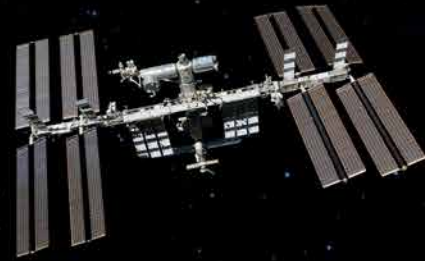




KENNEDY SPACE CENTER'S
SPACEPORT
m a g a z i n e



**Commercial Crew Astronauts Selected
for Boeing, SpaceX Flights**

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Astronauts were assigned to crew the first flight tests and missions of the Boeing CST-100 Starliner and SpaceX Crew Dragon. These spacecraft will take commercial crew astronauts to and from the International Space Station. Image credit: Amy Lombardo

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KENNEDY SPACE CENTER

**WILLIAM (BILL)
CHARDAVOYNE**

Ignition Overpressure Protection & Sound Suppression (IOP/SS) System Lead Design Engineer SI

I serve as the Lead Design and Operations/Maintenance Engineer for the Launch Pad 39B IOP/SS system, which uses high volumes of water to protect the SLS Rocket and launch infrastructure from the extreme energy and temperatures generated during ignition and liftoff. I'm responsible for all aspects of design, installation, testing and operation of this system.

One challenge of my job is maintaining seamless coordination between NASA and contractor stakeholders in order to meet cost, technical and schedule targets. Good teamwork, constant communication, a solid to-do list and lots of coffee are all critical tools I rely on daily to get the job done.

As a child, I was fascinated with the space shuttle and anything technical. That passion became stronger as I grew up, so selecting mechanical engineering as my major was a no-brainer! After graduation, I started work as a KSC contractor facility engineer. This gave me diverse experience with KSC facilities/systems and ultimately led me to my current role with NASA.

My favorite memory is sitting in the pilot seat of an active shuttle Endeavour – a childhood dream come true! Today I look forward to working on console during EM-1 and doing my part to ensure the world's most powerful rocket is launched safely and a major milestone on NASA's journey to Mars is achieved!

Explorers Announced

NASA assigns first crews to fly commercial spacecraft

BY MADISON TUTTLE



On Aug. 3, 2018, NASA announced the astronauts who will launch aboard new American-made spacecraft and rocket systems, the first human launches from the United States since 2011. Nine U.S. astronauts, eight NASA and one from Boeing, were assigned to the first test flights and operational missions for Boeing's CST-100 Starliner and SpaceX's Crew Dragon in partnership with NASA's Commercial Crew Program.

"Today we are taking a step that advances our great American vision and strengthens America's leadership in space," said Jim Bridenstine, NASA Administrator. "These accomplished American astronauts, who will fly on new spacecraft developed by our

Nine U.S. astronauts selected for commercial crew flight assignments gathered at NASA's Johnson Space Center in Houston, Texas, on Aug. 2 ahead of the announcement Aug. 3. From left NASA astronauts Suni Williams, Josh Cassada, Eric Boe, Nicole Mann, Boeing astronaut Chris Ferguson, NASA astronauts Doug Hurley, Bob Behnken, Mike Hopkins and Victor Glover were assigned to the first test flights and operational missions for Boeing's CST-100 Starliner and SpaceX's Crew Dragon. Photo Credit: NASA/Johnson Space Center

commercial American partners Boeing and SpaceX, will launch a new era of human spaceflight."

This public-private partnership marks the beginning of a new era of human spaceflight. NASA has worked closely with Boeing and SpaceX as the companies design, develop, and test their systems

to ensure safe, reliable and cost-effective commercial transportation for astronauts to low-Earth orbit. This will be an unprecedented achievement for the commercial space industry, and will allow NASA to focus on deep space exploration with **NASA's Orion spacecraft** and **Space Launch System**, as we return humans to the Moon and on to Mars.

"Together, we're delivering on the critical task of providing the capability to fly our crews on a U.S. built rocket and spacecraft; from U.S. soil on Florida's Space Coast; to the International Space Station. NASA, Boeing, and SpaceX have pulled expertise from across the nation, spurring innovation and economic growth, and expanding U.S. leadership in space."

These astronauts will be the first to fly sleek, 21st Century spacecraft. Boeing's CST-100 Starliner will launch atop a United Launch Alliance Atlas V rocket from Space Launch Complex 41 at Cape Canaveral Air Force Station in Florida. Just a few miles up the coast, SpaceX's Crew Dragon will launch atop the company's Falcon 9 rocket from historic Launch Complex 39A at NASA's Kennedy Space Center.

"At this moment we have six humans living and working in space about 200 miles above us. These spacecraft will allow us to expand the space station crew," said Mark Geyer, Director of NASA's Johnson Space Center. "This is just the beginning of enduring missions that this country is embarking upon."

Five of the astronauts will join seven revered astronauts who were the first to fly new U.S. spacecraft with NASA's **Mercury**, **Gemini**, **Apollo** and **space shuttle programs**.

The first astronauts who will launch on Boeing's Starliner are NASA's **Eric Boe**, Boeing's **Chris Ferguson** and NASA's **Nicole Mann**.

Boe worked side-by-side with Boeing and SpaceX throughout the last three years, as part of the commercial crew cadre of astronauts.

"Watching the small, incremental changes come together to make revolutionary change is just an amazing thing," said Boe. "Spaceflight is about people, and these last few years I've been watching the people and the teams come together, and now we're getting close to spaceflight and I'm looking forward to the journey."

Ferguson, the commander of STS-135, has been an integral part of Boeing's CST-100 Starliner program.

"What we really see now is a much greater emphasis on safety," said Ferguson. "We're returning to a full capability ascent abort system to keep astronauts safe all the way through the profile, and that's something that the shuttle didn't have."

Mann is honored to join the ranks of the revered seven

astronauts who flew on new U.S. spacecraft. She also is the first woman to be part of the first flight of a U.S. spacecraft.

"It's absolutely an opportunity of a lifetime. To be involved in the test and development and to be there on launch day, and to experience the results of all that hard work, it's going to be a proud moment for the team and for America," said Mann. "As a test pilot, it doesn't get any better than this."

