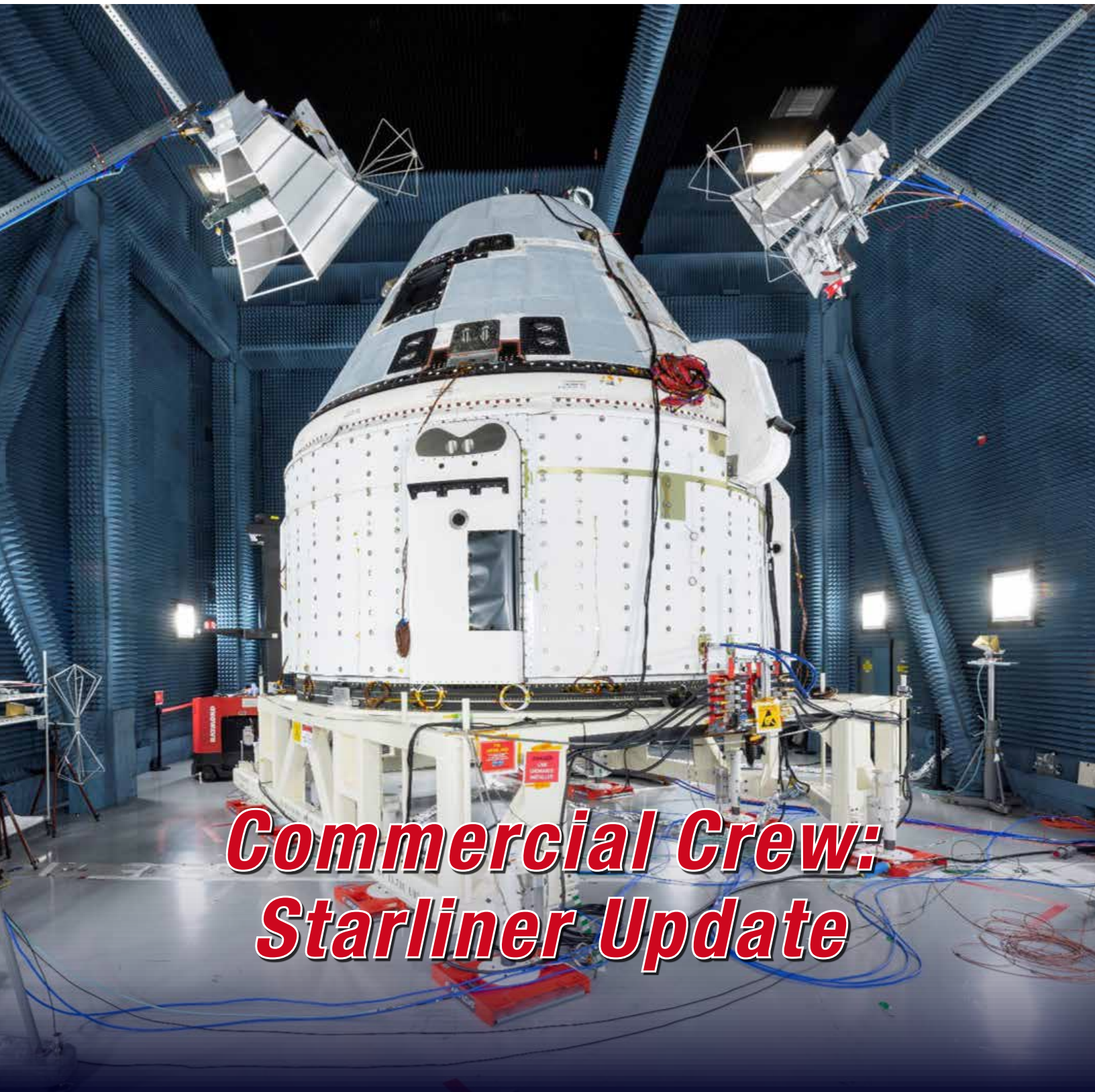


KENNEDY SPACE CENTER'S
SPACEPORT
m a g a z i n e



***Commercial Crew:
Starliner Update***

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Boeing's CST-100 Starliner prepares for electromagnetic interference and electromagnetic contamination (EMI/EMC) testing in a specialized test chamber at Boeing's Space Environment Test Facilities in El Segundo, California on March 22, 2019. These tests were the final part of Starliner's environmental qualification test campaign. EMI/EMC testing ensures that Starliner's systems will function properly in the orbital radiation environment and also not interfere with other electrical systems on the International Space Station. Once back in Boeing's Starliner facilities at the Kennedy Space Center in Florida, this same vehicle will be prepared to fly Starliner's first crew during the Crew Flight Test mission later this year. NASA's Commercial Crew Program is working with Boeing to return human spaceflight launches to the space station from U.S. soil. Photo Credit: Boeing

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KENNEDY SPACE CENTER

LEE ANN PFISTER

I am a design manager in the Construction of Facilities Design Management Branch in the Engineering Directorate at Kennedy Space Center. I have worked at the center since March 2018.

My main responsibilities include managing facility multi-discipline engineering projects. The work involves planning, programming, engineering, construction, site operations and maintenance of contractor performance. I develop architect/engineer designs for assigned facility engineering projects.

I graduated from New Mexico Tech in Socorro, New Mexico, in 2002, with a bachelor of science in chemical engineering, where I also studied pharmaceuticals. After graduation I joined the U.S. Air Force to do my part, where I served for seven years performing duties as a civil engineer. In 2009, I switched to the Air Force Reserves and took a civilian job with the Dept. of Defense (DoD) at Cape Canaveral Air Force Station as a project manager in the Civil Engineer Squadron. From there, I moved to the Naval Ordnance Test Unit as a design and construction engineer until I came to Kennedy.

The biggest challenge for me here was learning the "NASA way." The agency's design and construction process follows the same legal requirements as DoD, but is managed very differently. I was finally able to adjust to NASA's unique project management style, which I now love, by the way. The biggest hurdle for me thus far was learning the acronyms and the drastic change in mission.

I am most excited about the new missions NASA has been tasked with. I can't wait to see what roles the center will have in the new missions, and what part of that will come my way.



Commercial Crew **STARLINER** Update

NASA and Boeing extend Starliner crew flight test to space station, target new flight dates

NASA and Boeing have agreed to extend the duration of the company's first crewed flight test to the **International Space Station** after completing an in-depth technical assessment of the CST-100 Starliner systems. NASA found the long-duration flight to be technically feasible and in the best interest of the agency's needs to ensure continued access and better utilization of the orbiting laboratory.

The extended duration test flight offers NASA the opportunity to complete additional microgravity research, maintenance, and other activities while the company's Starliner is docked to station. The mission duration will be determined at a later date.

"NASA's assessment of extending the mission was found to be technically achievable without compromising the safety of the crew," said Phil McAlister, director of the commercial spaceflight division at NASA Headquarters. "Commercial crew flight tests, along with the additional Soyuz opportunities, help us transition with greater flexibility to our next-generation commercial systems under the Commercial Crew Program."

The agency and its industry partner also agreed to adjust the target launch dates for flight tests, which will demonstrate Boeing's readiness ahead of NASA certification to fly crew regularly to the station.

Boeing is now targeting August for its uncrewed Orbital Flight Test, although this date is a working date and to be confirmed. The decision to adjust that launch date was guided by limited launch opportunities in April and May, as well as a critical U.S. Air Force national security launch – AEHF-5 – atop a United Launch Alliance Atlas V rocket from Space Launch Complex-41 in June. The company's first flight with astronauts on board, called the Crew Flight Test, is now targeted for late 2019, again to be confirmed closer to that timeframe. Boeing also will fly a Pad Abort Test before those two orbital flights to demonstrate the company's ability to safely carry astronauts away from a launch vehicle emergency, if necessary.

