National Aeronautics and
Space Administration

KENNEDY SPACE CENTER

ANNUAL REPORT FY2017

CONTENTS

DIRECTOR'S MESSAGE

DIRECTOR
ROBERT D. CABANA

As you look across the Space Coast's horizon, you can see that our vision of transitioning NASA's Kennedy Space Center to a bustling spaceport that supports government and commercial space operations has become a reality. This was most evident when SpaceX launched the first commercial mission off Kennedy's historic Launch Complex 39A in February. Our commercial partners are manufacturing, processing and launching flight hardware side by side with their NASA counterparts.

In FY 2017, NASA's Orion crew module for Exploration Mission-1 (EM-1) was powered on for the first time. NASA's Ground Systems Development and Operations Program completed construction of the new platforms in High Bay 3 of the Vehicle Assembly Building, installed new bricks in the flame trench at Launch Pad 39B and continued to modify the mobile launcher, all to support EM-1. EM-1 is scheduled to lift off from the Kennedy Space Center atop the Space Launch System rocket, the most powerful rocket ever built, in late 2019.

During FY 2017, the Launch Services Program (LSP) launched GOES-R, CYGNSS and TDRS-M. LSP worked with United Launch Alliance to carry GOES-R and TDRS-M to orbit using the Atlas V rocket. Both are the next generation of a spacecraft that will study extreme weather patterns on Earth and advance communication systems, respectively. CYGNSS is a constellation that consists of eight microsatellites launched using a Pegasus XL rocket. CYGNSS will help forecasters better understand and predict hurricanes.

NASA's Commercial Crew Program is working with our commercial partners, Boeing and SpaceX, to restore our capability to launch astronauts to the International Space Station from the Space Coast in late 2018. In FY 2017, both companies manufactured spacecraft and launch vehicles, pushed their designs to the limits to verify they met our safety and performance standards, assessed recovery operations and unveiled the spacesuits our astronauts will wear as they fly to the station.

Finally, our Exploration Research and Technology Programs continued supporting the International Space Station through four resupply missions from Kennedy, expanding our knowledge and expertise with plant growth systems through Veggie and the Advanced Plant Habitat, in addition to assessing ways to enable NASA's deep space exploration goals of sending humans back to the Moon and on to Mars.

All of these accomplishments could not have been achieved without the dedication and amazing teamwork of the workforce at the center. I invite you to read more about all of the amazing work going on here at Kennedy Space Center in the following pages.

Robert D. Cabana

VISION, MISSION AND CORE COMPETENCIES

KSC VISION

KSC is the world's preeminent launch complex for government and commercial space access, enabling the world to explore and work in space.

KSC MISSION

KSC safely manages, develops, integrates and sustains space systems through partnerships that enable innovative, diverse access to space and inspires the nation's future explorers.

KSC CORE COMPETENCIES

Acquisition and management of launch services and commercial crew development

Launch vehicle and spacecraft processing, launching, landing and recovery, operations and sustaining

Payload and flight science experiment processing, integration and testing

Designing, developing, operating, and sustaining flight and ground systems, and supporting infrastructure

Development, test and demonstration of advanced flight systems and transformational technologies to advance exploration and space systems

SIGNIFICANT EVENTS – KENNEDY'S TOP 20

OCTOBER 2016

Underway Recovery Test 5

NASA's Ground Systems Development and Operations Program (now Exploration Ground Systems) and the U.S. Navy conducted Underway Recovery Test 5 using a test version of the Orion crew module, the well deck of the USS San Diego, various watercraft and equipment to prepare for recovery of Orion on its return from deep space missions. The testing allowed the team to demonstrate and evaluate recovery processes, procedures, hardware and personnel in open waters.

NOVEMBER 2016

GOES-R Launched Aboard Atlas V

NOAA's Geostationary Operational Environmental Satellite (GOES-R) lifted off aboard a United Launch Alliance Atlas V rocket from Cape Canaveral Air Force Station's Space Launch Complex 41. GOES-R was the first satellite in a series of next-generation GOES satellites.