The first astronauts who will launch on SpaceX's Crew Dragon are NASA's **Bob Behnken** and **Doug Hurley**. Behnken last flew on the space shuttle, which was designed in the 1970s.

"The space shuttle was extremely capable, and it's super hard to duplicate that in such a short period of time," said Behnken. "The shuttle had decades to mature to where it was when we had our chances to fly it. There were about 3,000 switches inside. We're grateful that the next vehicle that we're going to fly on is going to be a little bit more automated and have quite a bit less switches."

Hurley, a veteran of two spaceflights, was a fighter pilot and test pilot in the U.S. Marine Corps.

"The first flight is something you dream about as a test pilot, and you don't think it's ever going to happen to you," said Hurley.

"Bob and I are

extremely excited to put Crew Dragon through its paces in space and get to the International Space Station again."

After successful test flights with crew of both spacecraft, NASA will begin the process of certifying the spacecraft and rocket systems for regular crew missions to the space station. The agency has contracted six missions with up to four astronauts, per mission, for each company.

The NASA astronauts assigned to Boeing's first operational mission are **Josh Cassada** and veteran **Suni Williams**. Cassada will fly his first mission aboard Boeing's Starliner.

"A few of us had a chance to fly up to Alabama and meet some of the most talented, hardworking men and women at ULA who are building our rocket, and I'll tell you, we are in great hands," said Cassada. "When Americans are working together and respecting and cherishing our individual differences, that's when Americans do the impossible. I am so honored to be a part of that."

After her flight aboard the Starliner, Williams will have flown on three spacecraft, the shuttle, Soyuz and now the Starliner. Her mission also will be her third long-duration mission on space station.

"I'm really excited that we're actually going to be able to take these spacecraft and show them off to our international partners, and have them ride with us to the International Space Station," said

"Today we are taking a step that advances our great American vision and strengthens America's leadership in space."

Jim Bridenstine, NASA Administrator



NASA Astronaut Bob Behnken has been assigned to the first flight of SpaceX's Crew Dragon. Photo Credit: NASA/Johnson Space Center



NASA Astronaut Eric Boe has been assigned to the first flight of Boeing's CST-100 Starliner. Photo Credit: NASA/Johnson Space Center



NASA Astronaut Josh Cassada has been assigned to the second flight of Boeing's CST-100 Starliner. Photo Credit: NASA/Johnson Space Center



Boeing astronaut Christopher J. Ferguson has been assigned to the first flight of Boeing's CST-100 Starliner. Photo Credit: NASA/Johnson Space Center



NASA Astronaut Victor Glover has been assigned to the second flight of SpaceX's Crew Dragon. Photo Credit: NASA/Johnson Space Center



NASA Astronaut Mike Hopkins has been assigned to the second flight of SpaceX's Crew Dragon. Photo Credit: NASA/Johnson Space Center



NASA Astronaut Doug Hurley has been assigned to the first flight of SpaceX's Crew Dragon. Photo Credit: NASA/Johnson Space Center



NASA Astronaut Nicole Mann has been assigned to the first flight of Boeing's CST-100 Starliner. Photo Credit: NASA/Johnson Space Center



NASA Astronaut Suni Williams has been assigned to the second flight of Boeing's CST-100 Starliner. Photo Credit: NASA/Johnson Space Center

Williams. "That's going to help all of us understand a little bit more about how we live and work in space."

The NASA astronauts assigned to SpaceX's first operational mission are veterans **Mike Hopkins** and **Victor Glover**. Hopkins made his first trip to the International Space Station in 2013. His mission with SpaceX will be his second long-duration mission, where he will conduct research and demonstrate technology.

"Commercial transportation to and from the space station is going to enable us to maximize the benefit of that orbiting laboratory," said Hopkins. "In addition to not only taking the human resource—the astronauts—to the space station, it's also going to enable us to take science experiments up and bring some of the critical research home."

Glover will lift off on his first mission to the station from NASA's historic launch complex 39A, where astronauts launched to the moon.

"To have the opportunity to work with these great companies on something that is so important to our nation and to NASA, this is the stuff of dreams," said Glover. "I'm just excited to get to work making it a reality."

Additional crew members will be assigned by NASA's international partners at a later date.

This new era of human spaceflight begins with launches of spacecraft from U.S. companies Boeing and SpaceX. Regular operation of these spacecraft will be an unprecedented achievement for the commercial space industry.

"All of us are here today because we stand for something

new and profound, built upon an amazing legacy, and it is personal for all of us," said LeeAnn Caret, Chief Executive Officer of Boeing Defense, Space and Security. "Today we start a new chapter, and we're so thrilled to be on this journey."

Both companies bring unique approaches and ideas to the development and testing of their systems, which is why NASA selected both companies in September 2014.

"The 7,000 women and men of SpaceX understand what a sacred honor this was for us to be part of this program, and for us to fly [NASA astronauts]," said Gwynne Shotwell, Chief Operating Officer of SpaceX. "So thank you very much, we take it seriously, we won't let you down."

Commercial transportation to and from the space station will maintain a crew of seven astronauts, maximizing time dedicated to scientific research on the orbiting laboratory. This research is crucial for NASA to understand and overcome the challenges of long-duration spaceflight, which will allow humans to explore farther into space than ever before.

NASA's continued presence on the space station for nearly 18 years has enabled research in a variety of physical and life sciences leading to dramatic improvements in technology, infrastructure, medicine, and thousands of spinoff technologies that have improved quality of life. The return of human spaceflight from the United States will stimulate growth in a robust commercial space industry and spark life-changing innovations for future generations.