"The uncrewed flight tests provide a wealth of data for us to analyze every phase of flight," said Steve Stich, NASA's Commercial Crew Program deputy manager. "They offer a phenomenal opportunity for us to evaluate the end-to-end performance of the systems, and really set us up for flight tests with crew. Our Boeing and NASA teams are making tremendous progress without compromising safety as we prepare for launch."

While the Starliner spacecraft for the Orbital Flight Test is close to complete, the additional time will allow teams to thoroughly focus on the test and validation activities well ahead of launch.

"We remain diligent, with a safety-first culture," said John Mulholland, vice president and program manager, Boeing's Commercial Crew Program. "While we have already made substantial progress this year, this shift gives us the time to continue building a safe, quality spacecraft capable of carrying crews over and over again after a successful uncrewed test, without adding unnecessary schedule pressure."



Boeing's CST-100 Starliner prepares for electromagnetic interference and electromagnetic contamination (EMI/EMC) testing in a specialized test chamber at Boeing's Space Environment Test Facilities in El Segundo, California. These tests were the final part of Starliner's environmental qualification test campaign. EMI/EMC testing ensures that Starliner's systems will function properly in the orbital radiation environment and also not interfere with other electrical systems on the International Space Station. Commercial Crew Program is working with Boeing to return human spaceflight launches to the space station from U.S. soil. Photo Credit: Boeing



Boeing technicians meticulously lower the Starliner upper dome to the lower dome before bolting and sealing the pressure vessel. Photo credit: Boeing

Boeing continues to advance toward meeting the agency's goal of returning human spaceflight launches from American soil to the International Space Station as a part of NASA's Commercial Crew Program.

Orbital Flight Test Progress

Boeing's Starliner spacecraft for the uncrewed flight test is nearly complete. This spacecraft is designed to be reusable up to 10 times, and will be used for the company's first full operational mission after certification. The Starliner team is working to complete all of the critical testing and integration on the spacecraft to ensure the shortest possible time between the completion of the uncrewed flight and the first launch of crew, and then to operational missions to station.

On March 11, Boeing mated the upper and lower domes of the same spacecraft inside its Commercial Crew and Cargo Processing Facility at Kennedy Space Center in Florida. The two domes underwent outfitting with avionics, cooling systems, wire harnesses, fuel and life support lines, and other critical systems before being mated together. This is one of the last major milestones ahead of final processing and closeouts for flight.

NASA and Boeing teams also completed two parachute tests. In February, a "lawn dart" dropped out of a C-17 aircraft over the Yuma Proving Ground in Arizona, and the parachutes performed as planned. These reliability tests are part of a special studies program NASA initiated to validate the robust design of Starliner's parachute systems.

Then in March at the White Sands Missile Range in New Mexico, Boeing completed the fourth of five parachute qualification tests. Successful completion of all five tests will qualify the entire Starliner landing system for flight with crew.

Another key milestone for the capsule included successful range of motion testing on the docking adapter – known as the NASA Docking System, or NDS – that will connect Starliner to the space station's Harmony module later this year.

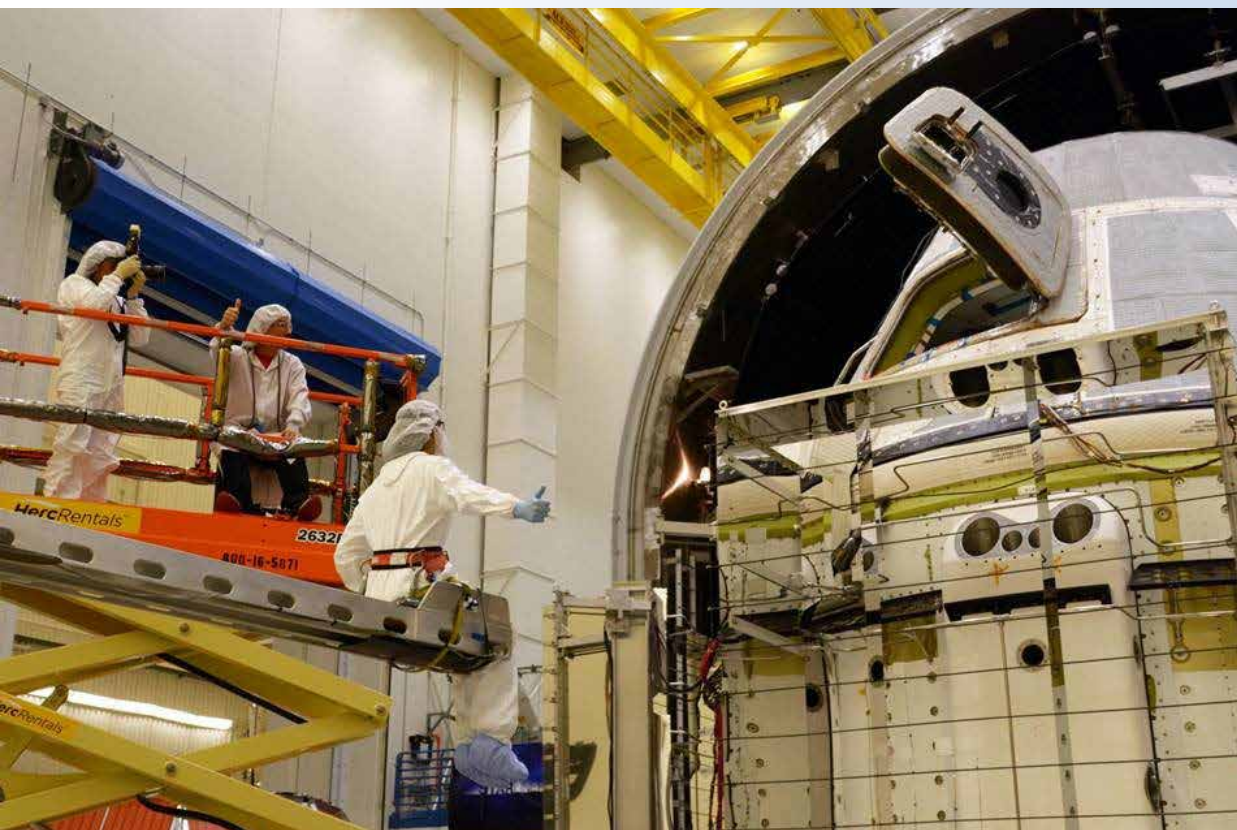
"The uncrewed flight tests provide a wealth of data for us to analyze every phase of flight. They offer a phenomenal opportunity for us to evaluate the end-to-end performance of the systems, and really set us up for flight tests with crew."

Steve Stich
Commercial Crew Program deputy manager.

Pad Abort Test Progress

Boeing also is working on the Starliner spacecraft slated to fly the Pad Abort Test, which will demonstrate the abort engines can push the spacecraft about a mile up and a mile out from the test site. This test will take place at White Sands Missile Range in New Mexico ahead of the Orbital Flight Test.

As a precursor to the abort, the company is preparing to restart its Service Module Hot Fire test campaign at NASA's White Sands Test Facility in New Mexico this spring. New hardware, including launch abort engine valves, have been redesigned and manufactured



NASA astronaut Suni Williams (seated), assigned to Boeing's first operational mission aboard the company's CST-100 Starliner spacecraft, watches as Boeing test teams outfit Starliner with hot plates and radiators ahead of the thermal vacuum test series at Boeing's Space Environment Test Facility in El Segundo, California. Photo Credit: Boeing



Boeing astronaut Chris Ferguson helps NASA astronauts Nicole Mann (left) and Mike Fincke (right) train for a spacewalk inside the International Space Station Airlock Mockup at NASA's Johnson Space Center in Houston in February. Mann, Ferguson and Fincke are assigned to Boeing's Crew Flight Test, Starliner's first flight with crew as part of NASA's Commercial Crew Program, which will restore human spaceflight launches to the space station from U.S. soil. Photo Credit: Boeing

and are being installed on the test abort engines. The next set of new hardware will soon be installed in the pad abort service module.

