October 2019 Vol. 6 No. 9

National Aeronautics and
Space Administration

KENNEDY SPACE CENTER'S

SPACEPORT magazine

SLS Pathfinder Practice

KENNEDY SPACE CENTER'S

SPACEPORT MAGAZINE

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The 212-foot-long Space Launch System Core Stage pathfinder arrived at the north end of the transfer aisle inside the Vehicle Assembly Building (VAB) at NASA's Kennedy Space Center on Oct. 3, 2019. A cover, called a spider, will be attached to the top of the pathfinder. With the spider secured in place, a crane will be attached to it to lift the pathfinder into the vertical position. The pathfinder arrived aboard NASA's Pegasus Barge at Kennedy's Launch Complex 39 turn basin wharf on Sept. 27, 2019, its first delivery to Kennedy in support of the agency's Artemis missions. Exploration Ground Systems and its contractor, Jacobs, will practice stacking maneuvers in the VAB, using ground support equipment to train employees and certify all the equipment works properly. Photo credit: NASA/Kim Shiflett

To get the latest Kennedy Space Center updates, follow us on our Blog, Flickr, Facebook and Twitter.

Kennedy Space Center has its own monthly podcast. Welcome to the "Rocket Ranch."

Check out **Episode 14**: The Kids of Summer, and **Episode 15**: Jedi Masters of Launchery. Read the full transcripts and catch up on missed episodes at https://www.nasa.gov/kennedy/rocketranch.

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Amy Jager, left, and Jessica Langley, both systems engineers with The Aerospace Corporation, are supporting Kennedy Space Center's Artemis Generation. Photo credit: NASA/Tammy Long

Artemis Generation

Amy Jager and Jessica Langley, with The Aerospace Corporation, are two of the engineers who are supporting NASA Kennedy Space Center's Deep Space Gateway Logistics Element (GLE) with systems engineering and integration activities.

The Artemis Generation professionals focus on GLE project documentation, draft requirements and integration activities, including computer-aided design models of a notional logistics module for Gateway analyses.

Jager has been a self-proclaimed human spaceflight nerd since her dad took her to Kennedy Space Center Visitor Complex. "I'm excited to be a part of the next Moon landing since I missed it the first time!" Jager said.

Langley grew up in Titusville, on the Space Coast. Her father worked on the Space Shuttle Program. She decided to follow in his footsteps because "human spaceflight is the coolest part of aerospace engineering," Langley said.

LARGE and on a BARGE

SLS core stage pathfinder arrives at Kennedy Space Center

BY DANIELLE SEMPSROTT

NASA's Pegasus barge arrived at the agency's Kennedy Space Center in Florida on Sept. 27, carrying the 212-foot-long **core stage pathfinder** for the **Space Launch System (SLS)** rocket. Weighing in at 228,000 pounds, the pathfinder is a full-scale mock-up of the rocket's core stage and will be used to validate ground support equipment and demonstrate it can be integrated with Kennedy facilities.

After arriving at the Launch Complex 39 turn basin wharf – a docking area initially used during the Space Shuttle Program that has been **modified** to accommodate SLS hardware deliveries – the pathfinder was moved into the Vehicle Assembly Building (VAB) on Sept. 30, where it remained for testing for about one month.

While in the VAB, pathfinder provided NASA's **Exploration Ground Systems (EGS)** and contractor Jacobs with the opportunity to practice stacking maneuvers in the VAB's High Bay 3 prior to the arrival of the SLS flight hardware that will be processed for the agency's **Artemis I** mission.

"This will help ensure that all core stage engineers and technicians are trained and certified in preparation for the flight core stage processing," said Jim Bolton, EGS core stage element operations manager at Kennedy. "It's a very significant milestone that will demonstrate the capabilities and ability for KSC to receive, process and integrate that flight hardware."

The core stage – the largest rocket stage in the world and the backbone of SLS – will provide the power necessary to send NASA's Orion spacecraft beyond Earth's orbit and to the Moon. Before it can be brought to Kennedy for processing, the core stage will undergo its first full test with all flight hardware, known as a **green run,** at the agency's Stennis Space Center in Mississippi. Following this, Pegasus will make its return journey to Kennedy in 2020 – this time, delivering the SLS core stage for launch.

Learn more about the SLS rocket's pathfinders at: **https://go.nasa.gov/2ngTev8**.

The 212-foot-long Space Launch System rocket core stage pathfinder is moved into the low bay of the Vehicle Assembly Building at NASA's Kennedy Space Center on Oct. 1, 2019. NASA's Pegasus barge arrived at the Launch Complex 39 turn basin wharf on Sept. 30, 2019, making its first delivery to Kennedy in support of the agency's Artemis missions. Photo credit: NASA/Kim Shiflett

NASA's Pegasus barge arrived at the Launch Complex 39 turn basin wharf at Kennedy Space Center to make its first delivery to Kennedy in support of the agency's Artemis missions. The upgraded 310-foot-long barge arrived Sept. 27, 2019, ferrying the 212-foot-long Space Launch System rocket core stage pathfinder. The pathfinder is a full-scale mock-up of the rocket's core stage. Photo credit: NASA/Mike Downs

Left: NASA's Ionospheric Connection Explorer (ICON) was attached to the Northrop Grumman Pegasus XL rocket inside Building 1555 at Vandenberg Air Force Base in California on Sept. 10, 2019. Photo credit: NASA/Randy Beaudoin

Airborne Launched

NASA's ICON satellite begins study of Earth's ionosphere

BY DANIELLE SEMPSROTT

A Northrop Grumman Pegasus XL rocket launched NASA's Ionospheric Connection Explorer, or ICON, satellite at 9:59 p.m. EDT on Oct. 10 from Cape Canaveral Air Force Station (CCAFS) to study the dynamic zone in our atmosphere where terrestrial weather from below meets space weather from above.