Making Advances

NASA, commercial partners progress to human spaceflight home stretch

BY MADISON TUTTLE

NASA and commercial industry partners Boeing and SpaceX are making significant advances in preparing to launch astronauts from U.S. soil for the first time since the space shuttle's retirement in 2011. As part of the Commercial Crew Program's public-private partnership, both companies are fine-tuning their designs, integrating hardware, and testing their crew spacecraft and rockets to prepare for test flights

Here's a look at the milestones so far in 2018:

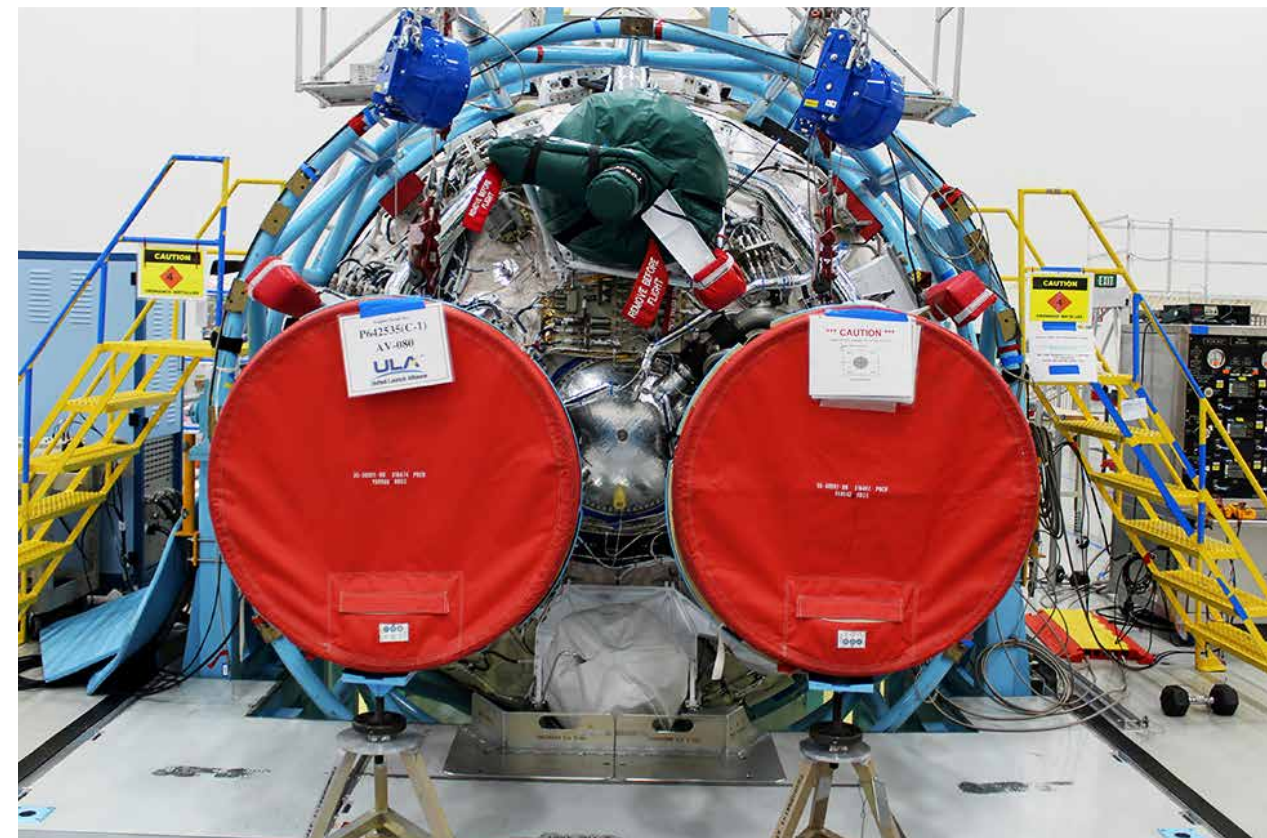
Commercial Crew Program astronauts, from the left, Suni Williams, Eric Boe, Bob Behnken and Doug Hurley take in the view from the top of Launch Complex 39A at NASA's Kennedy Space Center. The astronauts toured the pad for an up-close look at modifications that are in work for the SpaceX Crew Dragon flight tests. Tower modifications included removal of the space shuttle era rotating service structure. Future integration of the crew access arm will allow for safe crew entry for launch and exit from the spacecraft in the unlikely event a pad abort is required. Photo credit: SpaceX



Crew and International Space Station

In March, astronaut **Eric Boe** visited **Space Launch Complex 41 (SLC-41)** at Cape Canaveral Air Force Station in Florida. He had the opportunity to see a United Launch Alliance (ULA) Atlas V rocket on the pad and check out the Crew Access Tower. The crew assigned to Boeing's Starliner spacecraft will launch from SLC-41 atop an Atlas V on their way to the **International Space Station**.

(Right) NASA astronaut Eric Boe, one of four astronauts working with the agency's Commercial Crew Program, had the opportunity to check out the Crew Access Tower at Space Launch Complex 41 on Cape Canaveral Air Force Station in Florida, with a United Launch Alliance Atlas V on the pad. Boe, along with launch operations engineers from NASA, Boeing, and ULA, climbed the launch pad tower to evaluate lighting and spotlights after dark. The survey helped ensure crew members will have acceptable visibility as they prepare to launch aboard Boeing's Starliner spacecraft on the Crew Flight Test to the International Space Station. Photo credit: Boeing



(Left) The United Launch Alliance (ULA) Orbital Flight Test dual engine Centaur stage of the Atlas V rocket is in the final stage of production and checkout on May 22, 2018, at ULA's factory in Decatur, Alabama. Boeing's CST-100 Starliner will launch on its first uncrewed flight test on the ULA Atlas V rocket. Photo credit: United Launch Alliance

Also in March, astronauts Bob Behnken, Eric Boe, Doug Hurley and Suni Williams **toured SpaceX's Launch Complex 39A facilities** to survey the launch pad and tower modifications. The crew assigned to fly on the company's Crew Dragon will liftoff aboard a SpaceX Falcon 9 rocket from historic pad 39A.

Later in April, NASA trained Boeing and SpaceX teams to operate the Mine Resistant Ambush Protected (MRAP) armored vehicle designed to help personnel escape the launch pad in the

unlikely event of an emergency on launch day. Astronauts and ground crews would have the option to shelter in place in the MRAP, or drive away from the launch pad.

In June, astronauts Ricky Arnold and Drew Feustel **installed new cameras** on the space station during a spacewalk. These high-definition cameras will provide NASA with an enhanced look of Boeing and SpaceX's capsules as they approach and dock to the station.



