Atlantic Ocean and retrieved by recovery boats. Photo credit: NASA/Kim Shiflett



Members of the Ascent Abort-2 (AA-2) Flight Test team perform a drop test of data recording devices about 10 miles off the coast of NASA's Kennedy Space Center in Florida on Aug. 8, 2018. These devices, called Ejectable Data Recorders (EDRs), were tossed out of a helicopter hovering 5,000 feet over the Atlantic Ocean and retrieved by recovery boats. The AA-2 Flight Test team is evaluating how the systems in the devices react to elements encountered from the sky to the ocean. In April 2019, the EDRs will eject from the Orion test article during a scheduled test of the spacecraft's Launch Abort System. Photo credit: NASA/Kim Shiflett





Orion Pressure Vessel for Exploration Mission-2 Arrives

BY LINDA HERRIDGE

It's almost a packed house in the Neil Armstrong Operations and Checkout building high bay at NASA's Kennedy Space Center in Florida, with the arrival of the Orion pressure vessel for Exploration Mission-2 (EM-2) that will carry astronauts beyond the Moon atop the Space Launch System (SLS) rocket. The pressure vessel arrived on a super-wide transport truck at the center Aug. 24, and joined the Orion Exploration Mission-1 crew module in the high bay where technicians recently secured the heat shield to the bottom of the spacecraft.

The pressure vessel is Orion's primary structure that holds the pressurized atmosphere astronauts will breathe and work in while in the vacuum of deep space. The main structure of the pressure vessel consists of seven large aluminum pieces that are welded together to produce a strong, yet light-weight, airtight capsule. The pieces were joined at the Michoud Assembly Facility near New Orleans using a state-of-the-art process called friction-stir welding. This process produces incredibly strong bonds by transforming metals from a solid into a plastic-like state, and then using a rotating pin tool to soften, stir and forge a bond between two metal components to form a uniform welded joint, a vital requirement of next-generation space hardware.

The pressure vessel was loaded into the Crew Module Transportation Fixture and then lowered onto a heavy equipment semi-trailer for the nearly 700-mile journey over land to Kennedy. Efforts will now begin to prepare the pressure vessel for flight. Initially, the crew module will be secured into a precision alignment tool and Lockheed Martin technicians will begin the work to attach the main structural components to the exterior of the module. These critical parts, some made of aluminum and titanium, will provide structural strength to the pressure vessel and give the spacecraft its conical shape.

"Flying Orion on our new SLS rocket represents the beginning of a new era in space exploration," said Kent Beringer, EM-2 lead with Orion Production Operations at Kennedy. "This Orion spacecraft and the SLS will take humans farther into the solar system than ever before. It doesn't get any better than this."



FUTURE EXPLORERS

NASA research supported by new program at Kennedy Space Center Visitor Complex

BY BOB GRANATH

As NASA trains crews for work aboard the **International Space Station** and future trips to the **Moon** and on to **Mars**, prospective younger explorers now are participating in similar activities at the new Astronaut Training Experience (ATX) at the **Kennedy Space Center Visitor Complex**.

NASA experts are working closely with those developing education programs at the Kennedy visitor complex. But not only is this effort developing opportunities for participants to learn how NASA prepares crews for extended missions, the results of the new educational program are aiding the agency as it prepares to send astronauts to the Moon and Mars.

Matt Romeyn, a project scientist in Kennedy's Utilization and Life Sciences Office, has worked with education program specialists at the visitor complex to help design and plan the ATX facility.

"They want to teach kids how to do quality science," he said. "As part of the ATX, students will do the preparation and set up for experiments and measure plant growth."

It's a miniaturization of what NASA is doing in laboratories at Kennedy supporting research aboard the International Space Station. The NASA Vegetable Production System, known as "**Veggie**," is a plant growth unit capable of producing salad-type crops to provide the crew with a source of fresh food.

The visitor complex educational activities include two high-tech, hands-on programs: "Astronaut Training Experience" and "Mars Base 1."

The Astronaut Training Experience is an opportunity for visitors to prepare for a mission to Mars. Participants "train" for future missions using technology and simulators that mimic launching, landing and working on Mars. There also is an opportunity to simulate spacewalking in microgravity. These activities are set up to use NASA procedures to work through engineering challenges.

Mars Base 1 offers participants a chance to live on another planet as astronauts, while performing base operations along with real science experiments and engineering tasks.

As part of Mars Base 1, participants will help decide what crops are good to grow in space.