Crew Flight Test Progress

Boeing's Crew Flight Test spacecraft recently completed its Environmental Qualification Test campaign at the company's Space Environment Test Facilities in El Segundo, California. The Crew Flight Test vehicle underwent rounds of acoustics vibration, thermal vacuum and electromagnetic interference and electromagnetic contamination testing. These tests are designed to simulate the harsh environments of launch, ascent and orbit and also prove that the electronics systems will operate in space and not interfere with other satellites or the station.

NASA astronauts **Nicole Mann** and **Mike Fincke** and

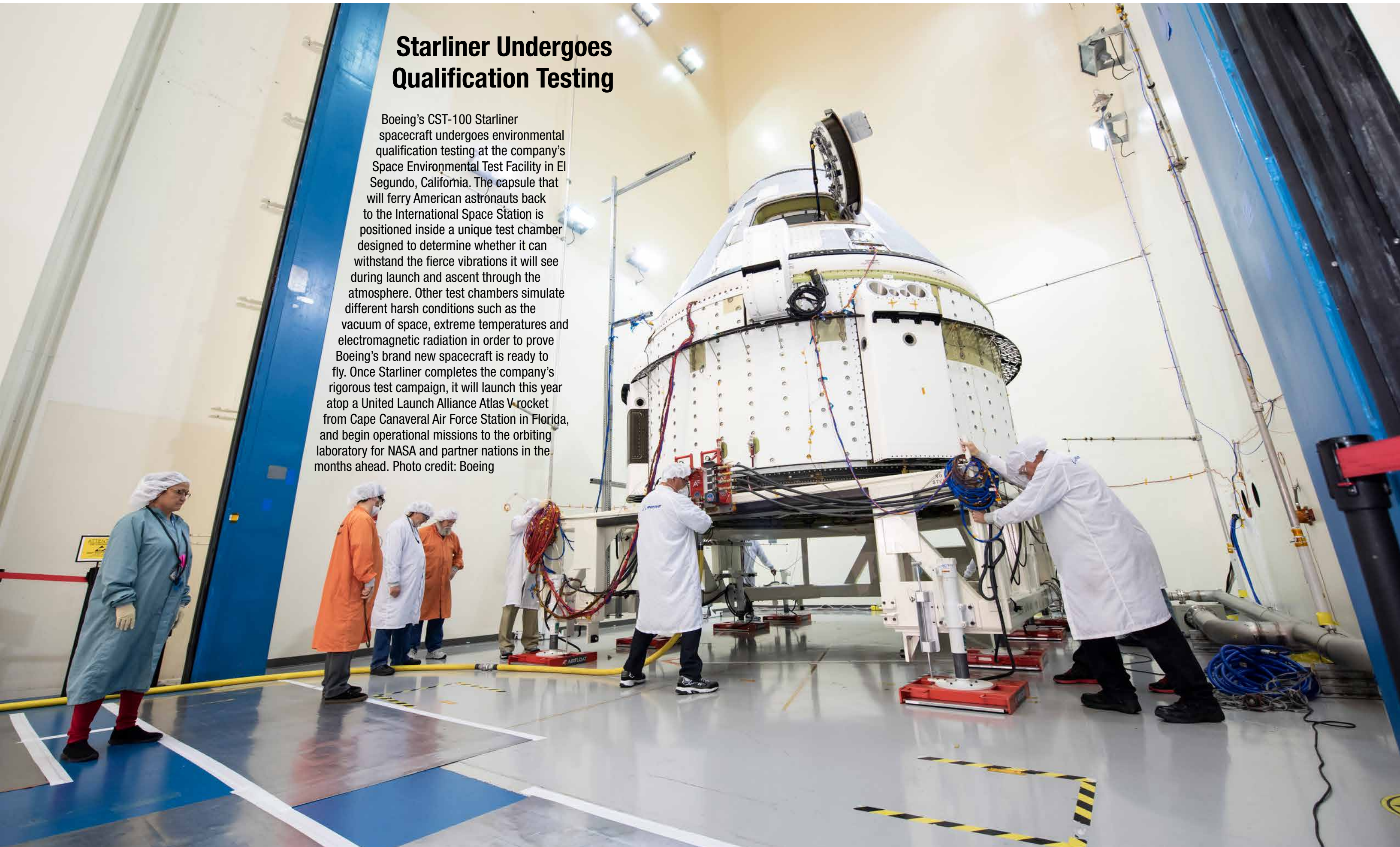
Boeing's **Chris Ferguson** are continuing preparations for the Crew Flight Test at Johnson Space Center in Houston. They are training on Starliner's systems, including nominal and unlikely scenarios, such as water rescue training. They are also well into space station training, and are now focusing on becoming a longer duration crew. Mann and Fincke are training for upcoming spacewalks, and Ferguson is training to support them from inside the station.

Post-Certification Mission Progress

The crew for NASA's first operational mission on Starliner, **Suni Williams** and **Josh Cassada**, are continuing similar training. All five Starliner crew members are making regular trips to Starliner production and test facilities to get to know the people and the vehicles that will take them safely to orbit and back.

Starliner Undergoes Qualification Testing

Boeing's CST-100 Starliner spacecraft undergoes environmental qualification testing at the company's Space Environmental Test Facility in El Segundo, California. The capsule that will ferry American astronauts back to the International Space Station is positioned inside a unique test chamber designed to determine whether it can withstand the fierce vibrations it will see during launch and ascent through the atmosphere. Other test chambers simulate different harsh conditions such as the vacuum of space, extreme temperatures and electromagnetic radiation in order to prove Boeing's brand new spacecraft is ready to fly. Once Starliner completes the company's rigorous test campaign, it will launch this year atop a United Launch Alliance Atlas V rocket from Cape Canaveral Air Force Station in Florida, and begin operational missions to the orbiting laboratory for NASA and partner nations in the months ahead. Photo credit: Boeing



Exciting Year Ahead

Kennedy Space Center accomplishments focus of center director's update

BY LINDA HERRIDGE

“We have a tremendously exciting year ahead of us.”

These were the words spoken by Kennedy Space Center Director Bob Cabana during his annual update to community leaders, stakeholders, partners, educators and government leaders at the Kennedy Space Center Visitor Complex on March 29, 2019.

“My number one goal is to see U.S. astronauts flying from U.S. soil on a U.S. rocket to the International Space Station before year's end. We're going to make that happen with the help of **Boeing** and **SpaceX**,” Cabana said. “It's going to happen this year, and I can't wait.”

Cabana also praised the center's partnership with the 45th space wing and others.

“All that we've accomplished in the last few years – none of it would have possible without the partnership that we have with the 45th space wing, Space Florida, the Federal Aviation Authority and many others.”

Cabana recapped accomplishments of programs led by Kennedy and provided a glimpse of what's to come:

Center Planning and Development

Cabana said it remains the center's “front door” for doing business here. Overall, Kennedy has more than 19 agreements with commercial companies of various types, doing work at the center.

“As many agreements as we've put in place, we still have room for more. We're going to continue to expand on the ones that we have and develop this amazing resource that we have here at the

Kennedy Space Center,” Cabana said.

Some of the center's great successes include the 20-year lease with SpaceX for Launch Complex 39A, the U.S. Air Force's X-37 aircraft in OPF Bay 1, and Boeing's CST Starliner in the C3PF (formerly OPF 3).



NASA Kennedy Space Center Director Bob Cabana updates community leaders, business executives, partners, educators and government leaders on Kennedy-led programs and accomplishments during a presentation March 29, 2019, at the Kennedy Space Center Visitor Complex in Florida. Cabana recapped achievements and future plans for the Commercial Crew Program, Exploration Ground Systems, Launch Services Program, Exploration Research and Technology, and Center Planning and Development. After the presentation, guests had the opportunity to ask questions and visit displays from the programs and some of the commercial partners. Photo credit: NASA/Kim Shiflett



Guests visit with a representative from Exploration Research and Technology during NASA Kennedy Space Center Director Bob Cabana's update to community leaders, business executives, partners, educators and government leaders March 29, 2019, at the Kennedy Space Center Visitor Complex in Florida. Photo credit: NASA/Kim Shiflett

Commercial Crew Program

Cabana described this year as very busy, with a crewed flight test by SpaceX, uncrewed and crewed test flights with Boeing, and abort tests coming up with SpaceX and Boeing.