(Left) In the photograph on the left, the upper and lower domes of the Boeing CST-100 Starliner Spacecraft 2 Crew Flight Test Vehicle were mated June 19, 2018, inside the Commercial Crew and Cargo Processing Facility (C3PF) at NASA's Kennedy Space Center. The Starliner will launch astronauts on a United Launch Alliance Atlas V rocket to the International Space Station as part of NASA's Commercial Crew Program. On the right, the SpaceX Crew Dragon spacecraft that will be used for the company's uncrewed flight test, known as Demonstration Mission 1, arrived to Cape Canaveral Air Force Station 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. Photo credits: Photo on the left, Boeing, on the right, NASA/SpaceX

Boeing

Boeing continues to manufacture its Starliner spacecraft inside NASA Kennedy Space Center's Commercial Crew and Cargo Processing Facility in Florida. The company is currently producing three Starliner spacecraft. Boeing's Starliner is designed to be reused up to 10 times.

In January, astronauts had the opportunity to **train using mixed reality**—a combination of real world and virtual environment—technology to practice exiting their seats in an uncommon landing situation. The crew were suited up and secured in a mock-up Starliner allowing them to simulate removing their seat harness and opening the hatch of the spacecraft without assistance.

In February, Boeing completed the first in a series of reliability tests of the Starliner flight drogue and **main parachute systems** in Yuma, Arizona. Data collected from these tests continue to improve accuracy of computer models in predicting parachute performance and verifying reliability.

In March, teams from Boeing, NASA and ULA gathered in control rooms across the country for an integrated crew exercise of Boeing's Orbital Flight Test. Boeing also completed two joint rendezvous docking system simulations with the space station.

In May, the White Room, which astronauts will walk through just before boarding Starliner, was installed on SLC-41.

In June, Boeing, NASA and U.S. Army teams rehearsed safely bringing the Starliner spacecraft home to Earth at White Sands Missile Range in New Mexico. When the vehicle prepares for landing, it will deploy a parachute system and touch down in the desert. This exercise tested procedures and communication in place for recovery teams to retrieve the capsule and the crew after landing.

Also in June, Boeing, ULA and NASA simulated an evacuation from SLC-41 to practice escaping from the pad in the unlikely event of an emergency on launch day. Astronauts and ground crews rehearsed zip lining from the launch tower to the ground and driving an MRAP to a triage site for medical attention. Boeing also connected the upper and lower domes of its Crew Flight Test spacecraft and attached its docking system in June.

In July, the dual engine Centaur for the **ULA Atlas V** rocket that will launch Starliner in the uncrewed Orbital Flight Test was completed.

SpaceX

SpaceX continues to test its systems and integrate its launch infrastructure to support the Crew Dragon capsule. The company currently has six Crew Dragon modules in various stages of production and testing.

In March, SpaceX performed two parachute tests, the company's 14th and 15th overall **parachute test** supporting Crew Dragon development in the Mojave Desert in Southern California. The latter test demonstrated Crew Dragon's ability to land safely in an off-nominal situation, deploying only one of the system's two drogue parachutes and three of the four main parachutes.

In April, astronauts completed a SpaceX spacesuit fit check at the company's headquarters in Hawthorne, California. These suits will help keep the astronauts safe and comfortable throughout their journey to and from the space station. The company is manufacturing custom suits for each astronaut to ensure a proper fit and comfortable ride on Crew Dragon.

Also in April, SpaceX, NASA and the Department of Defense (DOD), conducted **joint rescue and recovery exercises** in the Atlantic Ocean off of Florida's eastern coast. In this simulation, DOD pararescue specialists jumped from military aircraft, parachuted to the water, and simulated stabilizing the Crew Dragon capsule and safely removing astronauts from the spacecraft.

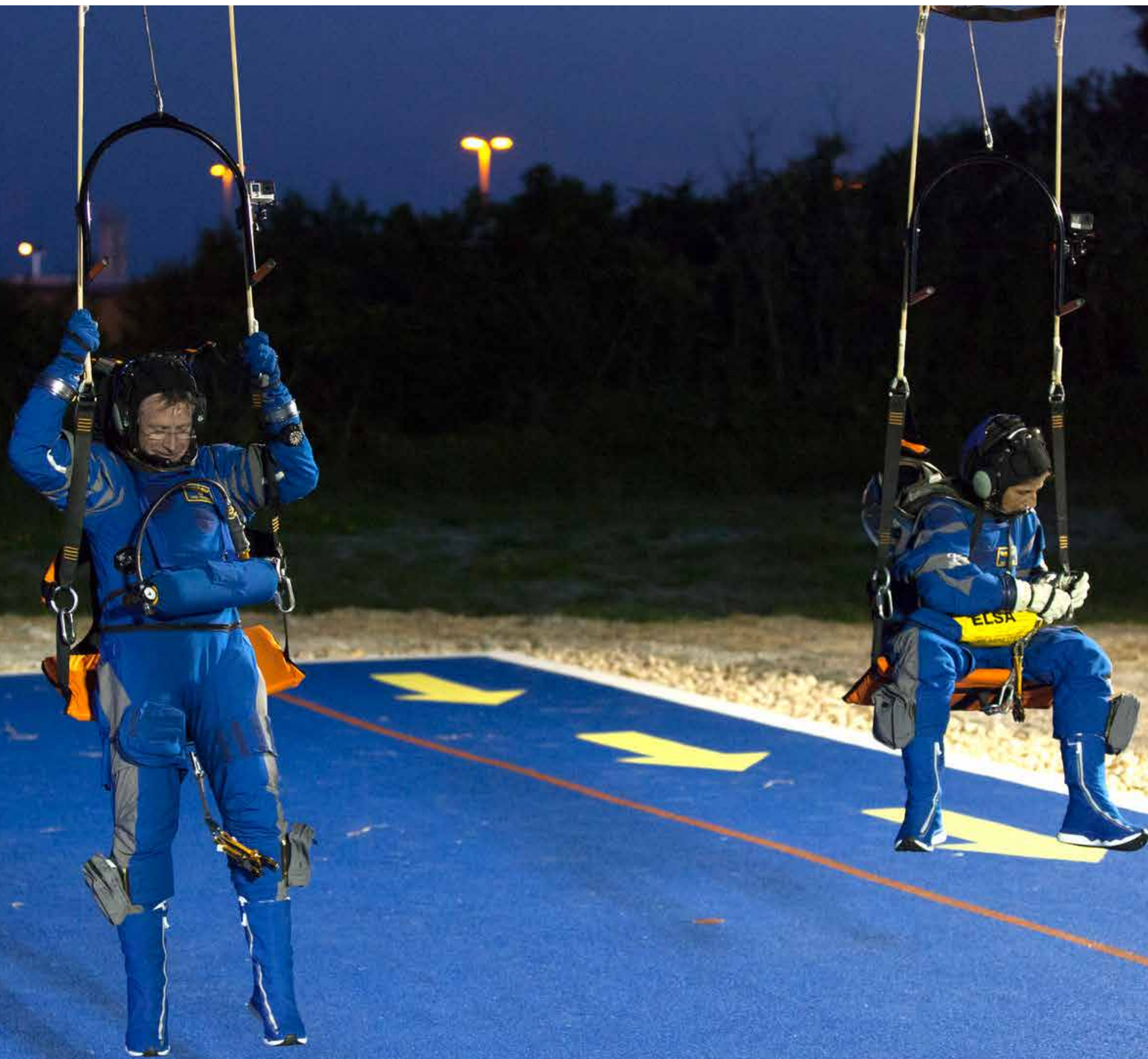
In May, SpaceX completed its 16th overall **parachute system test** for Crew Dragon at Naval Air Facility El Centro in Southern California. This test demonstrated the system's ability to land the spacecraft safely in the unlikely event of a low altitude abort.