DECEMBER 2016

CYGNSS Launched Aboard Pegasus XL

NASA's Cyclone Global Navigation Satellite System (CYGNSS) launched aboard an Orbital Sciences Pegasus XL rocket carried aloft by the company's Stargazer aircraft, which took off from Cape Canaveral Air Force Station. The CYGNSS satellites will make frequent and accurate measurements of ocean surface winds throughout the life cycle of tropical storms and hurricanes.

JANUARY 2017

Boeing Unveiled Spacesuit

Boeing unveiled the company's new, blue spacesuit astronauts will wear while aboard the Starliner. Designed to meet NASA's safety and functionality requirements, the suit weighs about 20 pounds and uses advanced materials, new joint patterns and zippers that make the suit light and flexible.

FEBRUARY 2017

New Platform Installation Completed in Vehicle Assembly Building

Installation of 10 levels of new work platforms was completed inside High Bay 3 of the Vehicle Assembly Building. Efforts to install the platforms came to a conclusion as the final work platform, A North, was lifted, installed and secured on its rail beam on the north wall of the high bay inside the iconic facility.

FEBRUARY 2017

First Solid Rocket Booster Forward Skirt Arrived

The forward skirt for the left-hand solid rocket booster of NASA's Space Launch System (SLS) rocket arrived at Cape Canaveral Air Force Station from booster prime contractor Orbital ATK's facilities in Promontory, Utah. The left-hand forward skirt was transported to Hangar AF, where it continued refurbishment to support the first uncrewed flight test of the Orion spacecraft atop the SLS rocket.

FEBRUARY 2017

First Commercial Liftoff from Launch Complex 39A

SpaceX launched its 10th commercial resupply services mission for NASA for the first time from Launch Complex 39A. The company's Falcon 9 rocket lifted off from the modified Pad A and carried the Dragon module, loaded with supplies, equipment and science experiments, to the International Space Station.

MARCH 2017

Interim Cryogenic Propulsion Stage Arrived

The first integrated piece of flight hardware for NASA's Space Launch System rocket, the Interim Cryogenic Propulsion Stage (ICPS), arrived at Cape Canaveral Air Force Station. It was shipped from the United Launch Alliance facility in Decatur, Alabama, aboard the Mariner barge.

MARCH 2017

First Umbilical Installed on Mobile Launcher for Space Launch System and Orion

The first launch umbilical for NASA's Space Launch System and Orion spacecraft was installed on the mobile launcher tower. The Orion Service Module Umbilical (OSMU) was installed high up on the tower at about the 260-foot level. The OSMU will connect to the Orion service module and transfer liquid coolant and purge air/gaseous nitrogen for environmental control.

APRIL 2017

Orbital ATK Launched Seventh Commercial Resupply Services Mission

Orbital ATK's seventh commercial resupply mission for NASA launched atop a United Launch Alliance Atlas V rocket from Space Launch Complex 41 at Cape Canaveral Air Force Station. Orbital's Cygnus spacecraft delivered supplies, equipment and science experiments to the International Space Station.

APRIL 2017

Boeing Starliner Powered Up

Inside Boeing's Commercial Crew and Cargo Processing Facility, the "Spacecraft 1," as the individual Starliner is known, was powered up for the first time. It is being assembled for use during a pad abort test that will demonstrate the Starliners' ability to lift astronauts out of danger in the unlikely event of an emergency. Later flight tests will demonstrate Starliners in orbital missions to the station without a crew, and then with astronauts aboard.

MAY 2017

Final Brick Installed in Launch Complex 39B Flame Trench

The final heat-resistant brick was installed on the north side of the flame trench below the surface of the pad. During a year's worth of work, 96,000 heat-resistant bricks, in three different sizes, were secured to the walls using bonding mortar in combination with adhesive anchors.

MAY 2017

Kennedy Space Center Earned Voluntary Protection Program Star

The center earned the Voluntary Protection Program (VPP) Star from the Occupational Safety and Health Administration (OSHA). It is OSHA's highest honor, and Kennedy has held the Star rating each year since 2004.

JUNE 2017

SpaceX Launched 11th Commercial Resupply Mission

SpaceX launched a Falcon 9 rocket on the company's 11th commercial resupply services mission for NASA from Launch Complex 39A. The SpaceX Dragon cargo module carried supplies, equipment and science experiments to the International Space Station.