The satellite was attached to the Pegasus XL rocket, which hitched a ride on the company's L-1011 Stargazer aircraft. Once the aircraft reached an altitude of 39,000 feet, the rocket was dropped, with ignition occurring five seconds after.

"This is a fun launch. In my operational function, this is about as good as it gets," said Omar Baez, launch director in NASA's Launch Services Program. "The anxiety level is higher, the adrenaline is flowing, but what a cool way to fly."

Originally targeting a 9:30 p.m. drop, NASA and Northrop Grumman determined to bypass the first drop attempt due to a loss of communication between ground teams at CCAFS and the Stargazer.

"When your launch pad is moving at 500 to 600 miles per hour, things happen," said Baez. "The first attempt got us because we lost positive communication with the aircraft and the ground, and our rule is to abort the flight and go back around and try it again. And we were able to execute it flawlessly."

The region of space where ICON will conduct its study – the ionosphere – comprises of winds that are influenced by many different factors: Earth's seasons, the heating and cooling that takes place throughout the day, and bursts of radiation from the Sun.

This region also is where radio communications and GPS signals travel, and fluctuations within the ionosphere can cause significant disruptions to these critical technologies.

As a response to the recent scientific discovery that the ionosphere is significantly impacted by storms in Earth's lower atmosphere, Northrop Grumman designed, integrated and tested the ICON satellite under a contract from the University of California Berkeley's Space Sciences Laboratory. NASA's Launch Services Program at Kennedy is responsible for launch service acquisition, integration, analysis and launch management.

The ICON mission is part of NASA's Explorer Program managed by the agency's Goddard Space Flight Center in Maryland for the Science Mission Directorate in Washington, which aims to provide frequent flight opportunities for small- to medium-sized spacecraft that are capable of being built, tested and launched in a shorter period of time.

ICON is expected to improve the forecasts of extreme space weather by utilizing in-situ and remote-sensing instruments to survey the variability of Earth's ionosphere. The mission also will help determine the physics of our space environment, paving the way for mitigating its effects on our technology, communications systems and society.

Learn more about NASA's ICON mission and mission updates at: https://www.nasa.gov/icon

Northrop Grumman's L-1011 Stargazer aircraft, with the company's Pegasus XL rocket attached beneath, takes off from the Skid Strip runway at Cape Canaveral Air Force Station in Florida on Oct. 10, 2019. NASA's Ionospheric Connection Explorer (ICON) is secured inside the rocket's payload fairing. The air-launched Pegasus XL was released from the aircraft at 9:59 p.m. EDT to start ICON's journey to space. Photo credit: NASA/Frank Michaux

Award Winner

Kennedy employee receives "All-Star" recognition

BY DANIELLE SEMPSROTT

From the time she was 11 years old, Tiffaney Miller Alexander, Ph.D., knew she wanted to be an electrical engineer and work for NASA. Now, after having chased that dream and turned it into reality, she is being recognized as a Technology All-Star by Career Communications Group, Inc.'s Women of Color magazine.

Founded in 1985, Career Communications Group, Inc. aims to shed light on career achievements of women within the science, technology, engineering and math (STEM) fields. One way they do so is by hosting an annual Women of Color STEM Conference and presenting awards to a select few group of women. This year, Alexander was among those honored with the Technology All-Star Award during a luncheon on Oct. 4, 2019, in Detroit, Michigan.

Tiffaney Miller Alexander is chief of the Exploration Ground Systems safety branch at NASA's Kennedy Space Center in Florida. Photo credit: NASA

"I didn't get here by myself, I stood on the shoulders of so many other great people and had a great support system," said Alexander, chief of **Exploration Ground Systems' (EGS)** safety branch at NASA's Kennedy Space Center in Florida. "This award means a lot to me, and if I can use this to inspire others, that's what it's all about."

Initially nominated for the Women of Color Professional Achievement Award by **Kelvin Manning**, associate director, technical, at Kennedy, Alexander was unaware of and honored by the effort Manning and her management put into the nomination. In Manning's nomination letter, he "enthusiastically recommended her," stating that her "technical yet natural leadership style pulls teams together who respect her and trust her judgment, allowing her to lead and inspire a new generation in the pursuit of excellence."

In her current role, Alexander is responsible for management planning, directing, and coordinating the work of EGS safety engineers and specialists – those individuals who assure the safety of vehicle ground support equipment that will support Artemis missions to the **Moon and to Mars**.

Having always enjoyed helping people, and now being in a supervisory role, Alexander said her favorite part of her job is having the opportunity to guide her team members and help them grow.

"I pinch myself every day that I get to come and do what I love," she said. "I learn so much from my team, they're brilliant and I do whatever I can to help them be successful. Not only do I want them to reach and meet the goals and responsibilities of the organization, but I want them to reach their personal career goals as well."

In addition to serving her colleagues and team members, Alexander also is active in the community, speaking at local schools, universities and conferences on behalf of NASA. One thing she enjoys is interacting with girls still in school, encouraging them to pursue careers in STEM and not be discouraged by the fact that it's a male-dominated field.

"There are a lot of brilliant women out here doing really great things, and I want them to see that they can do it, too," she said.

"At the end of the day, it's about the knowledge in your head and not your gender."

Some words of advice Alexander gives to students are to never give up, learn from mistakes and failure, utilize and learn from individuals who are already in career positions they have an interest in, always be willing to help others and, most importantly, have a strong support system. For Alexander, that support system growing up was her mother and has now expanded to her husband, children, family, professional and community leaders, and mentors.