"This is a great partnership," Romeyn said. "Not only is this a learning experience for students, their plant growth experiment results will be reported back to us aiding our ongoing research."

Center Director Bob Cabana recently spoke at the opening of the new ATX at the visitor complex, noting that this special educational program provides an opportunity for young people to learn about NASA and careers supporting space exploration.

"What a unique facility this is," he said. "I appreciate Lockheed Martin sponsoring this awesome facility."

Therrin Protze, chief operating officer of the Kennedy Space Center's Visitor Complex, believes the Astronaut Training Experience will help further the educational focus.

"The ATX Center gives participants a chance to train like an astronaut, perform real NASA science experiments and contribute to data that will be used in the field," he said.

Opening in 1967, the Kennedy visitor complex is the world's window into NASA's work at the Florida spaceport. Exhibits and displays show more than 1.5 million visitors each year the agency's history, information about ongoing programs and glimpses into future efforts to send humans well beyond low-Earth orbit. Another key aspect of visitor complex programs includes NASA educational programs focusing on STEM – science, technology, engineering and math.

"Featuring the **Orion** spacecraft, which we are building for NASA, the ATX puts young space enthusiasts in an immersive environment and lets them train and work together," said Lisa Callahan, vice president and general manager of Commercial Civil Space at Lockheed Martin Space.

The Orion spacecraft and the **Space Launch System** rocket are part of NASA's deep space exploration program designed to send humans on trips to the Moon, Mars and beyond.

"We hope we have a lot of future space industry experts coming out of these experiences, as well as a lot of future astronauts," Protze said.

Callahan echoed that expectation.

"Inspiring our next generation of space explorers, engineers and scientists is very important," she said. "Industry and society must continue to work together to develop the workforce that has the skills to compete in the 21st century high-tech economy."



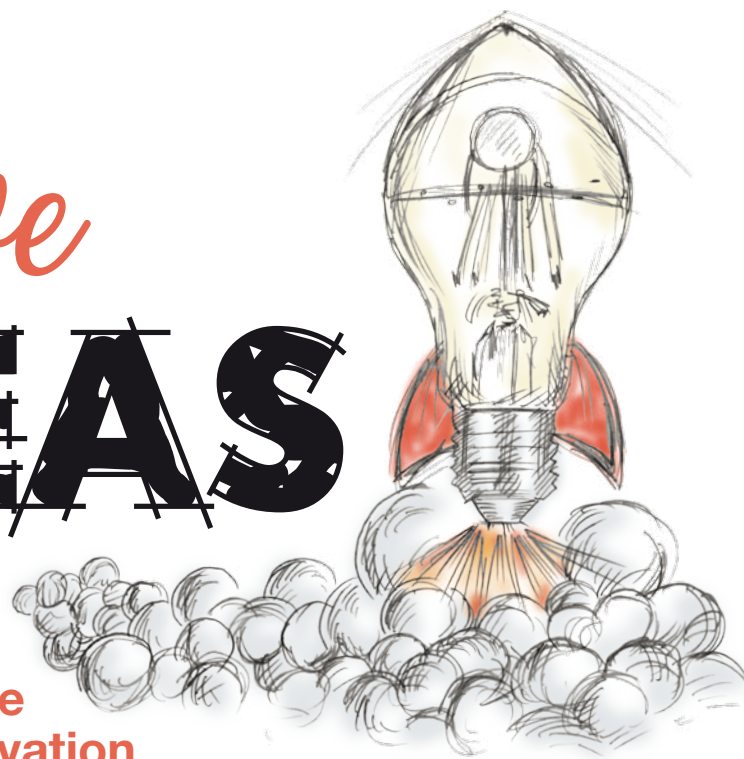
(Above) Kennedy Space Center Director Bob Cabana speaks to guests attending the opening ceremony for the new Astronaut Training Experience (ATX) at the Kennedy Space Center Visitor Complex. Photo credit: NASA/Kim Shiflett



(Left) Plant experiments, similar to Veggie plant growth experiments performed inside the Space Station Processing at Kennedy Space Center, are part of the Astronaut Training Experience at nearby Kennedy Space Center Visitor Complex. Growth in the chamber mimics the growth of plant experiments in the Veggie plant growth system on the International Space Station. Photo credit: NASA/Cory Huston

(Opposite Page) Confetti flies during the opening ceremony for the new Astronaut Training Experience (ATX) at the Kennedy Space Center Visitor Complex. The ATX uses three-dimensional computer display simulation technology to "transport" participants to Mars, training them to live and work in the environment of the Red Planet. The educational experience also teaches what it's like to travel there. The facility uses NASA science to deal with engineering challenges in space travel. Lockheed Martin is the title sponsor for the Astronaut Training Experience. Photo credit: NASA/Kim Shiflett

Creative IDEAS



First-time event sparks wide range of employee innovation

BY JIM CAWLEY

Innovation is alive and well at NASA's Kennedy Space Center in Florida.