In June, the Crew Dragon capsule for SpaceX's uncrewed flight test, Demo-1, arrived at Plum Brook Station at NASA's Glenn Research Center in Ohio. There, the spacecraft underwent testing in the In-Space Propulsion Facility—the world's only facility capable of testing full-scale upper-stage launch vehicles and rocket engines under simulated high-altitude conditions. The chamber allowed SpaceX and NASA to **verify Crew Dragon's** ability to withstand the extreme temperatures and vacuum of space. Crew Dragon also completed acoustical vibration testing on-site at Plum Brook Station.

In July, SpaceX shipped its Crew Dragon spacecraft to Kennedy Space Center in Florida for processing in preparation for Demo-1, and completed its first high-altitude balloon drop test – and 17th overall parachute system test – in the Mojave Desert from ~50,000 feet. SpaceX also completed another major round of astronaut and operations team training and simulations in preparation for the Demo-2 mission. Heat shield qualification, as well as a majority of qualification testing for both Crew Dragon and Falcon 9, is now complete.

NASA astronaut Suni Williams, fully suited in SpaceX's spacesuit, interfaces with the display inside a mock-up of the Crew Dragon spacecraft in Hawthorne, California, during a testing exercise on April 3, 2018. Photo credit: SpaceX

Astronauts participate in a Boeing/United Launch Alliance emergency egress system demonstration at Cape Canaveral Air Force Station's Launch Complex 41 in Florida on June 19, 2018. The system features seats attached to slide wires which would carry astronauts and ground crew more than 1,300 feet away from the crew access tower in the unlikely event of an emergency prior to liftoff on launch day. Photo credit: NASA/Kim Shiflett





SpaceX recently completed its 16th parachute system test for the company's Crew Dragon spacecraft, which will carry astronauts to and from the International Space Station as part of NASA's Commercial Crew Program. SpaceX conducted the test at Naval Air Facility El Centro in Southern California, deploying parachutes to slow the spacecraft for a safe landing in the desert. Crew Dragon is designed for water landings in a nominal scenario, but the test demonstrated the system's ability to land the spacecraft safely in the unlikely event of a low altitude abort. Photo credit: SpaceX

NASA's Kennedy Space Center Innovators' Launchpad:

Shirley Holland-Hunt



Please explain your job in a single sentence.

My job entails monitoring contractors' performance and delivery of products and/or services for their contracts, and I support the identification and establishment of the center's partnerships and Space Act Agreements that enable the development and research of new technology.

What do you find most exciting about your job as Kennedy Space Center's agreements integration manager, and how does that motivate you?

The most exciting part of my job as an agreements integration manager is to be involved in shaping innovative ideas by supporting and assisting the team with implementing new technology. Seeing the future of space being shaped by technology and applying better solutions for space travel is exciting. Working in the Exploration Research and Technology group allows me to be a part of changes made to an existing product, idea or field.

What is a typical day like for you?

During a typical day, I monitor agreements and update the team on in-work and active agreements. This includes identifying the appropriate type of agreement. I work with my team, the partnership office, the chief technologist and sometimes Legal to ensure the work is beneficial to the center's mission. As the technical monitor representative and contracting officer representative for my team's contracts, I develop, modify and review task orders provided by the contractors. I review inputs for award fee evaluations and monitor contractor performance and delivery of products or services under the contract. If a contract needs additional work content added, my job is to work with the contracting officer to ensure it is within the scope of the contract.

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

I have a Bachelor of Science in electrical engineering and a Master of Business Administration. I chose engineering because I have an older sibling who majored in engineering. During his years in college I became fascinated by the math and science. Another motivator was that I had a high school teacher tell me I could never be an engineer because I was a female. At that point I set out to prove him wrong, and I did.

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

I grew up in a small town in Texas during a time when there were not many female engineers. I learned to give 110 percent daily to prove I belonged in this limited field. My dad always told me nothing good comes easy and now I see how those words hold true to life. I have gained respect from my peers, so the hard work paid off.

What motivated you to want to work for NASA?

One reason I wanted to work for NASA is that the projects will make a difference to society. I knew I would be able to use my talent and passion to contribute to the impact NASA has on the world. Also, I knew I would be able to work with the best of the

best because NASA employs world-class, diverse talent to help tackle complex problems, and you never stop learning.

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

Conducting research and developing new technology matters to me because it will help advance NASA's exploration. Technology is constantly changing and the next biggest solution to space travel is right around the corner. The most rewarding part of working with this group is I can help people put their ideas, concepts and thoughts together, then see it fly into space.

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

One of the most challenging problems I have had to overcome here was to reinvent myself. My background is in flight software and avionics. When the Space Shuttle program ended I had to figure out how to best use my background at Johnson Space Center for future capabilities. That is the great part of working at NASA; there are many opportunities that bring together a range of people and perspective to foster innovation. The Research and Technology team gives me an opportunity to learn new technology as well as work with people that can help me expand my expertise.