Receiving a bachelor's degree in electrical engineering, and a master's and doctorate degree in industrial engineering from the University of Central Florida, Alexander said it was not always an easy journey and without her mother's support, she would not be where she is today. "She pointed me back to my dream – took me all the way back to when I was 11 – and said, 'remember that dream, and what you always wanted to be. Don't let that go.'"

As NASA prepares for a new era of space exploration, returning to the Moon and eventually on to Mars, Alexander hopes to further use her Technology All-Star recognition to engage and inspire the agency's next generation of engineers.

"I love the fact that we're pushing boundaries, exploring new territory and doing things in an innovative way," she said. "I'm just thankful that I can represent and use this platform now to spread the word even more to kids of all backgrounds."

Kennedy Space Center's Tiffaney Miller Alexander is recognized as a Technology All-Star by Career Communications Group Inc.'s Women of Color magazine at a luncheon in Detroit, Michigan, on Oct. 4, 2019. Photo credit: NASA

Kennedy Space Center's Tiffaney Miller Alexander, second from right, is recognized as a Technology All-Star by Career Communications Group Inc.'s Women of Color magazine at a luncheon in Detroit, Michigan, on Oct. 4, 2019. Photo credit: NASA

Verification Complete

NASA, SpaceX test pad emergency egress system

BY LINDA HERRIDGE

NASA and SpaceX conducted a formal verification of the company's emergency escape, or egress, system at Kennedy Space Center's Launch Complex 39A in Florida on Sept. 18, 2019. NASA astronauts **Bob Behnken** and **Shannon Walker** participated in the exercise to verify the crew can safely and swiftly evacuate from the launch pad in the unlikely event of an emergency before liftoff of SpaceX's first crewed flight test, called Demo-2.

"This demonstration allowed all the various teams responsible for ground operations, system design, ground safety and emergency management to observe and verify the system is ready for operational use," said Steve Payne, launch operations integrator for the agency's **Commercial Crew Program**. "It's a system we hope we never have to use, but we have to be prepared for every scenario."

During the exercise, Behnken and Walker demonstrated two escape methods to show the crew could leave the 265-foot-level of the launch tower quickly. One method was an expedited non-emergency egress, where the crew started at the end of the crew access arm, called the white room, as if they just exited the capsule, and descended the crew access tower by taking the elevator to the base of the launch pad. Then, they were picked up by the pad team to be returned to crew quarters.

The other method involved an emergency egress, where the crew and pad team started at the crew access arm and escape to the ground using the slidewire baskets, with all alarms and fire suppression systems activated. From there, they boarded an armored vehicle that took them to safety.

"Safety of crew members is the top priority," Walker said. "This was a great opportunity to test the emergency egress system and procedures on the pad."

SpaceX provided a demonstration of activating alarms and beacons, putting on emergency breathing air bottles and activating the water deluge system on the crew access level, followed by egress from the white room. The astronauts also practiced loading into the baskets. The release mechanisms were also tested, and a weighted empty basket was sent down the length of the slidewire cable to the landing area.

NASA astronauts Shannon Walker, in front, and Bob Behnken participated in the exercise to verify the crew can safely and quickly evacuate from the launch pad in the unlikely event of an emergency before liftoff of SpaceX's first crewed flight test, called Demo-2. During the escape verification, Walker and Behnken passed through the water deluge system on the 265-foot-level of the crew access tower. Photo credit: SpaceX

At tower level on the pad, NASA astronauts Shannon Walker and Bob Behnken practiced loading into a slidewire basket and simulating an emergency escape to ground level. Photo credit: SpaceX

The slidewire baskets have had a number of design improvements since they were used during the shuttle era. A new braking system was added that regulates the speed as astronauts descend the slidewire, which makes for a smoother ride for the crew. Adjustments to the system have also made dismounting the slidewire baskets much easier than with the previous design.

Also, the platform used for emergency escape on the tower was relocated and reinstalled to the 265-foot-level, up 70 feet from its original shuttle-era location, in order to accommodate a taller launch vehicle.

"If the emergency egress system were ever to be needed to escape from a hazardous event, we want to have complete confidence that it will operate as designed and get our flight crew and pad personnel off the tower quickly and safely," Payne said.

The verification team also included personnel from the Astronaut Office at NASA's Johnson Space Center in Houston, NASA Flight Surgeons, SpaceX systems engineers, Kennedy Aero Medical, Commercial Crew Program Safety, and other observers.

"Each time today when we headed down the crew access arm, I couldn't help but think about what it will be like to strap into Dragon on launch day," Behnken said. "It's exciting to have this verification test behind us on our way to the SpaceX Demo-2 mission."

As commercial crew providers SpaceX and Boeing begin to make regular flights to the space station, NASA will continue to advance its mission to go beyond low-Earth orbit and establish a human presence on the Moon with the ultimate goal of sending astronauts to Mars.

Teams from NASA, Boeing and the White Sands Missile Range, rehearsed landing and crew extraction from Boeing's CST-100 Starliner, which will be used to carry humans to the International Space Station, on Sept. 12, 2019 at the White Sands Missile Range outside Las Cruces, New Mexico. Using a convoy of vehicles Boeing uses to recover their spacecraft after landing and a boiler plate test article of the Starliner capsule, the teams worked through the steps necessary to safe the vehicle and get future crew members out of the Starliner to return home. NASA astronauts Mike Fincke and Nicole Mann and Boeing astronaut Chris Ferguson will fly to the space station aboard the Starliner for the Boeing Crew Flight Test mission. Photo Credit: NASA/Bill Ingalls

Immersive Technology

Virtual field trips take students inside NASA's Commercial Crew Program

BY DANIELLE SEMPSROTT

As NASA begins a new era of space exploration – returning to the Moon and eventually on to Mars – education in science, technology, engineering and math (STEM) subjects is increasingly important to the future of our nation's space program. **NASA's Commercial Crew Program** (CCP) plays an integral role in the agency's deep space exploration goals as it works with commercial partners to launch astronauts to the **International Space Station** from U.S. soil on American-built rockets and spacecraft. In an effort to inspire the next generation of explorers, **NASA's NextGen STEM CCP project** is introducing immersive technology into classrooms to share the story of groundbreaking innovation coming from this government-industry partnership.