SpaceX had a successful Demo-1 flight test in March.

“It was really great to see a crew vehicle launching off a NASA pad at 39A for the first time since the space shuttle Atlantis in 2011,” Cabana said. I'm really looking forward to seeing crews flying on these vehicles to the International Space Station.

Exploration Ground Systems

The upgraded mobile launcher recently rolled out to Launch Pad 39B and then to the Vehicle Assembly Building, where it is now going through verification and validation testing. In a couple of months, the mobile launcher will be tested at Launch Pad 39B. Extensive modifications were completed on the mobile launcher so it can accommodate the extra weight of the Space Launch System and Orion spacecraft, though additional modifications are needed. The mobile launcher will be ready this fall when it completes testing at the pad.

EGS broke ground for a new liquid hydrogen tank at Launch Pad 39B. The new tank will be able to hold more than 1 million

gallons of LH2. It will be able to handle multiple launch attempts in the current configuration. The existing tank holds 750,000 gallons of LH2.

Exploration Mission-1 (EM-1) will put Orion in space without crew on board and bring it out to a distant retrograde orbit around the Moon. The most important thing NASA will get from the mission is a check of the thermal protection system of the Orion crew module during lunar reentry velocities.

The team completed some great **recovery tests** recently in the Pacific Ocean off the coast of San Diego, using a test version of the Orion spacecraft.

To prepare for **Ascent Abort Test-2**, the Launch Abort System is currently integrated with a test version of Orion inside the Launch Abort System Facility. NASA is targeting a June test date from Cape Canaveral Air Force Station.

“The data that will be looked at from this test is on the separation of Orion from the Launch Abort System,” Cabana said.

Firing Room 1 is where NASA's first female launch director, Charlie Blackwell-Thompson, will give the “go” for launch of SLS and Orion on EM-1. She has been running launch simulations and work is continuing on the software needed for processing and launch.



Guests visit with representatives from United Launch Alliance during NASA Kennedy Space Center Director Bob Cabana's update to community leaders, business executives, partners, educators and government leaders March 29, 2019, at the Kennedy Space Center Visitor Complex in Florida. Photo credit: NASA/Kim Shiflett

Going Back to the Moon

The president directed NASA to land American astronauts in the next five years, and the agency is working to accelerate humanity's return to the lunar surface by all means necessary.

"We'll get back to the Moon in 2024, and we can go to Mars in the 2030s," Cabana said. "I know the team at Kennedy Space Center is ready."

This time, when NASA goes to the Moon, we will stay. And then we will use what we learn on the Moon to take the next giant leap – sending astronauts to Mars.

"It's important to be able to establish a presence in our solar system beyond our home planet and eventually move on to Mars," Cabana said. "We've got some work to make that happen."

Gateway

The advantage of the Gateway, a lunar orbiting outpost, is that it will allow access to anywhere on the lunar surface. Kennedy's key role will be to establish a commercial logistics contract.

"We're putting together the team that will issue the request for proposals. It will be similar in the way we did the requests for proposals for commercial cargo and commercial crew," Cabana said. "It's a great role for us."

Launch Services Program

The program has a challenging year. The big mission coming up in 2020 is **Mars 2020**, the rover that will land on the Red Planet. Also, efforts are in work to launch the Ionospheric

Connection Explorer (ICON) later this year.

"LSP is doing an outstanding job of procuring the expendable rockets for NASA's science and interplanetary missions," Cabana said.

Exploration Research and Technology

Last year, Kennedy was the only NASA center to receive an award from the Federal Laboratory Consortium on technology transfer and partnerships. The **Automated Flight Termination System** for launch vehicles was developed by a Kennedy research and technology team.

"This is helping us get that range of the future," Cabana said. "This software will be used on all launch vehicles as we move forward."

Plant research is ongoing at Kennedy. Two plant growth systems, **Veggie** and the **Advanced Plant Habitat**, are in use on the space station.

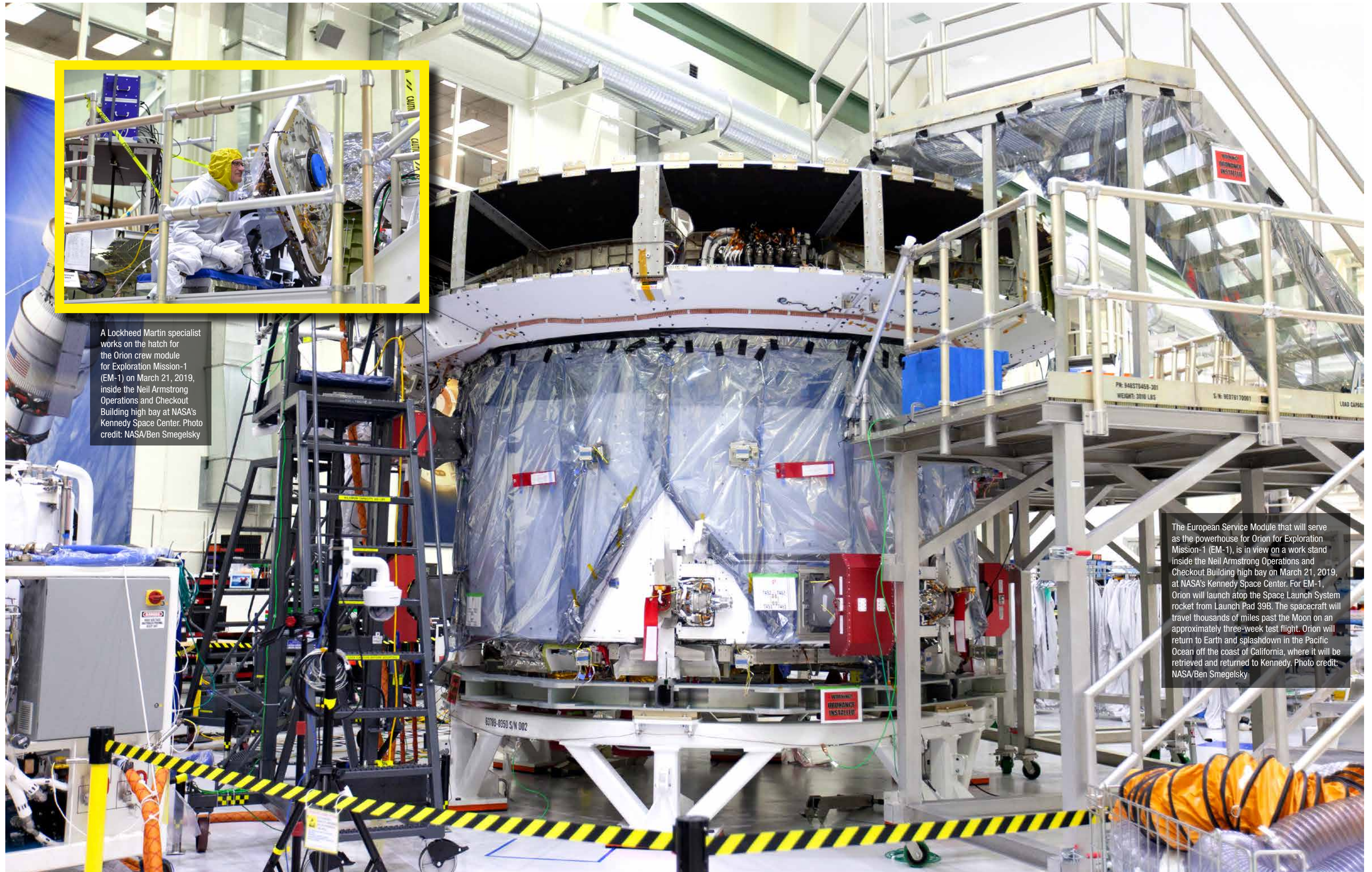
"Our efforts are providing nutritional and psychological benefits to space station crews," Cabana said.