Kennedy civil servants and contractors presented their ideas during the 2018 Chief Technologist Innovation Call “Innovation without Boundaries” event held at the Space Station Processing Facility on Aug. 2. The judging panel, which included about 20 members of senior staff, contractors and representatives from several center organizations, faced a wide range of topics among the 39 proposals.

“I was very pleasantly surprised at the quality and the variety,” said Deputy Chief Technologist and event organizer **Kathy Loftin**. “We had ideas ranging from planting a mile of wildflowers on the causeway to putting solar panels on the Vehicle Assembly Building.”

Proposals were split into two categories: innovation ideas with little or no associated costs and innovation ideas that require procurement. Submitters had two minutes to present their proposals, followed by a three-minute question-and-answer session. It was a lot to accomplish in a short period of time, but as Loftin pointed out, that was part of the challenge. Presenters ranged in experience from novices to polished experts.

“So we have two purposes here: one is to reward innovative ideas, but second — and I think more importantly — is just to encourage innovation; give people an opportunity to get up there, present a proposal and get acclimated to the process,” Loftin said.

Judges remained engaged, inquisitive and constructive during the presentations. They worked diligently during the brief intervals between presenters, striving to rank their top proposals. “Innovation without Boundaries” involved an entire day of commitment from the panel.

“What I appreciated most was the diversity of the presenters from students to managers, as well as the range of proposed projects,” said Communication and Public Engagement Deputy Director and event judge Hortense Diggs. “A few dealt with safety, employee morale, aids for interns and a few were technical. The variety of projects and the fact that they only had two minutes to present kept my interest high.”

The Chief Technologist Innovation Call is agencywide. All 10 NASA centers receive the same agency funding through the **Office of the Chief Technologist** Innovation Fund. The twist is in the execution and application — each center organizer is allowed to put his or her own spin on it, effectively making them the initial innovators in the project.

Since this was Loftin’s first time organizing such an event, she did some benchmarking at Kennedy, modeling “Innovation without Boundaries” after **Exploration Ground Systems’** “Sharkish Tank”



Guy Naylor presents his proposal to judges during the “Innovation Without Boundaries” event held in the Space Station Processing Facility at Kennedy Space Center on Aug. 2. Naylor won first place for individual and team projects in the “innovation ideas with little or no associated costs” category. There were 39 proposals featuring a wide range of innovative ideas from Kennedy employees as part of the Chief Technologist Innovation Call. Photo credit: NASA/Ben Smegelsky



Pathways intern Duncan Manor presents his proposal during an “Innovation Without Boundaries” event held in the Space Station Processing Facility at Kennedy Space Center on Aug. 2. Civil servants and contractors at Kennedy participated in the event, which featured 39 proposals as part of the Chief Technologist Innovation Call. Photo credit: NASA/Ben Smegelsky

competition earlier this year. She broadened the idea to include technical and non-technical proposals throughout Kennedy.

In the innovation ideas with little or no associated costs category, there were awards for first, second and third place for both individuals and teams. The first place-individual award went to Guy Naylor for a field laptop workspace project. There was a tie for second place: Dionne Jackson for an electronic access training checklist and Genevieve Ayala for an Exploration Ground Systems communication support request site. Naylor also took first in the team category for a 3/8 drive cross adapter tool proposal, while Hunter Goodenow placed second for the electronic access training checklist.

The innovation ideas that require procurement category is a bit more complicated, and those winning proposals are still in the process of being funded. The Office of the Center Chief Technologist is working with other KSC programs to leverage additional funding where possible and increase the number of awardees. One winner in this category will be selected by Kennedy’s chief technologist to present their idea to NASA Chief Technologist Douglas Terrier at Headquarters and compete against winners from other centers for an additional \$50,000. The prize will be used to develop the winning proposal concept.

At Kennedy, everyone who submitted a proposal was invited to an innovator recognition luncheon held on Aug. 23. Loftin surprised winners with oversized checks, adding a sweepstakes feel to the awards. She expects to make this an annual event.

“It was a raging success, though I do have a page of lessons learned since this was the first event,” Loftin joked. “The overall objective was to inspire innovation in all areas. I really love the fact that we were able to have a competition that included all Kennedy employees.”