One such technology uses virtual field trips to take students along on a journey into the heart of CCP—visiting the NASA centers where the program first began, and the Boeing and SpaceX facilities where next-generation, human-rated spacecraft and rockets are being developed and tested for flight.

"The goal was to use technology to take students and educators to places they probably will never get to see first-hand. We want to excite and inspire with something experiential," said Joshua Santora, a NASA public affairs officer who conceptualized and developed the tours.

Through 360-degree video and virtual reality technology, students can get a behind-the-scenes look at NASA and commercial partner facilities without leaving the classroom. Teachers can run one video to 30 sets of virtual reality goggles – a class set – centering an entire lesson on space exploration, or they can allow students to choose from a library of videos, making it an individualized experience.

"These field trips are really nice because they allow teachers to bring NASA to their students and explore places they wouldn't have physical access to otherwise," said Brianna Parsons, an intern with **NASA's Internship and Fellowship Program** in Kennedy Space Center's communication and public engagement department.

Field trip tour "stops" feature the inside of Boeing's CST-100 Starliner and SpaceX's Crew Dragon crew capsules, the NASA and provider facilities where astronauts train, and launch pads where commercial crew flights will lift off to the space station.

These videos can play on any device that can download and use virtual reality – even iPhones. For those who are prone to motion sickness, Google Expedition is another form of virtual reality technology being utilized that contains static images rather than videos and features different points of interest for a more controlled experience.

"The technological leaps and bounds from mine, to my kids' to today's youth is very cool," said Denise Coleman, NASA's NextGen STEM CCP project manager at Kennedy. "I see the passion within NASA, within the educators and within those who want to help the educators. We just have to make sure we instill that same passion in the kids."

The virtual field trips and mobile app are part of a larger effort by the agency's Office of STEM Engagement (OSTEM) to educate students and teachers about NASA missions and research while providing resources for teachers to engage students in authentic STEM experiences. The NextGen STEM program focuses on four themes: **Small Steps to Giant Leaps**, **CCP**, **Moon to Mars** and **STEM on Station** – each of which offer unique K-12 educational materials developed for hands-on lessons.

"Engaging students in STEM activities might get them thinking or will help turn that switch on that this is something they're interested in," said Jen Hudgins, an education specialist with Paragon TEC at Kennedy. "We need those hands-on careers, even more-so now, as NASA prepares for human spaceflight missions that will take us farther than we've ever gone before."

To access the CCP virtual field trips, click here.

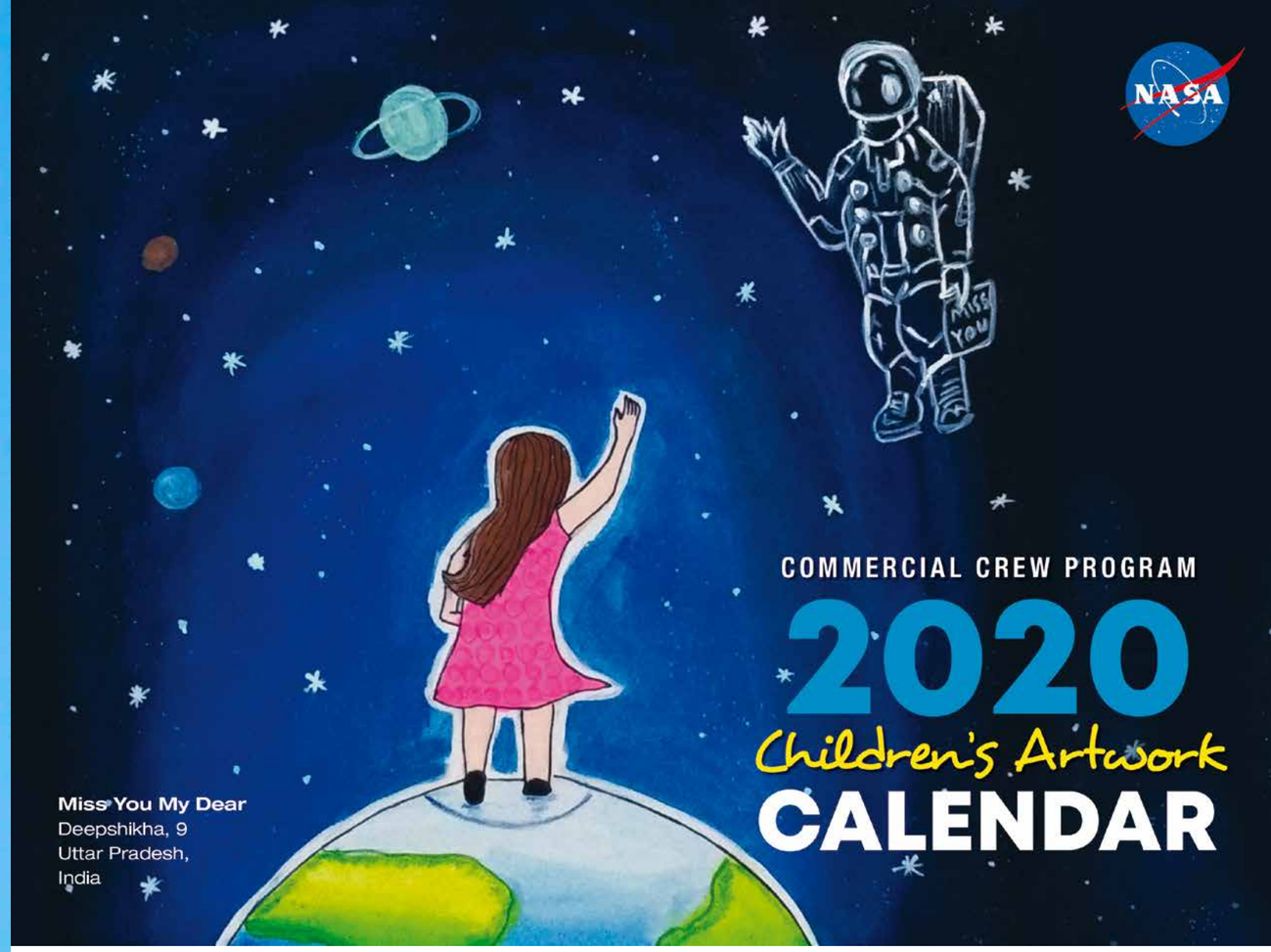
Live demonstrations of the virtual field trips also will appear in a series of webcasts each Monday at 2 p.m. Eastern Standard Time beginning Oct. 28 through Dec. 9 at **https://go.nasa.gov/DEEP**.