Habitability modules are being produced across the nation for NASA's Next Exploration for Technologies Partnerships, or **NextSTEP**, program. One of the modules being reviewed by astronauts at the center's Space Station Processing Facility was built by Lockheed Martin using an older logistics cargo module from the space station

"This is our year and we've got so much to accomplish. And get ready for even more in 2020," Cabana said. "We are an integrated team. This is a community effort. Let's keep working together."



The iconic Vehicle Assembly Building (VAB) and Launch Control Center cast reflections on the surface of a nearby waterway at NASA's Kennedy Space Center. The lights illuminating the VAB provide a splendid nighttime view. Photo credit: NASA/Ben Smegelsky



A Lockheed Martin specialist works on the hatch for the Orion crew module for Exploration Mission-1 (EM-1) on March 21, 2019, inside the Neil Armstrong Operations and Checkout Building high bay at NASA's Kennedy Space Center. Photo credit: NASA/Ben Smegelsky

The European Service Module that will serve as the powerhouse for Orion for Exploration Mission-1 (EM-1), is in view on a work stand inside the Neil Armstrong Operations and Checkout Building high bay on March 21, 2019, at NASA's Kennedy Space Center. For EM-1, Orion will launch atop the Space Launch System rocket from Launch Pad 39B. The spacecraft will travel thousands of miles past the Moon on an approximately three-week test flight. Orion will return to Earth and splashdown in the Pacific Ocean off the coast of California, where it will be retrieved and returned to Kennedy. Photo credit: NASA/Ben Smegelsky

Dragon Will Deliver Experiments, Supplies to International Space Station

COMMERCIAL RESUPPLY SERVICES MISSION: SpaceX CRS-17

Launch: Late April 2019

Lift Off: Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida

Launch Vehicle: SpaceX Falcon 9, 230 feet tall

Spacecraft: Dragon cargo module, 20 feet high, 12 feet in diameter

Payload: Dragon will deliver cargo and material to support science investigations aboard the International Space Station, including the Orbiting Carbon Observatory (OCO), the Space Test Program-Houston 6 (STP-H6) x-ray communication investigation, and the Genes in Space student experiment.

Return to Earth: After about one month attached to the space station, Dragon will return with results of earlier experiments, splashing down in the Pacific Ocean off the coast of Baja California.



The SpaceX two-stage Falcon 9 launch vehicle lifts off Space Launch Complex 40 at Cape Canaveral Air Force Station carrying the Dragon resupply spacecraft to the International Space Station. Liftoff was at 1:16 p.m. EST on Dec. 5, 2018. Photo credit: NASA/Tony Gray and Kenny Allen



InSight's (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) Principal Investigator W. Bruce Banerdt presents information on the first launch to Mars from the West Coast and the latest findings from InSight to Kennedy Space Center employees on March 12, 2019, at the center's Space Station Processing Facility Conference Center in Florida. InSight is a NASA Discovery Program mission that placed a single geophysical lander on Mars to study the Red Planet's deep interior and will ultimately provide a better understanding of the processes that shaped the rocky planets of the inner solar system, including Earth. Photo credit: NASA/Kim Shiflett



InSight's (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) Principal Investigator W. Bruce Banerdt and Launch Services Program Mission Manager Alicia Mendoza-Hill present information on the first launch to Mars from the West Coast and the latest findings from InSight to Kennedy Space Center employees on March 12, 2019, at Kennedy's Space Station Processing Facility Conference Center in Florida. Photo credit: NASA/Kim Shiflett

NASA's Kennedy Space Center Innovators' Launchpad:

Daren Etienne



Daren Etienne is the information technology specialist of the Exploration Research and Technology Programs at NASA's Kennedy Space Center. Photo credit: NASA/Kim Shiflett

Please explain your job in a single sentence.

I am the information technology specialist of the Exploration Research and Technology (ER&T) Program supporting civil servants, contractors and commercial partners, satisfying their **IT and communication needs**.

What do you find most exciting about your job as IT specialist lead?

The most exciting thing that I have found in my new role is being able to interface with the many different aspects of ER&T program and assisting them in achieving their mission goals by supporting various unique requests.

What is a typical day like for you?

My days are consistently inconsistent. They vary from assisting a commercial partner rationalize an IT requirement, ordering products and services for a project, or providing IT expertise to a particular NASA resource board.

Was the work you did your first month at NASA anything like your current work?

The closest activity that could be comparable to my first month as an intern is that I am back working with **commercial partners** to utilize the center's many assets.

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

I have a Bachelor of Science in Business Administration. I used to work with my grandmother as a youth in her store selling fruits and vegetables. I thought I would grow up and take over the business when I got older and that a degree would help hone my business skills.

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

Growing up in South Florida in the '90s with siblings two, four, then 11 years apart, all I knew is that my father made things happen

for us. We never wanted for anything and the funds were always on the kitchen table, even for the field trips we didn't want to go to. I don't take a single day working on center for granted since I know the effort that was put into getting me to this point in my life.

What motivated you to want to work for NASA?

My motivation came from needing to **secure an internship** to graduate from my university. As soon as I got off the phone informing me that I was accepted for the internship, I let my parents know. To this day, I still bring up my dad saying, "Isn't NASA shutting down?" I truly didn't know much about the space program at the time, but if they were going to offer me an internship, I was going to make the best of it. Six years later, I'm still learning something new every day.

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

In order to continue advancing as a civilization, we have to put the time and effort into developing paths forward. If we stopped at the wheel and fulcrum, I certainly don't believe we would be where we are today. Can you imagine still having to have a separate camera and phone with external antennas?

How do you think your NASA research or the agency as a whole benefits people on Earth?

There are so many **NASA contributions to society** that people constantly overlook the agency's impact. I would highly recommend for all NASA employees even to check out the annual "**Spinoff**" publications to stay abreast of all the wonderful things the agency is doing.

Do you have any advice for people trying to foster innovation in the workplace?

Not all ideas will work out, but if it only remains an idea forever, it never will. Be open to feedback and collaboration to have your idea become a reality.

Efforts Rewarded

Tech Transfer Office, AFTU project receive recognition

BY DANIELLE SEMPSROTT

Last year, Kennedy Space Center led NASA technology transfer with the highest number of patent licenses—18. Recently, the center's Technology Transfer Office was presented with an internal award for the achievement. Daniel Lockney, NASA Headquarters **Technology Transfer program** executive, presented the team with the trophy via Skype.

Lockney first introduced the internal trophy three years ago as a way to incentivize healthy competition among NASA's 10 centers for patent licensing. This trophy travels to the winning center for one year at a time, and this year, Kennedy will have it on display, "cementing Kennedy's place in tech transfer," said Lockney.

Patent licensing enables outside companies to use technology developed by NASA in commercial products and services that benefit the public. Thanks to the agency's robust Technology Transfer program, NASA's innovative solutions are found in hospitals, factories, family rooms and more, where they **benefit everyone**.

Among the employees recognized were Jim Nichols, Kennedy licensing manager; Jonathan Leahy, Kennedy licensing attorney; Ginger Arrington, licensing paralegal; Jeff Kohler and Kurt Kessel, technology transfer specialists; and Lewis Parrish, senior technology transfer specialist.

Shawn Quinn, director of engineering at Kennedy, also recognized individuals supporting the Autonomous Flight Termination Unit (AFTU) on behalf of Kennedy. The team is part of a joint project among NASA, the U.S. Air Force, the Defense Advanced Research Projects Agency (DARPA), and the Federal Aviation Administration (FAA) slated to receive the Federal Laboratory Consortium (FLC) for Technology Transfer 2019 Interagency Partnership Award on April 24 at the FLC national meeting in Orlando.