Who is the most interesting, inspiring or amazing person you have met or worked with at NASA, and how did meeting that person affect you?

There are actually two people who inspired me at NASA. The first is Vanessa Wyche, director of the Exploration, Integration and Science Directorate. She was the first NASA manager I worked for. One of her quotes is, "You just have to have the confidence in yourself that if you don't get that win, ask yourself what you can learn from it." The other person is Jasen Raboin, who designed and patented workout equipment on the International Space Station and is now deputy division chief for Structural Engineering. He taught me that if you don't try, you don't get what you want. The inspiration from these two individuals has taught me how to attain goals, embrace change and contribute to transforming the world.

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

Each employee should be encouraged to do something he or she has never before attempted. Rejection is not failure. It can be used as a motivator to regroup, strategize and meet the challenge head on. Team innovation will also help the group. People should know their ideas are always important. Employees should be trusted to take safe risks and attempt new ways of doing things, and they might stumble across that next great idea.

Swinging Success

Mobile launcher's crew access arm successfully tested

BY BOB GRANATH

As astronauts prepare for trips to destinations beyond low-Earth orbit, their last steps before boarding an Orion spacecraft will be across the Crew Access Arm (CAA) on the **mobile launcher**.

Earlier this year, the CAA was added to the mobile launcher being prepared to support NASA's **Orion** spacecraft and **Space Launch System (SLS)** rocket, the largest in the world. Technicians and engineers in **Exploration Ground Systems** at the agency's Kennedy Space Center recently tested the crucial arm, confirming it worked as designed.

The test was designed to determine the functionality and integrity of the CAA and supporting mobile launcher systems.

"This was the first functional swing testing for the Crew Access Arm," said Cliff Lanham, Mobile Launcher Project Manager at Kennedy. "Prior to testing, we checked the mechanical attachment, hydraulics and cabling to make sure we had confidence it would work properly."

The CAA is designed to rotate from its retracted position and line up with Orion's crew hatch. The arm will provide entry and emergency egress for astronauts and technicians into and out of the Orion spacecraft.

In advance of those missions, the Exploration Ground Systems team at Kennedy has been overseeing testing of umbilicals and other launch accessories on the 380-foot-tall mobile launcher in preparation for stacking the first launch of the SLS rocket with Orion.

During the test, there were several moves of the arm controlled by systems on the mobile launcher. The test also was important because of the upcoming move of the mobile launcher from its park site to the Vehicle Assembly Building (VAB).

"The CAA will be extended when it goes inside the VAB," Lanham said. "We cannot rotate the arm once in the VAB due to space constraints."

Testing inside the VAB is designed to ensure all systems work properly in connection with the building prior to stacking the first SLS and Orion for **Exploration Mission-1**. EM-1 will be the first uncrewed flight of the new NASA spacecraft traveling 280,000 miles from Earth well beyond the Moon.



(Above) Technicians and engineers in Exploration Ground Systems at NASA's Kennedy Space Center recently tested the Crew Access Arm that was added on the mobile launcher. The mobile launcher is being prepared to support the agency's Orion spacecraft and Space Launch System rocket. Photo credit: NASA/Kim Shiflett



The Crew Access Arm (CAA) is located at the 274-foot level on the 380-foot-tall mobile launcher tower. The CAA will rotate from its retracted position and interface with the Space Launch System rocket at the Orion crew hatch location to provide entry in and exit from the spacecraft. Photo credit: NASA/Kim Shiflett

Engineers Mark Completion of Umbilical Testing at Launch Equipment Test Facility

BY LINDA HERRIDGE

The team that tested the **umbilical lines** and launch accessories that will connect from the mobile launcher (ML) to NASA's Space Launch System (SLS) rocket and Orion spacecraft for **Exploration Mission-1** celebrated their achievement during a banner signing at the Launch Equipment Test Facility (LETF) at the agency's Kennedy Space Center in Florida.

Engineers and technicians in the Engineering Directorate and the Exploration Ground Systems Program, along with contractor support, began the tests at the LETF about 2.5 years ago. The first to be tested was one of two aft skirt electrical umbilicals. Testing of the final umbilical, the second of two tail service mast umbilicals, was completed on June 27.

"The team of NASA test engineers and test managers, and contractor engineers and technicians, worked tirelessly six days a week, 10 hours a day, in order to meet the highly aggressive schedule and deliver the hardware to the mobile launcher for installation," said Jeff Crisafulli, Test and Design branch chief in the Engineering Directorate.

In all, 21 umbilicals and launch accessories were tested on various simulators at the LETF that mimicked conditions during launch to ensure they are functioning properly and ready for installation on the ML. Most have been delivered and installed on the ML tower. These include the Orion service module umbilical, interim cryogenic propulsion stage umbilical, core stage forward skirt umbilical and core stage inter-tank umbilical. Two aft skirt electrical umbilicals, two aft skirt purge umbilicals, a vehicle stabilizer system, eight vehicle support posts and two tail service mast umbilicals were installed on the 0-level deck of the ML.

Before launch, the umbilical lines will provide power, communications, coolant and fuel to the rocket and spacecraft. Additional accessories will provide access and stabilization. During launch, each umbilical and accessory will release from its connection point, allowing the SLS and Orion to lift off safely from the launch pad.

"Design, fabrication and testing of the new mobile launcher's umbilicals and launch accessories is a once-in-a-lifetime opportunity that I am proud to have been part of," Crisafulli said.



A banner signing event was held at the Launch Equipment Test Facility on July 24, 2018, at NASA's Kennedy Space Center in Florida, to mark completion of umbilical testing. Photo credit: NASA/Kim Shiflett

(Left) Test team members from the Engineering Directorate and Exploration Ground Systems sign a banner to mark completion of testing of the launch umbilicals for the mobile launcher on July 24, 2018, at the Launch Equipment Test Facility at NASA's Kennedy Space Center. Photo credit: NASA/Kim Shiflett

Aeroshells prepared for Orion's Launch Abort System Test

The third and final aeroshell, or outer covering, for Orion's Launch Abort System (LAS) arrived in High Bay 4 of the Vehicle Assembly Building on July 12, 2018, at NASA's Kennedy Space Center in Florida. The aeroshell was shipped from EMF Inc. on nearby Merritt Island. Technicians prepared the aeroshell to be lifted off of the flatbed truck and transferred to slats.