For more information on the full suite of NextGen STEM educational resources, visit: **https://www.nasa.gov/stem/nextgenstem/index.html**.

NASA astronauts Doug Hurley and Bob Behnken familiarize themselves with SpaceX's Crew Dragon, the spacecraft that will transport them to the International Space Station as part of NASA's Commercial Crew Program. Their upcoming flight test is known as Demo-2, short for Demonstration Mission 2. Photo credit: SpaceX

The crew module of Boeing's CST-100 Starliner spacecraft is lifted onto its service module on Oct. 16, 2019, inside the Commercial Crew and Cargo Processing Facility (C3PF) at NASA's Kennedy Space Center ahead of the company's Orbital Flight Test to the International Space Station as part of the agency's Commercial Crew Program. Photo credit: Boeing

A young Great Blue Heron balances perfectly on the branch of a tree at NASA's Kennedy Space Center in Florida. The center shares a border with the Merritt Island National Wildlife Refuge. More than 330 native and migratory bird species, along with 25 mammal, 117 fish and 65 amphibian and reptile species call Kennedy and the wildlife refuge home. Photo credit: NASA/Glenn Benson



The Commercial Crew Program is holding an artwork contest now that ends Nov. 4 for children ages four to 12 years old. The winning artwork will be used to create a 2020 calendar, which has a different space-related theme for each month. The themes educate students about the International Space Station, astronauts, growing food in space and more! Unique and original artwork will be selected for each month. The calendar also will include supplemental education materials for kids here on Earth to learn more about the space-related themes.

Go to **https://go.nasa.gov/2lfdsgu** for more information about the competition's themes, rules and deadlines plus the entry form.

Get your parent's permission, of course!

NASA's Kennedy Space Center Innovators' Launchpad:

Kelvin Ruiz

Kennedy Space Center's Kelvin Ruiz assists NASA in receiving the resources necessary to further the agency's Moon to Mars exploration goals. Photo credit: NASA/ Glenn Benson

Please explain your job in a single sentence.

I work with researchers and scientists here at NASA's Kennedy Space Center to respond to research announcements in order to receive approval and funding to develop new technologies that further **NASA's Moon** to Mars exploration goals.

What do you find most exciting about your job as the bid and proposal manager for Kennedy Space Center's Strategic Implementation Office?

I get to work with amazing scientists and researchers across the entire spectrum of research areas at **Kennedy**. This makes it exciting as there are always new ideas and concepts in development. It is rewarding to see the agency acknowledge the importance of these cutting-edge **technologies** and to receive the resources necessary to pursue them.

What is a typical day like for you?

Every day I need to be alert to new research announcements, determine if they are applicable to our center's research areas and communicate them to our research community. Also, when new efforts are starting, the proposers approach me for assistance and I guide them through the proposal, approval and submission process.

How does your job contribute to NASA's effort to go forward to the Moon and to Mars?

The **Artemis program** has created many new research opportunities within our research community. Our researchers are focused on developing new architectures that will make living on the **Moon and Mars** a reality. I work hard so that the concepts and proposals here at Kennedy align with NASA's mission and are processed in a timely manner to meet the 2024 date for landing the first woman and next man on the Moon.

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

I have a Bachelor of Science in electrical engineering from the University of Puerto Rico at Mayaguez. My dad was in the electronics and telecommunication fields, so I got exposed to electronics and computers from an early age. I was always amazed at how devices like telephones and TVs worked. How your voice is sent through the air or a wire and received miles away was like magic to me back then. So I think that's why I went into engineering. Also, my mom being a math teacher helped me stay on track and develop strong study habits. After joining NASA in 2004, I started working toward a master's in industrial engineering. Although less technical in nature, it helped me develop leadership skills and a "big picture" mentality.

What motivated you to want to work for NASA?

NASA is always pushing the boundaries of what's possible and **every discovery** opens up even more possibilities and opportunities. That's why I wanted to be a part of NASA, and I feel privileged to be here.

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

I'm always trying to learn and to solve problems. So, what we learn through research results in new technologies, and that drives exploration.

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

I believe that as we expand our knowledge and make new discoveries, we become better equipped to solve not only current problems but also future challenges that may affect our planet. Our story at NASA is all about steady progress into the unknown for the **benefit of all humanity**.