Lisa Valencia, project manager of the Autonomous Flight Termination System in the Engineering Directorate; Parrish; Erik Magnuson, AFTU systems engineer; Roger Zoerner, AFTU software engineer, and many others on the team worked on the development and transfer of this technology.

According to the FLC, the award recognizes these agencies for "collaboratively accomplishing outstanding work in the process of

transferring a technology." The FLC represents over 300 federal laboratories, and the AFTU competed with multiple nominations across the U.S. government for this award, resulting in Kennedy being the only NASA center to win a FLC award this year. The FLC stated that the AFTU's nomination was "truly of the highest caliber."

The AFTU is a subsystem that allows the rocket it is flown on to independently determine if it is off course and self-destruct if it discovers this is the case. "This system eliminates the need for ground personnel, transmitters, telemetry receivers and radars historically used for monitoring rocket launches and commanding launch vehicle destruction when a rocket goes off course," Parrish said.

Quinn spoke on the significance of this technology, stating "The AFTU is not only an important endeavor for NASA to make launch operations safer and more efficient from a time and cost perspective, but through the transfer of this enabling technology, it also has a multiplier effect across the entire space industry."

Both the AFTU hardware and software were developed by the technical team at Kennedy led by Valencia. This team worked closely with the Air Force to develop the Core Autonomous Safety Software (CASS), which is the software that provides the rules and restrictions that enables the launch vehicle to make destruction decisions and, thus, is flown on any vehicle using AFTU technology. DARPA, another key agency in the development of this project, provided the necessary funding and launch opportunities for the development and testing of this CASS software and AFTU technology. Additionally, the FAA assisted with writing and approving NASA AFTU requirements for design, testing and operation.

One flight test of this technology was enabled by NASA's **Flight Opportunities program**, which aims to provide access to space-related test environments through the use of four types of flight platforms as a way to demonstrate technical readiness. Through this program, two AFTUs were flown on UP Aerospace's SpaceLoft (SL)-12 mission, and another test is scheduled for the SL-14 mission.

Parrish's role in the process was to lead the technology transfer

aspect of this project and provide transfer support to Valencia's office, including software release review and approval, vetting companies requesting to receive the AFTU design package, working with export control, and completing technology transfer and software usage agreements. In addition, Parrish marketed the technology to emerging commercial space companies, further expanding awareness that ultimately led to transferring the technology to outside companies.

The AFTU technology currently has been transferred to 35 recipients, including commercial space companies and Department of Defense agencies, and will be fully operational by summer. The team at Kennedy is making available the reference design drawings and generic wrapper software that will allow custom implementation by each partner. Rocket Lab will be the first company to use the AFTU as is, while other companies, such as SpaceX, have already started using the software derived from this

technology. Parrish continues to actively work on this project. "Being able to help move NASA-developed technologies out of the laboratories and into use by the public is the most gratifying aspect of my job," said Parrish.

"Every time I hit that 'send' icon to transfer those design files, that technology benefits yet another customer who can utilize it for safer, more affordable launches of their rockets and payloads," he said. "My hope is that the awareness of this technology will continue to grow across the space industry."

While receiving the FLC's Interagency Partnership Award acknowledges Kennedy's capabilities in developing cutting-edge technology, the sheer number of patent licenses put out by the center's Technology Transfer Office demonstrates research and technology advancements made at the multi-user spaceport supports U.S. economic competitiveness and enables NASA's exploration missions.



Kennedy Space Center Director Bob Cabana (center), stands among individuals from NASA's Technology Transfer Office who received an internal award for leading the agency in technology transfer with 18 patent licenses. Also recognized were individuals supporting the Autonomous Flight Termination Unit, a project that has received the Federal Laboratory Consortium (FLC) for Technology Transfer 2019 Interagency Partnership Award. The recognitions took place March 18, 2019, at Kennedy. From left are, Kurt Kessel, Technology Transfer specialist; Megan Victor, Business Development specialist; Mikaela McShane, Technology Marketing and Communications specialist; Lew Parrish, senior Technology Transfer specialist; Jim Nichols, Kennedy licensing manager; Dave Makufka, Kennedy Technology Transfer Program manager; Cabana; Erik Magnuson, AFTU systems engineer; Lisa Valencia, NASA AFTU project manager; Roger Zoerner, AFTU software engineer; Meredith Reeves, Kennedy new technology representative; Mike Lester, Technology Transfer Partnership manager; and Jonathan Leahy, Kennedy patent attorney. Photo credit: NASA/Tony Gray



James Fesmire, senior principal engineer, transfers a charged Cryogenic Flux Capacitor device to a bath of water in the Cryogenics Test Laboratory at NASA's Kennedy Space Center on March 20, 2019. This demonstration is a visual aid that conveys that a large quantity of fluid is stored in the device at low temperature. Photo Credit: NASA/Kim Shifflett

SAFETY AND HEALTH DAYS

A reinforcement of Kennedy Space Center's safety culture

BY DANIELLE SEMPSROTT

Each year, NASA Kennedy Space Center's Safety and Health Days demonstrates how this topic is not only a top priority both centerwide and agencywide, but that it's ingrained in the spaceport's DNA. This year's Safety and Health Days took place March 25–29. Events and presentations held during the week emphasized the importance Kennedy places on the wellbeing of its employees, both at home and at work.

A few of the classes and presentations open to employees included: "Stop the Bleed," a hands-on course that teaches basic life-saving interventions to equip individuals with the knowledge and power to act quickly and save lives; "Moments Matter," where

a flight crash survivor revealed how resiliency, leadership and managing your mind can help you overcome obstacles to grow and thrive; and a briefing on the "Space Launch System Low Oxygen Tank Mishap," in which a team of investigators delved into the cause of the incident and discussed recommendations and corrective actions that have helped to prevent future incidents at Kennedy.

Also available for employees were presentations on how to determine if you are getting a good night's sleep, the seriousness of skin cancer and what to look for, the Crimeline, safety awareness, crime prevention and education program, presented by Brevard County's well-known Sheriff Wayne Ivey, and the importance of



Kennedy Space Center employees and guests take off at the start of the Florida spaceport's annual KSC Walk Run on March 26, 2019. Part of Kennedy's Safety and Health Days, the event takes place at the Shuttle Landing Facility runway and offers participants the chance to partake in a two-mile walk or run, a 5K or a 10K. Photo credit: NASA/Ben Smegelsky

Cyclists take off from the Kennedy Space Center Visitor Complex at the start of the center's annual Tour de KSC. The bicycle tour took place March 30, giving Kennedy employees and guests the opportunity to choose from three different routes that ranged from seven to 33 miles along some of the Florida spaceport's most notable facilities such as the Vehicle Assembly Building, the Shuttle Landing Facility and historic Launch Pad 39As. Photo credit: NASA/Ben Smegelsky



safe behaviors at home and at work. In addition to presentations, Kennedy and Cape Canaveral Air Force Station employees had the opportunity to attend the KSC Walk Run on March 26. Employees and up to four of their registered guests were able to participate in two-mile walk or run, a 5K run, or a 10K run.

The Tour de KSC, a bike tour on Kennedy grounds open to employees and up to five guests per employee, is another event employees are encouraged to attend. Originating in 2009, the Tour de KSC is another way the spaceport promotes an active lifestyle and a healthy work-life balance. This year's tour took place March

30, with attendees riding alongside Center Director Bob Cabana, an avid bicyclist.

In addition to the presentations and events that took place during the week, Kennedy offers year-round fitness center and balance zone classes every week, giving employees the opportunity to improve and maintain their health throughout the year. The activities and information readily available to all employees reinforce the notion that health and safety continues to be a hallmark of Kennedy's values — not only during this week, but throughout the entire year.