All three aeroshells will be stacked and placed around the LAS for a full-stress test, called Ascent Abort-2 (AA-2) flight test, scheduled for April 2019. During the test, a booster will launch from Space Launch Complex 46 at Cape Canaveral Air Force Station, carrying a fully functional LAS and a 22,000-pound Orion test vehicle to an altitude of 31,000 feet and traveling at more than 1,000 miles an hour.

The test will verify the LAS can steer the crew module and astronauts aboard to safety in the event of an issue with the Space Launch System (SLS) rocket when the spacecraft is under the highest aerodynamic loads it will experience during a rapid climb into space. Orion is being prepared for its first integrated uncrewed flight atop the SLS on Exploration Mission-1.

Photo credit: NASA/Frank Michaux



MAJOR UPGRADE

Astronaut crew quarters being prepped for return to human spaceflight from American soil

BY JIM CAWLEY

You'll have to excuse Lauren Lunde if her enthusiasm is tempered with just a little bit of anxiety. A NASA flight crew specialist who manages the astronaut crew quarters at Kennedy Space Center in Florida, Lunde helps take care of the elite few who are in the business of pioneering space.

And business is picking up.

Kennedy is actively preparing for a return to human spaceflight, with Boeing and SpaceX both targeting Commercial Crew uncrewed flight tests — followed by crewed missions. In addition, [NASA's Orion spacecraft](#) also will carry astronauts into deep space in the near future.

"There's stress and excitement," said Lunde, who has held her current position since 1994. "During the shuttle program, we had so many launches every year, we were always ready. We knew exactly what to do. When you take seven — going on eight — years off, you're thinking, 'what did we do? How did we get ready?' But it's exciting; it'll be nice to get back into it."

Actually, they were never completely out of it. Past and current astronauts stay at the crew quarters for more than just missions to space. There are important meetings, speaking engagements, [Silver Snoopy Award](#) presentations, critical hardware testing and other official business that brings astronauts to the crew quarters, located on the third floor of the Neil Armstrong Operations and Checkout Building. In recent years, the facility has gone from hosting about 50 astronauts a year to three times that amount, Lunde said.

"Now we're moving toward something," Lunde said. "And we're going there fast."

The crew quarters occupies about 26,000 square feet, taking up the third floor's entire west wing. Access is restricted to this area, which features 23 bedrooms — each with a bathroom — and the iconic suit room, where astronauts are helped into their pressure suits moments before boarding a vehicle to take them to the pad for launch. The crew quarters also includes a kitchen, pantry, dining room, lounge, gym, two conference rooms, two laundry rooms, a flight surgeon's office and three medical exam rooms. A group of eight offices — including Lunde's — are located just off of the main hallway.

A significant, recently completed upgrade will await the Commercial Crew astronauts. There are new carpets and ceiling tiles, and fresh paint on the walls. Appliances all have been replaced, as has the audio/visual teleconference system in both conference rooms. The suit room, last used in an official capacity in July 2011 for [STS-135](#), the final mission of the [Space Shuttle Program](#), has been reactivated and remodeled. The area is furnished with new recliners and tables, and there are now three suit containment rooms — one each for Orion, Boeing and SpaceX.

Final touches are being put on the remodeling. New artwork representing Orion, Boeing and SpaceX will hang in the hallways. These replace space shuttle images, which by no means are being discarded. They will hang



Above: New carpeting, ceiling tiles, appliances and fresh paint are among the improvements that have been made to the astronaut crew quarters, located in the Neil Armstrong Operations and Checkout Building at Kennedy Space Center. Shown here is the suit room, where astronauts are helped into their pressure suits before leaving the crew quarters for a mission. This room now features three suit containment rooms — one each for Orion, Boeing and SpaceX. Photo credit: NASA/Kim Shiflett

Below: During the Space Shuttle Program, the dining room of the astronaut crew quarters, located in the Neil Armstrong Operations and Checkout Building at Kennedy Space Center, was a popular place. Located just off of the kitchen, the dining room features lighting that can simulate broad daylight or evening hours. As Kennedy builds toward a return to human spaceflight, the crew quarters are being prepared to once again house mission-bound astronauts. Photo credit: NASA/Kim Shiflett





The hallway of the astronaut crew quarters at Kennedy Space Center reflects new carpeting and a fresh coat of paint. The crew quarters, located on the third floor of the Neil Armstrong Operations and Checkout Building, has been recently upgraded in preparation for Kennedy's return to human spaceflight. Photo credit: NASA/Kim Shiflett

in the conference rooms and in the refurbished suit room as part of a history display.

"A lot of the astronauts have been amazed at how nice and clean and fresh everything looks," Lunde said.

The astronaut crew quarters has been modified several times since it first opened its doors in the 1960s. Prior to the current upgrades, the last major renovation was in 1994.

During the shuttle program, it was common for all of the bedrooms to be occupied leading up to a mission. Flight surgeons, astronaut support personnel and flight operations management accompanied astronauts in the living quarters.

"They came down here at L-minus-4 day, and we would be packed," Lunde said. "We rarely were not full."

That is expected to change. One reason is smaller crews: space shuttle crews averaged five to seven astronauts — with as many as eight — while upcoming missions are planning for two to four astronauts. Another reason is more emphasis on quarantine, Lunde said, adding that she expects mission-bound astronauts to stay in the crew quarters about twice as long, or eight to nine days.

"Because the quarantine will be so much stricter, we are going to keep it down to a minimum of people," Lunde said. "Unless you absolutely have to be here and stay here, you're not going to be here. You'll stay in town."

She said that should result in a maximum of 16 to 18 bedrooms being occupied leading up to crewed missions.

One thing that won't change is Lunde and her staff's commitment to service. While the purpose of the crew quarters

ultimately is quarantine and suit-up, ensuring the astronauts are relaxed before their stressful job ahead also is critical.

"It's nice to make their stay here comfortable — that's the important thing, and that's what we always strive to do," Lunde said. "Little things mean a lot to them at that time."