From left, team members Annie Meier, Malay Shah and Jamie Toro assemble the flight hardware for NASA's Orbital Syngas Commodity Augmentation Reactor (OSCAR) on Oct. 10, 2019, in the Space Station Processing Facility at the agency's Kennedy Space Center. OSCAR is an Early Career Initiative project at the spaceport that studies technology to convert trash and human waste into useful gasses such as methane, hydrogen and carbon dioxide. By processing small pieces of trash in a high-temperature reactor, OSCAR is advancing new and innovative technology for managing waste in space. A prototype has developed, and the team is in the process of constructing a new rig for a suborbital flight test. Photo credit: NASA/Cory Huston

Did You Know?

Veggie Plant Growth System

NASA has led the charge in space exploration for more than six decades and through the **Artemis** program we will build on our work in low-Earth orbit. NASA's Artemis lunar exploration program includes sending a suite of new **science instruments and technology demonstrations** to study the Moon, landing the first woman and next man on the lunar surface by 2024, and establishing a sustained presence by 2028. The agency will leverage its Artemis experience and technologies to prepare for the next giant leap – sending astronauts to Mars.

As humans explore space, we will want to bring plants for both aesthetic and practical reasons. We already know from our pioneering astronauts that fresh flowers and gardens on the International Space Station create a beautiful atmosphere and let us take a little piece of Earth with us on our journeys. They're good for our psychological well-being on Earth and in space. They also will be critical for keeping astronauts healthy on long-duration missions in deep space.

Veggie is a plant growth unit on the **International Space Station**. The Veggie concept is a simple, low-power system to grow fresh, nutritious **food for our astronauts** to supplement their diet and use as a tool to support relaxation and recreation. There are **two Veggie units** aboard the space station, along with a more sophisticated growth chamber, the **Advanced Plant Habitat**, also on the space station.

ALL VEGGIE CROP EXPERIMENTS FOR HUMAN CONSUMPTION

VEG-01 B: 'Outredgeous' red romaine lettuce – July 8 – Aug. 10, 2015.

VEG-03 A: **'Outredgeous' red romaine lettuce** using **cut-and-come-again** repetitive harvest technique – **October 25** – Dec. 28, 2016.

VEG-03 B: **'Tokyo Bekana' Chinese cabbage** – Jan. 20 – Feb. 17, 2017.

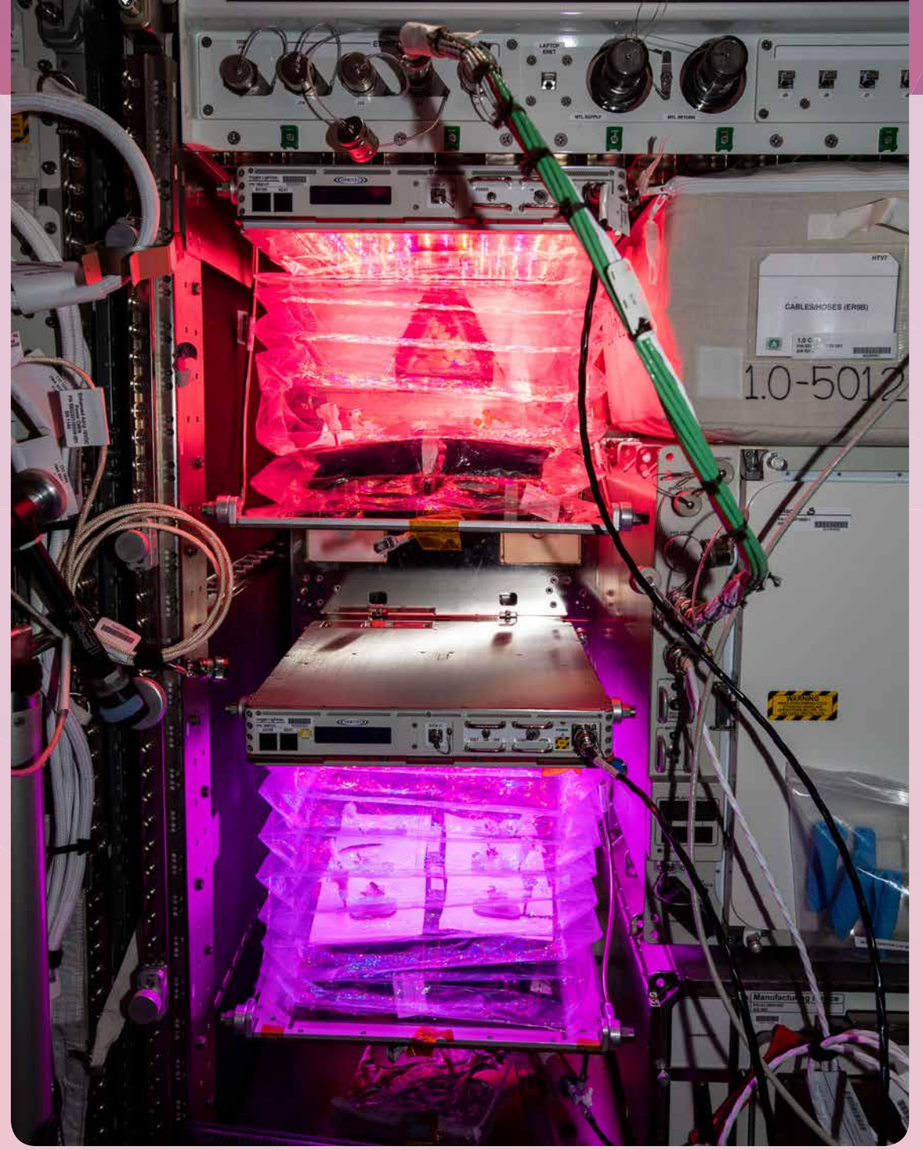
VEG-03 C: **'Tokyo Bekana' Chinese cabbage** using **cut-and-come-again** repetitive harvest technique – April 3 – May 31, 2017.