NASA's Kennedy Space Center Innovators' Launchpad:

Kathy Loftin



Please explain your job in a single sentence.

I am the deputy chief technologist at NASA's Kennedy Space Center and I am responsible for helping manage the center's research and technology portfolio.

What do you find most exciting about your job as Kennedy Space Center's deputy chief technologist? How does that motivate you?

I love interacting with researchers and being part of NASA's innovative atmosphere. I love that my work is constantly changing and that I get to stay current with state-of-the-art technologies. I never stop learning here at Kennedy.

What is a typical day like for you?

Lots of meetings! I spend about half of my time with research and technology work at Kennedy and about half of my time doing work with the agency's Office of the Chief Technologist and the Chief Technologist's Council.

Was your first month at NASA anything like your current work?

During my first month, I was a researcher at Kennedy and now I'm managing research and technology, so yes, it's similar and a natural progression. However, I am now doing things that I had never dreamed of. Before, my job was quite focused on one area of research. Now I am working in multiple disciplines.

What is your educational background and why did you choose to study those areas?

I have a Bachelor of Science in chemistry, Master of Science in industrial chemistry and Ph.D. in chemistry with specialization in materials and environmental chemistry. I've always liked science and nature. As a kid, I fell in love with the Florida Springs and have been very interested in preserving the environment. I probably would have majored in any of the sciences or engineering, but I received a Dow Chemical Scholarship and that nailed down the decision.

How do the era and place in which you grew up shape how you approach your work?

I was a high school senior during the Challenger accident. It affected me greatly, and I try to always work to advance science at NASA as a tribute to those who lost their lives to advance space exploration and science.

What motivated you to want to work for NASA?

My master's research was on cleaning up pollutants left behind from the Apollo era. When I came to Kennedy to do research, I knew that I wanted to spend my career at NASA. Being around our technology and brilliant employees inspires me.

Why does conducting research and developing new technology matter to you?

Research is trying to do new things and doing old things in a new way. To me, we are only advancing humanity if we continue to challenge our ideas of what we know. I want to leave this life knowing that I helped make Earth a better place. The only way I know how to do that is to keep trying to do everything better which means trying new things — which is research.

What is the most challenging problem you have overcome or are currently working on at NASA?

I just started my new job in February and was starting to become proficient. In May, the chief technologist had a really bad car accident and was suddenly unable to be here. As her deputy, I had to step up. It's been challenging but fun. The good news is that she is okay and will be returning soon. It really motivates me to help Kennedy prepare for the retirement of our employees. We have such a wealth of information with our human capital, and we really need to work on succession planning if we want to maintain our knowledge base.

How do you think NASA benefits people on Earth?

My favorite example is that spaceflight research challenges us to learn to make optimal use of our resources — power, water, food, and air — and this is completely applicable to our challenges on Earth to maintain our precious resources.

Do you have any advice for people trying to foster innovation in their workplaces?

Always look to question why you do the things you do. Ask yourself constantly, "Is there a way I can do this better?" When faced with challenges, try to keep an open mind and consider several solutions. When I hear what sounds like a crazy idea, I try to consider how this idea could work instead of focusing on why it shouldn't.

‘NASA needs people like me’

First Nations launch winners briefed on aerospace careers

BY BOB GRANATH

A group of college students and their faculty advisors from Northwest Indian College and Chief Dull Knife College recently toured NASA’s Kennedy Space Center with an opportunity for an up-close look at career opportunities. All were members of winning teams that successfully flew high-powered rockets in the First Nations Launch competition.

The competition is funded by NASA and administered by the Wisconsin Space Grant Consortium (WSGC). It provides a chance for students attending tribal colleges and universities, or who are members of a campus with an American Indian Science and Engineering Society, or AISES, chapter, to design, build and launch high-powered rockets in the annual competition at Kansasville, Wisconsin.

Student teams at affiliated universities demonstrate engineering and design skills through the rocket competition. This is the ninth year NASA has supported the project.

“The collaboration between Kennedy Space Center and the First Nations Launch is invaluable,” said Christine Bolz, assistant director

for the WSGC, based at Carthage College in Kenosha, Wisconsin. “It provides students the opportunity to be inspired, engaged and educated by NASA professionals, transforming students’ perspective of becoming employed by NASA and the aerospace industry.”

Students representing both winning teams learned about the variety of career paths while touring work in areas such as the Vehicle Assembly Building, Launch Control Center and the Kennedy visitor complex. But for Kaiya Gorman, who is studying research in microbiology, the center’s Veggie Project was of special interest.