Derwin Bradley, a veteran police officer and former soldier, speaks to Kennedy Space Center employees on the topic of personal safety and awareness. The presentation was held March 27, 2019, as part of the Florida spaceport's Safety and Health Days. During the presentation, Bradley also demonstrated basic self-defense tactics. Photo credit: NASA/Kim Shiflett

Earth Day Celebrations Take Flight at Kennedy

By Danielle Sempsrott

This year, Kennedy Space Center kicked off its annual Earth Day celebrations with a butterfly release and sustainability expo at the center's visitor complex. On April 11, approximately 40 exhibitors from across the nation assembled to provide information ranging from energy-saving solutions to wildlife and natural conservation.

Also on display were electric cars for attendees to admire. Plant and wildlife specialists from organizations such as Merritt Island Wildlife Refuge and the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS), among others, were there to provide expertise on safeguarding wildlife and preserving natural resources.

Continuing the center's Earth Day focus, Kennedy employees had the opportunity to attend two lunch and learns, held April 23 and 24, to further learn about ways in which we can protect our natural environment. Florida Fish and Wildlife Conservation Commission Investigator Steve Wayne and Officer Jeff Sidor brought a special K9, Harry, for a demonstration. Dogs such as Harry are trained to locate protected species and detect non-native wildlife that can be harmful to native flora and fauna.

Sally Scalera, urban horticulture agent and master gardener coordinator from the UF/IFAS Brevard Extension office, led the second lunch and learn, which educated employees on ways to make their yards Florida-friendly. Topics included using native plants to reduce water consumption, reducing turf area, watering efficiently and learning how to employ integrated pest management.

For more than five decades, NASA has used the vantage point of space to understand and explore our home planet, improve lives and safeguard our future. The activities held at Kennedy in celebration of Earth Day further promote awareness of our planet's natural resources and strengthen the center's emphasis on the importance of sustainability. They encourage employees and guests to engage in practices that benefit the environment, both at work and at home.

Top right: A butterfly sits in the palm of a visitor's hand at the Kennedy Space Center Visitor Complex in Florida. Kennedy kicked off its annual Earth Day celebrations with a sustainability expo at the visitor complex on April 11, 2019, where butterflies were released throughout the day. Photo credit: NASA/Isaac Watson

Bottom right: Members of the Florida Native Plant Society converse with visitors during a sustainability expo held at the Kennedy Space Center Visitor Complex in Florida on April 11, 2019. The expo kicked off Kennedy's annual Earth Day celebrations. Photo credit: NASA/Isaac Watson

Background: A newly released butterfly sits in a cluster of flowers at the Kennedy Space Center Visitor Complex on April 11, 2019. Photo credit: NASA/Isaac Watson



In Memoriam

Richard G. Smith

1929 - 2019



Richard G. Smith, a former director of NASA's Kennedy Space Center in Florida, passed away March 14, 2019, in Decatur, Alabama. He was 89 years old.

Smith served as director of Kennedy from Sept. 26, 1979 to Aug. 2, 1986. During his years as director, the buildup of the space shuttle was completed, 25 space shuttle missions were launched and planning efforts began for the International Space Station.

At the beginning of his career, Smith became a member of the rocket research and development team at Redstone Arsenal in Alabama in 1951. He transferred to NASA in July 1960 when the Development Operations Division of the Army Ballistic Missile Agency became the nucleus for the establishment

of the George C. Marshall Space Flight Center in Huntsville.

Smith served in various positions at Marshall, including in the former Guidance and Control Laboratory and in the Systems Engineering Office prior to being appointed deputy manager and later manager of the Saturn Program. In 1974, Smith was named deputy director of the Marshall Center.

In August 1978, Smith accepted a one-year assignment as deputy associate administrator for Space Transportation Systems at NASA Headquarters in Washington. He served as director of the Skylab Task Force, appointed by the NASA administrator to represent NASA preceding and following the re-entry of Skylab.

For his contributions to the Apollo Lunar Landing Program and the Skylab Program, Smith received the NASA Medal for Exceptional Service in 1969 and the NASA Medal for Distinguished Service in 1973. Smith was inducted into the Alabama Engineering Hall of Fame in 2011.

Smith was born in Durham, North Carolina, in 1929. He attended Florence State College and Auburn University in Alabama, where he received a bachelor's degree in electrical engineering in 1951. In June 1981, he was awarded an honorary doctorate of science degree by Florida Institute of Technology in Melbourne, Florida. He also was awarded an honorary doctorate of science degree by his Alma Mater, Auburn University, in December 1983.

He is survived by his wife of close to 66 years, Louise Self Smith, two daughters, two grandchildren and four great-grandchildren.

NASA ON THE AIR

Participants tuned in, tweeted around the world

BY RACHEL COX

In a surprising and touching turnout, tens of thousands of people around the world turned on their ham (or amateur) radios to participate in several "NASA on the Air" events held over the past year. "This was a beautiful thing," said Kevin Zari, head of the amateur radio club at NASA's Kennedy Space Center. Zari especially loved the event photos tweeted by people from different countries.

Radio clubs from 10 NASA centers and the Jet Propulsion Laboratory in Pasadena, California, all supported the yearlong event. Ham radio operators tuned in from all 50 U.S. states and 56 countries across six continents to chat with NASA personnel. "There were times in our log where we had 20 contacts a minute – it was that quick. And there were other more relaxed times, where we were able to just sit and talk," said Zari. "I don't know how many times people said, 'We thought NASA was gone. We thought NASA was dead.' So we educated people around the world."

The NASA on the Air event wrapped up with three special opportunities for people to use their radios to download images from the International Space Station. This was done in coordination with Amateur Radio on the International Space Station (ARISS), an international consortium of amateur radio organizations and space agencies. ARISS encourages young people to explore science, technology, engineering and math through the use of ham radios, and their program works to connect students worldwide with astronauts onboard the space station.

For the final three events, cosmonauts on the station transmitted several NASA on the Air images from space. Participants could compete to collect images and upload them to a website for credit. Over 34,600 uploads were received from 18,619 participants.

The reaction to NASA on the Air was so positive, NASA Radio Clubs plans to activate NASA on the Air for special anniversaries in 2019 and beyond (e.g. 50th Anniversary of Apollo 11). Follow @NASARadioClubs on Twitter or join the **NASA on the Air (NOTA) group** on Facebook for notifications of future activities.