VEG-03 D: **Mizuna Mustard**, 'Outredgeous' red romaine lettuce, and **'Waldmann's Green' lettuce** using cut-and-come-again repetitive harvest technique – Sept. 26 – Nov. 23, 2017 (harvested and eaten on Thanksgiving).

VEG-03 E: Mizuna Mustard, 'Outredgeous' red romaine lettuce, and 'Waldmann's Green' lettuce using cut-and-come-again repetitive harvest technique grown concurrent with VEG-03 F – Feb. 6 – April 6, 2018.

VEG-03 F: Mizuna Mustard, 'Outredgeous' red romaine lettuce, and 'Waldmann's Green' lettuce using cut-and-come-again repetitive harvest technique grown concurrent with VEG-03 E – Feb. 8 – April 9, 2018.

VEG-03 G: 'Red Russian' kale and 'Dragoon' lettuce – Oct. 25 – Nov. 28, 2018.



The VEG-04B payload, consisting of 12 plant growth pillows with Mizuna mustard seeds, launched to the International Space Station on the SpaceX CRS-18 mission on July 25, 2019. The Mizuna plants will be grown for 56 days under two different light ratio formulations in each Veggie, which are red-rich lighting and blue-rich lighting. Astronauts will use multiple harvests, in a repetitive harvest technique called cut-and-come-again harvests. This should increase the amount of time the crew has fresh produce to eat. The astronauts initiated the experiment on Oct. 1, 2019. Photo credit: NASA

VEG-03 H: 'Wasabi' Mustard and 'Extra Dwarf' Pak Choi – March 9 – April 6, 2019.

VEG-04 A: **Mizuna Mustard** using Red-Rich and Blue-Rich light recipes – June 4 – July 9, 2019.

VEG-04 B: Mizuna Mustard grown using Red-Rich and Blue-Rich light recipes and cut-and-come-again repetitive harvest technique – experiment initiated on Oct. 1, 2019.

GROWTH Experience

Oklahoma college students blossom during tour of Florida Spaceport

BY JIM CAWLEY

A small group of undergraduate students from Langston University in Oklahoma soaked up an extraordinary experience during a tour of NASA's Kennedy Space Center.

Traveling with Byron Quinn, Ph.D., Langston's director of the Science Research Institute, the students were making their first trip to Kennedy — and to the Sunshine State — on Sept. 18, 2019. The tour included stops at SwampWorks, Space Station Processing Facility (SSPF) labs, the microgravity simulator in the Neil Armstrong Operations and Checkout Building, the Vehicle Assembly Building and the visitor complex. The students also met with science, technology, engineering and mathematics (STEM) leads at the Center for Space Education to explore internship possibilities.

"It was definitely eye-opening," said Sherman Cravens, who attended with fellow Langston students Kashia Cha, Makyah Farris and Courtney Miller. "It's very exciting to see the work they are doing here firsthand. And they're reaching out to students and saying 'you can do this work, too.'"

Kennedy's Dr. Gioia Massa, the NASA Veggie project lead, along with Lashelle Spencer, research and development scientist, guided the students through SSPF areas featuring International Space Station environmental simulator chambers; Veggie; Greenwerks, which studies plant growth in space; and food production innovation.

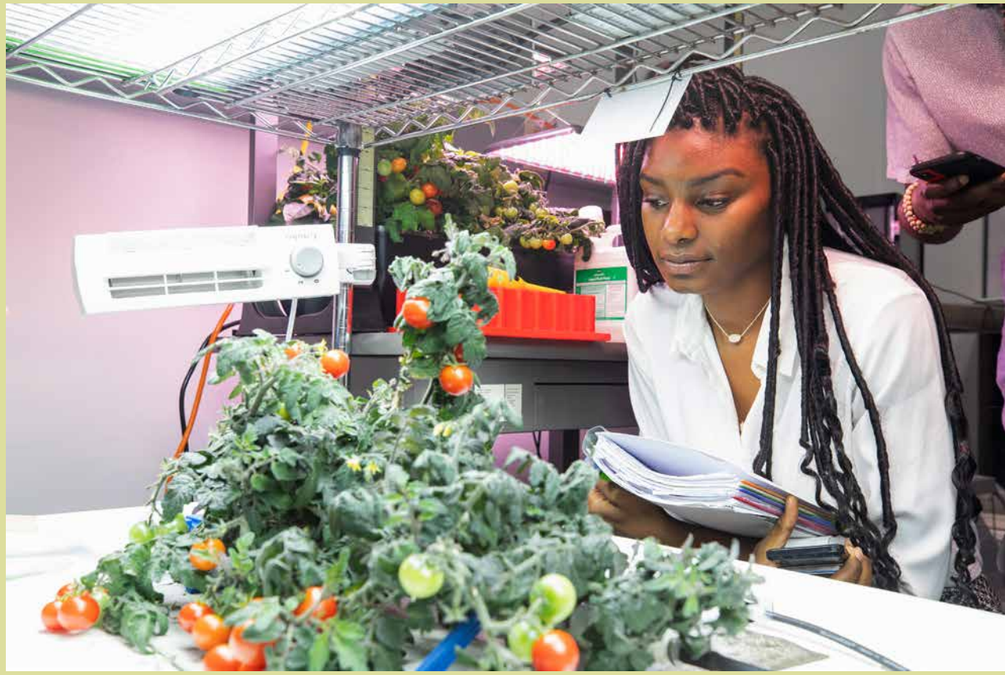
Cha, whose family owns a wholesale produce business, was particularly interested in hydroponics, a method with which she has some experience.