The Vegetable Production System (Veggie) is a deployable plant growth unit capable of producing salad-type crops on the International Space Station. It is designed to provide long-term space crews with fresh food that is palatable and nutritious.

Gorman is a student at Northwest Indian College, established by the Lummi Nation in Bellingham, Washington. She said that the career presentation was a “highlight of her visit.” The panel discussion focused on career opportunities with NASA, contractors and other areas of the aerospace industry.

There are two annual challenges students may choose to enter. In this year’s Tribal Challenge, a rocket was launched and judged on its stability using a small onboard camera. In the AISES Challenge, student teams from the organization’s chapters designed,

Dr. Gioia Massa, NASA life sciences project scientist in Exploration Research and Technology Programs, briefs a group of college students and their faculty advisors on the center’s Veggie Project. The guests were members of winning teams that successfully flew high-powered rockets in the First Nations Launch competition. The visit was designed to provide the students with opportunities for an up-close look at career opportunities. Photo credit: Wisconsin Space Grant Consortium

built and launched a rocket that was able to provide an active drag system integrated into the rocket with a mechanical device.

For the competition, teams attend workshops to learn concepts necessary for a successful launch, including guidance, navigation, control, propulsion, electrical systems and flight software. Participants follow NASA project management processes giving formal presentations and participating in design reviews and safety package generation. By guiding students through a rocket’s design, build and fly process, students are encouraged to explore STEM – science, technology, engineering and mathematics.

“The career panel and tours made aerospace tangible,” Bolz said. “The First Nations Launch students began to see how they could be a part of NASA initiatives in a way that relates to their unique interests.”

Bolz believes the end result of the engineering competition, Kennedy tour and discussions about aerospace careers was a great experience.

“There was a moment when the students realized,” she said, “NASA needs people like me.”

During a tour of NASA’s Kennedy Space Center Visitor Complex, Troy Bearcomesout, left, and Steve Vought examine a model of the James Webb Space Telescope. Both are students at Chief Dull Knife College in Lama Deer, Montana and part of the First Nations Launch competition group. Photo credit: Wisconsin Space Grant Consortium



(Above) Ryon Olson, a student at Chief Dull Knife College in Lama Deer, Montana, and part of the First Nations Launch competition group, looks at a replica of a space shuttle main engine at Kennedy Space Center Visitor Complex. Photo credit: Wisconsin Space Grant Consortium





**NASA'S KENNEDY SPACE CENTER
NATIONAL WILDLIFE REFUGE**

BY REBECCA BOLT
KSC ECOLOGICAL PROGRAM

It's that time of year again when bird eggs are hatching and chicks are fledging, or growing feathers. There is no riskier time for a young bird than those days between leaving the nest and becoming a proficient flier.

What should I do if I find a baby bird that can't fly?

The answer depends on the age of the bird. If it hasn't developed feathers and is naked or fuzzy, report it to the Duty Office (861-5050). If the bird has feathers, but is hopping around and not flying, it has fledged from the nest. Leave the fledgling alone because its parents know where it is; they will feed and defend it if they don't feel threatened themselves. The fledgling will be able to fly within a day or two.

Isn't it true that a mother bird will abandon the nest if you touch the eggs or chicks?

This is just not true! The parents will not desert the nest just because you touch it. They might leave a nest if there is too much disturbance for a long period of time, so if you put a chick back into a nest, be quick!

What are the dangers that young birds face?

For eggs and nestlings, predators pose the greatest threat. Road mortality is a problem for young birds that have fledged and are independent. Not speeding and paying attention to the road when we are driving will help avoid collisions with young birds that are inexperienced fliers and not road wary.



A fledgling mockingbird is outside of the Logistics Facility at NASA's Kennedy Space Center. Photo credit: NASA/Rebecca Bolt

Can a nest that is built in a "bad" place (such as on equipment, in a car grill, or over a door) be relocated?

If a nest is moved from where the adult birds built it, they will likely abandon it, even if they figure out where the nest is located. That is why it is KSC policy not to remove or relocate nests once there are eggs or chicks in the nest.

How can I keep birds from nesting in "bad" places?

If you have a specific object or area that you want to keep nest-free, cover it so the birds can't access anywhere to build. Moving equipment or vehicles daily also will help discourage nesting. The best thing you can do is be vigilant; it takes a bird anywhere from a couple of days to several weeks (depending on the species) to build a nest.