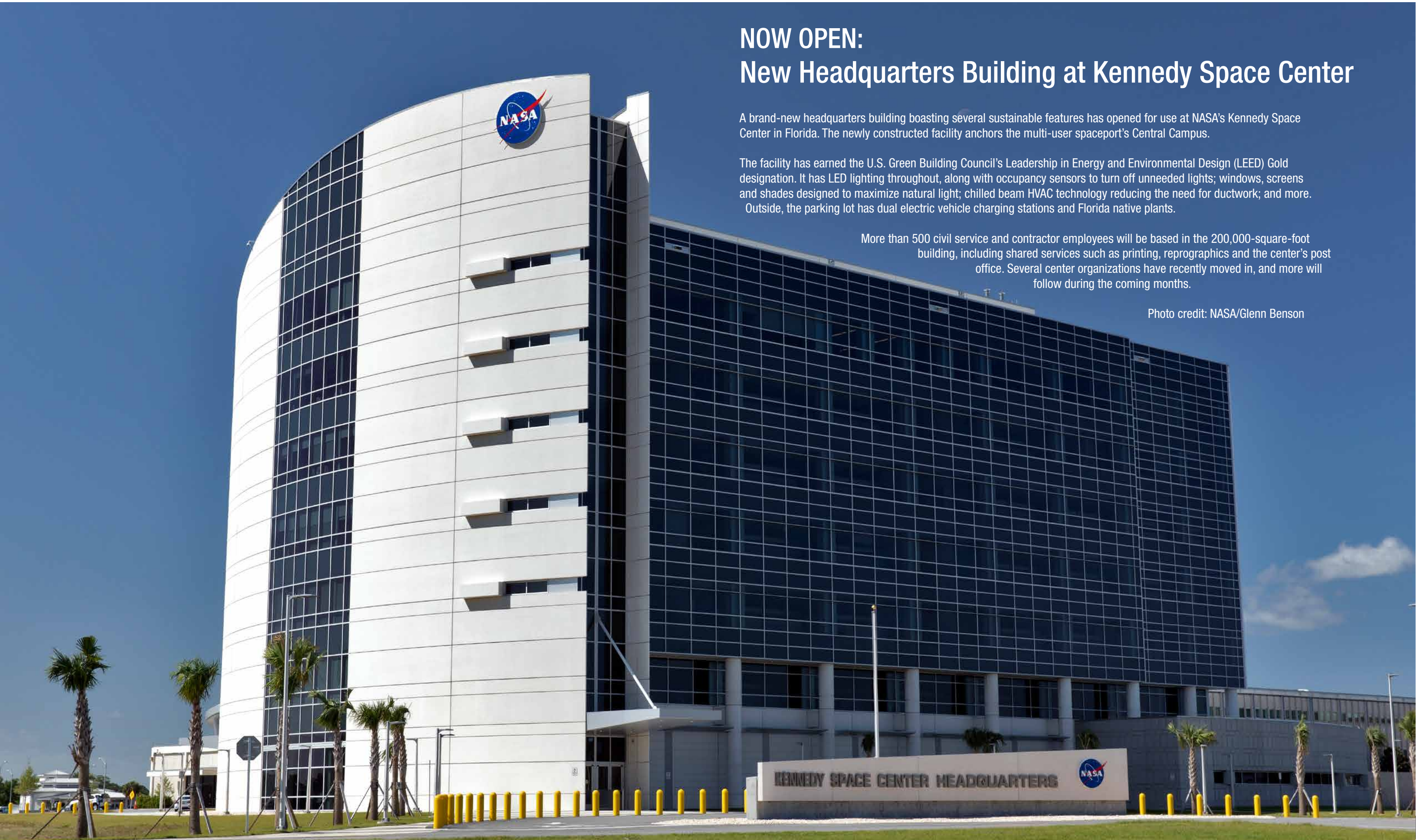
NOW OPEN: New Headquarters Building at Kennedy Space Center

A brand-new headquarters building boasting several sustainable features has opened for use at NASA's Kennedy Space Center in Florida. The newly constructed facility anchors the multi-user spaceport's Central Campus.

The facility has earned the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Gold designation. It has LED lighting throughout, along with occupancy sensors to turn off unneeded lights; windows, screens and shades designed to maximize natural light; chilled beam HVAC technology reducing the need for ductwork; and more. Outside, the parking lot has dual electric vehicle charging stations and Florida native plants.

More than 500 civil service and contractor employees will be based in the 200,000-square-foot building, including shared services such as printing, reprographics and the center's post office. Several center organizations have recently moved in, and more will follow during the coming months.

Photo credit: NASA/Glenn Benson





Our Refuge

NASA'S KENNEDY SPACE CENTER
NATIONAL WILDLIFE REFUGE

WADING BIRDS

BY REBECCA BOLT (KEMCON)

The wading birds are one of the most numerous and visible components of our Kennedy Space Center wildlife assemblage. Just learning to notice these beautiful creatures at the edges of the waterways as we travel to and from work will help make the routine drive a more enjoyable, relaxing experience. Warning: Once you start looking, you will see them everywhere!

Exactly what is a wading bird?

“Wading bird” or “wader” is an informal term used to describe a group of long-legged birds that typically feed in shallow wetlands. There are 14 species of waders found at Kennedy: great blue heron, great egret, snowy egret, little blue heron, tricolored heron, reddish egret, cattle egret, green heron, black-crowned night-heron, yellow-crowned night-heron, white ibis, glossy ibis, roseate spoonbill and wood stork.

What kinds of habitats do they use?

Waders are found in open water and marshes that can be fresh, brackish, or salty. The water must be shallow because they do not dive or swim to catch food. Edges of lakes, rivers, streams, estuaries, ocean, ditches and retention ponds are all used for feeding. Some species of waders, particularly cattle egrets and ibises, will feed in fields and lawns.

What do they eat?

You name it, and one of the wading bird species will eat it! Aquatic invertebrates, insects, fish, frogs, lizards, snakes, small mammals, and even other birds are all on the list of wading bird prey. The herons and egrets use their long pointed bills to grab or stab prey,



A Great Blue Heron wades in a waterway at NASA's Kennedy Space Center. Photo credit: NASA/Glen Benson

and the ibises' curved bills are perfectly shaped for probing into mud and grass. Roseate spoonbills and wood storks are tactile feeders. As they wave their partially open bills through the water, receptors on the inside of the bill help them feel prey items. They can feed in water that is dark or murky because they don't need to see the food to find it. All of these different configurations of bill shapes and sizes make it possible for so many wading bird species to live together in the same place at the same time.

Where do wading birds nest?

The 14 species of wading birds found at Kennedy are colonial nesters, meaning that they nest in large

mixed-species groups called colonies. A colony can have just a few nests or thousands of nests. Trees and shrubs located near water are used for nesting; the preferred substrate for Kennedy's wading birds is mangrove. Colonial nesting is a good strategy because there are so many birds to help detect and mob predators, find food resources, and numerically reduce the chances for each individual bird of getting eaten by a predator.

How many wading birds are there on Kennedy?

Based on data collected on Kennedy wading birds from 1987 through 2016, there is an average of 2,081 wading bird nests each year, and an estimated average of 5,140 wading birds present at any given time. That's a lot of birds!

What are the threats to wading birds?

In the 1800s, millions of wading birds were killed so that their beautiful feathers could be used by the fashion industry on hats. Laws passed in the early 1900s made this practice illegal and many species' populations rebounded. Current threats include loss and degradation of wetlands habitat to development and sea level rise. Four of the species of waders on Kennedy (little blue heron, tricolored heron, reddish egret, and roseate spoonbill) are protected as Threatened by the State of Florida and the wood stork is federally listed as Threatened under the Endangered Species Act.



Two juvenile roseate spoonbills pause near a waterway at Merritt Island National Wildlife Refuge in Florida. NASA's Kennedy Space Center shares boundaries with the refuge. Photo credit: NASA/Bill White



A Little Egret wades in a waterway in an area called Wilson's Corner in the Merritt Island National Wildlife Refuge near NASA's Kennedy Space Center. The bird is one of more than 330 native and migratory bird species that call Kennedy and the wildlife refuge home. Photo credit: NASA/Glen Benson

Why are wading birds beneficial?

Waders have much to offer on many levels. From a global perspective, they are an excellent indicator of wetlands health. When wading bird populations are declining, it is likely because their wetlands are suffering from direct or indirect ecosystem damage. At the local level, Merritt Island National Wildlife Refuge is a premier birding site in Florida and home to the annual Space Coast Birding and Wildlife Festival, one of the largest birding festivals in the U.S. Thousands of tourists from all over the world visit this area to see

reddish egrets, roseate spoonbills, and wood storks, along with the 300+ other bird species that occur on the refuge. This has significant impact on our local economy. At a personal level, because wading birds are large and often stay still for long periods of time, beginning bird watchers, and especially children, can enjoy finding and learning about these birds without getting frustrated or needing binoculars. With just a little bit of effort and attention, anyone can find a wader to watch!



Columbia Flies

Just seconds past the scheduled launch time of 7 a.m. on April 12, 1981, America's Space Transportation System becomes a fact, with the liftoff of the first space shuttle from Launch Pad 39A. The successful maiden flight of the new concept in space vehicles took astronauts John Young and Robert Crippen into an Earth orbital mission scheduled to last 54 hours, concluding with an unpowered landing at Edwards Air Force Base in California. Photo credit: NASA

National Aeronautics and Space Administration

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