"It's exciting to see NASA using the same thing; it's also very intriguing to see the differences in it as well," Cha said. "I'm here to learn and to see. I loved it all — especially the hydroponics."

Langston, a Historically Black College and University (HBCU), is a NASA Office of STEM Engagement grantee under the Minority University Research and Education Project (MUREP) Institutional Research Opportunity (MIRO). Wednesday's trip addressed a main focus of research being done at the university by Quinn and his students: to develop natural countermeasures — through extracts from plants — that will benefit astronauts' immune systems.

"For the students to be able to learn from the scientists here … it's so beneficial for their growth," Quinn said. "NASA really pushes the bounds of science. It's just amazing to have this opportunity."

Dr. Gioia Massa, NASA Veggie project lead, addresses Langston University students, from left, Sherman Cravens, Kashia Cha, Courtney Miller and Makyah Farris, along with Langston professor Byron Quinn, Ph.D., at Kennedy Space Center. Photo credit: NASA/Cory Huston



Courtney Miller, a student at Langston University in Oklahoma, participates in a hands-on experience inside a Space Station Processing Facility lab at Kennedy Space Center on Sept. 18, 2019. Miller was part of a tour of the Florida spaceport organized by NASA's Office of Education and Langston professor Byron Quinn, Ph.D. Photo credit: NASA/Cory Huston

Kennedy Space Center Veggie Project Manager Trent Smith talks with students from Langston University during their trip to the Florida spaceport on Sept. 18, 2019. Photo credit: NASA/Cory Huston

Buildup of a new liquid hydrogen (LH2) storage tank is in progress on Oct. 1, 2019, at Launch Complex 39B at NASA's Kennedy Space Center. The new tank will hold 1.25 million gallons of usable LH2 to support future launches from the pad, including Artemis missions to the Moon and on to Mars. On the pad in the background is the mobile launcher. Photo credit: NASA/Cory Huston

Yanidsi Velez-Bonet, senior director of Florida Programs and Policy for the Hispanic Federation, speaks to workers at NASA's Kennedy Space Center on Oct. 10, 2019. The event was hosted by the center's Hispanic Outreach and Leadership Alliance (HOLA) employee resource group for Hispanic Heritage Month. This year's theme is "Hispanic Americans: A history of serving our nation." Photo credit: NASA/Ben Smegelsky

Kennedy Space Center workers mingle before a Hispanic Heritage Month presentation in the Neil Armstrong Operations and Checkout Building Mission Briefing Room on Oct. 10, 2019. Photo credit: NASA/Ben Smegelsky

Kennedy Space Center Celebrates Hispanic Heritage Month

BY LINDA HERRIDGE

Hispanic Americans have made significant contributions to our country. They have served in every war since the Revolutionary War and made advancements in their roles in government, the U.S. Supreme Court, science, technology, engineering and mathematics (STEM), and NASA.

Hispanic Heritage Month is celebrated from Sept. 15 to Oct. 15. With the theme, "A History of Serving our Nation," NASA Kennedy Space Center's Hispanic Outreach and Leadership Alliance (HOLA) employee resource group hosted a special event for the workforce.

Yanidsi Velez-Bonet, senior director of Florida Programs and Policy for the **Hispanic Federation**, was the featured speaker on Oct. 10, 2019. She brought with her a wealth of information on the achievements of Hispanic Americans and the contributions of the Hispanic Federation since it was created as a non-profit, non-partisan organization in 1990. Originally founded in New York, the federation has established regional offices in areas with larger Hispanic populations, including Florida and Texas.

Velez-Bonet said that the nation's Hispanic population has changed and grown. The regional office in Florida provides assistance and empowers more than 800,000 Hispanic Americans.

"It's a blessing to represent the Hispanic Federation," Velez-Bonet said. "We come here to be together with our community and our country."

The Federation advocates for Hispanic issues and creates innovative initiatives. For example, the organization provided relief to Puerto Rico and its citizens as the island continues to recover from the devastating effects of Hurricane Maria.

"We were so grateful to have Yanidsi as the featured speaker for this year's Hispanic Heritage Month Event. Her impressive community influence and accomplishments are extraordinary and her message helps bring awareness to the contributions of Hispanics in our community and our country," said Alfred Berrios, a Safety and Mission Assurance engineer and HOLA co-chairperson.

HOLA's mission is to promote education and diversity, recruitment, foster positive relationships and communication through mentoring, coaching and networking, and supporting community outreach efforts. All to advance the NASA mission to promote STEM educational activities among a demographically diverse audience, with a focus on Hispanic outreach.

First All-Woman Spacewalk on International Space Station

Two NASA astronauts switched their spacesuits to battery power at 7:38 a.m. EDT on Oct. 18, 2019. Expedition 61 Flight Engineers Christina Koch and Jessica Meir ventured out into the vacuum of space to replace a failed power controller, also known as a battery charge-discharge unit (BCDU). The BCDU regulates the charge to the batteries that collect and distribute solar power to the orbiting lab's systems. It was the first time all spacewalkers were women and the 43rd spacewalk to include women.

Koch was designated extravehicular crew member 1 (EV 1), wearing the suit with red stripes, and her helmet camera is labeled #18. Meir is designated extravehicular crew member 2 (EV 2), wearing the suit with no stripes, and with helmet camera #11.

The spacewalk is the 221st in support of station assembly, maintenance and upgrades and the eighth outside the station this year.

National Aeronautics and Space Administration

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NP-2019-10-2548-KSC