How long does it take for eggs to hatch and the young birds to fledge?

That depends on the species. It takes about 3.5 weeks for mockingbird eggs to hatch and the chicks to fledge, great blue herons and ospreys fledge in 12 or 13 weeks, and bald eagle chicks stay in or around the nest for up to 18 weeks.

Can adult birds be dangerous if you are around their chicks?

Again, that depends on the species. Small birds such as a Carolina wren or red-winged blackbird can be quite aggressive, but they will try to scare you away instead of actually attacking. Some birds, especially the hawks and owls, can badly injure you with their talons if they feel you are threatening them or their young.

How many species of birds can be found on KSC?

There are 330 species that have been documented on KSC, including those that live here year-round, ones that come just to reproduce, and those that pass through the area during migration.

How can I help nesting birds?

Interfering with the natural nesting process is prohibited on KSC and the Merritt Island National Wildlife Refuge. However, you can do things at your home that will assist your backyard nesting birds. Keep your cats indoors and don't draw free-ranging cats into your yard by feeding them. Even if the cats aren't hungry, they will take a serious toll on nests



A mockingbird nest is on a ladder near a launch pad at NASA's Kennedy Space Center. Photo credit: NASA/Rebecca Bolt



A nest in a high lift contains nestlings waiting for their dinner near a heavy equipment facility at NASA's Kennedy Space Center. Photo credit: NASA/Rebecca Bolt

and young birds. Providing water and high protein bird food will encourage nesting and survival of the fledglings. If you find a nest, don't return to it. Your scent may attract predators, especially raccoons, opossums, and foxes that will destroy the nest and eat the adult birds, eggs and young.

Why is bird watching so popular and how can I get involved?

Bird watching is a multi-million dollar business annually, and the east central-Florida coast is one of the top-ranked places to see birds in the U.S. There are many characteristics that make bird watching a great activity: age and physical ability don't matter; you can travel the world to see birds or stay home and attract them to you; there is an unlimited amount of information available to learn; or you can simply enjoy the beauty and behavior of these amazing creatures. Good resources are www.habitat.network (how to create wildlife habitat in urban landscapes), <http://merlin.allaboutbirds.org/> (a bird identification app from the Cornell Lab of Ornithology), and <https://ebird.org> (also from Cornell) that has a huge amount of information and activities for novice to expert birders. As an added bonus for living on or near Florida's space coast, we are home to the Space Coast Birding and Wildlife Festival, one of the largest and most popular birding events in the U.S. The 2019 festival will be January 23-28 in Titusville.

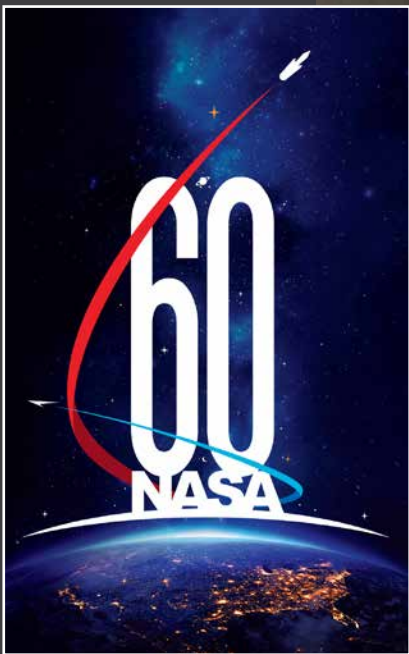


Eilene Galloway helped write National Aeronautics and Space Act

Eilene Galloway began work with the Congressional Research Service of the Library of Congress in 1941, but one of her greatest contributions was helping write the National Aeronautics and Space Act. Galloway researched and wrote House and Senate documents including "Guided Missiles in Foreign Countries," released just before the Soviet Union launched Sputnik on Oct. 4, 1957. On Jan. 31, 1958 the United States answered by orbiting Explorer 1 and the Space Race was on. Later that year, then-U.S. Senator Lyndon B. Johnson asked her to help with Congressional hearings that led to the creation of a civilian space agency – NASA.

Galloway helped write the legislation, emphasizing international cooperation and peaceful exploration. She also proposed that NASA be an administration rather than an agency, enabling the new National Aeronautics and Space Administration to plan and coordinate across federal agencies the variety of activities involved in the development and uses of outer space. Later, she served on nine NASA Advisory Committees. More importantly, she was America's representative in drafting treaties governing the exploration and uses of outer space and launched the field of space law and international space law.

Photo credit: Library of Congress



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