Little things include stocking the astronauts' favorite food and drink, right down to specific brands of salad dressing and condiments. Cooks on staff are very much in tune with these preferences. Movies are important, too. The crew decides which movies they want to watch prior to making the trip from Johnson Space Center, Lunde said.

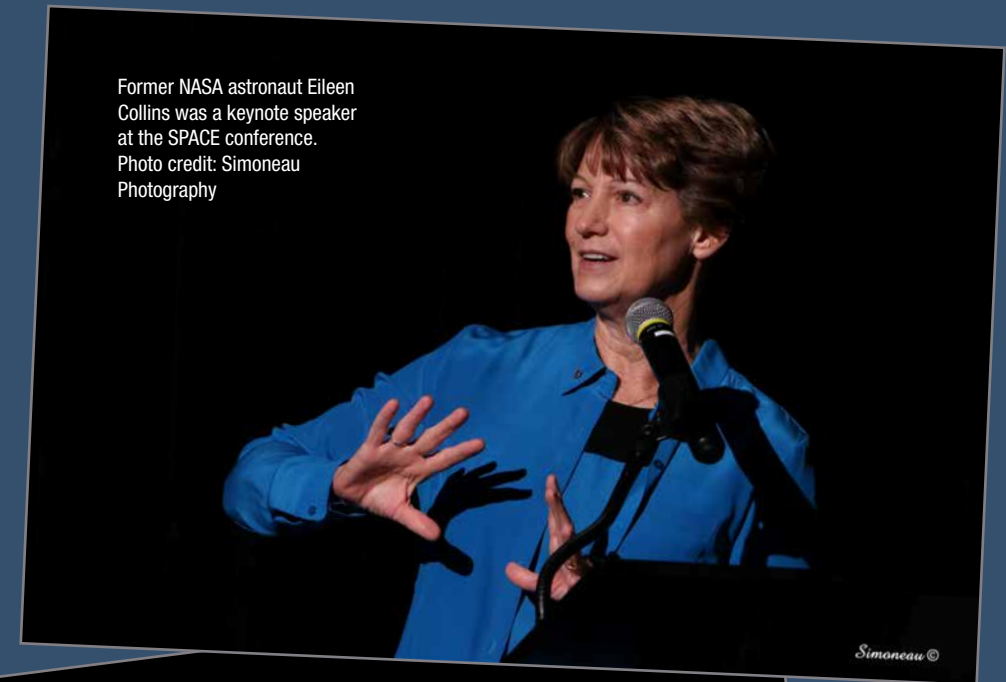
Lighting throughout the facility can be altered to make it look like it is the middle of the night, or a bright, sunny afternoon, depending on the prescribed sleep schedule. But that light won't make its way into the bedrooms.

"All of the rooms have light suppression stripping so the light doesn't come through from the hallway," Lunde said. "And the bedrooms are very well-insulated. It's quiet — very quiet."

As for the crew quarters itself, things won't be quiet for much longer. And that's just fine with Lunde, who expects all of the remodeling to be completed by the middle of August. That will put them in position to be fully prepared for the first round of uncrewed spacecraft testing.

"We're going to act like it's crewed. That way, we can test all of our procedures and make sure everything is ready and in place," Lunde said. "We will really have to be on our toes. It's going to be a blast!"

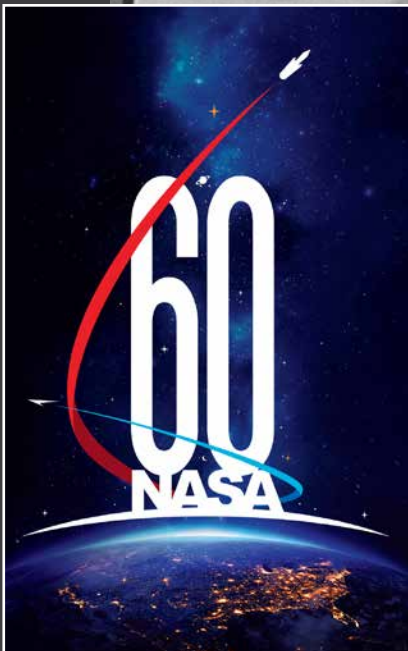
The Spaceport Area Conference for Educators (SPACE) was held July 11-13, in the Public Engagement Center at NASA's Kennedy Space Center Visitor Complex. The conference provided lunar certification on lunar rocks and meteorites for 80 K-12 and informal educators. They participated in three days of workshops, presentations and tours. Sessions were led by teachers and NASA experts, including Kennedy Space Center Director Bob Cabana, retired astronauts Eileen Collins, Mike Foreman and Winston Scott, and Hakeem Oluseyi, Ph.D., a distinguished research professor of Physics and Space Sciences at the Florida Institute of Technology. Sessions focused on science, technology, engineering and math for all educator grade levels. Educators toured the Saturn V Center, Merritt Island Wildlife Refuge and Cape Canaveral. The conference was hosted by The Astronauts Memorial Foundation. Photo credit: Simoneau Photography



Former NASA astronaut Eileen Collins was a keynote speaker at the SPACE conference. Photo credit: Simoneau Photography



Hakeem Oluseyi, Ph.D., a distinguished research professor of Physics and Space Sciences at the Florida Institute of Technology in Melbourne, Florida, was a keynote speaker at the SPACE conference. Photo credit: Simoneau Photography



Congress, President Eisenhower create NASA

On July 16, 1958 Congress passed the National Aeronautics and Space Act creating NASA – the National Aeronautics and Space Administration – out of the National Advisory Committee for Aeronautics (NACA). President Dwight D. Eisenhower signed the legislation into law on July 29. The President, center, is pictured on Aug. 19, 1958, after swearing in Dr. Hugh Dryden, NASA's first deputy administrator, left, and Dr. Keith Glennan, the agency's first administrator. Glennan had been president of Case Institute of Technology in Cleveland, Ohio, and Dryden, director of the NACA. The creation of NASA came a year after the Space Age began with the Soviet Union launching its Sputnik satellite. The United States responded on Jan. 31, 1958, when the Army Ballistic Missile Agency at Redstone Arsenal in Huntsville, Alabama, and the Jet Propulsion Laboratory in Pasadena, California orbited Explorer 1. NASA officially began operations on Oct. 1, 1958, consolidating civilian research efforts in space flight and aeronautics. Photo credit: NASA

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