JUNE 2017

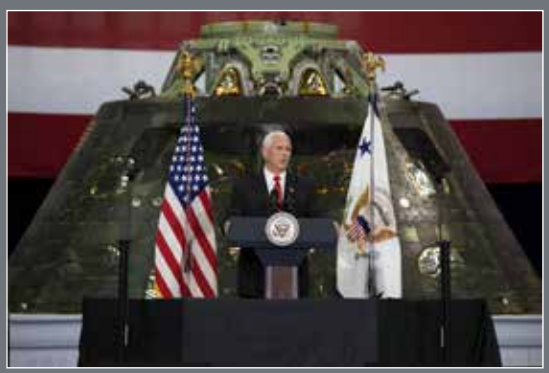
Turn Basin Prepped for Space Launch System Core Stage Arrival

The dock area that was used for arrival and offloading of space shuttle external tanks received a makeover to accommodate the Space Launch System's larger and heavier core stage when it arrives aboard NASA's modified barge, Pegasus.

JULY 2017

Vice President Mike Pence Visited Kennedy

Speaking in the Vehicle Assembly Building before an audience of NASA leaders, U.S. and Florida government officials, and employees, Vice President Mike Pence thanked the Kennedy workforce for advancing American leadership in space. During his visit, the Vice President also toured facilities highlighting public-private partnerships as both NASA and commercial companies prepare to launch American astronauts from the multi-user spaceport.



AUGUST 2017

TDRS-M Launched into Earth Orbit

The Tracking and Data Relay Satellite-M (TDRS-M) spacecraft launched from Space Launch Complex 41 at Cape Canaveral Air Force Station atop an Atlas V rocket. TDRS-M will replenish NASA's Space Network and provide the ability to support space communication for an additional 15 years. The network consists of TDRS satellites that transmit data to and from ground stations on Earth for NASA missions and expendable launch vehicles.

AUGUST 2017

Orion Spacecraft Powered Up

The Orion spacecraft for Exploration Mission-1 was successfully powered up for the first time in the Neil Armstrong Operations and Checkout Building to ensure everything performs as planned during its uncrewed flight test atop NASA's Space Launch System rocket.

AUGUST 2017

SpaceX Launched 12th Commercial Resupply Mission

SpaceX launched its Falcon 9 rocket and Dragon cargo spacecraft on the company's 12th commercial resupply services mission to the International Space Station. The Dragon was filled with equipment, supplies and science experiments for delivery to the space station.

AUGUST 2017

SpaceX Unveiled New Spacesuit

SpaceX unveiled the first look at its new spacesuit design that astronauts flying to and from the International Space Station will wear inside the Crew Dragon spacecraft. Suit testing is underway to ensure the suit performs as designed. NASA astronauts have been doing spacesuit fit checks and other testing to prepare for missions, including the first pressurized spacesuit tests using NASA astronauts.

Two ospreys keep a watchful eye on activities around their nest, built atop a sign near the Kennedy turn basin.

CENTER PLANNING AND DEVELOPMENT

A SpaceX Falcon 9 rocket stands on Launch Complex 39A awaiting liftoff on the company's 10th commercial resupply flight to the International Space Station. In the background are the Vehicle Assembly Building and the mobile launcher that will be used for stacking NASA's Space Launch System rocket.

Kennedy Space Center's Center Planning and Development Directorate (CPD) pivoted off its successes in 2016 with a robust list of accomplishments throughout FY 2017.

Now a vibrant, state-of-the art multi-user spaceport, Kennedy christened the first commercial launch of SpaceX's Falcon 9 rocket carrying the Dragon cargo vehicle from historic Launch Complex 39A to the International Space Station in February 2017. Launch Complex 39A has been and continues to be one of the centerpieces in American spaceflight history, all made possible by commercial partners' interest in Kennedy.

A key factor in the center's success stems from its ability to streamline commercial launches. NASA, the Federal Aviation Administration and the United States Air Force provide for diverse launch operations in both the government and commercial capacity due to the Commercial Space Launch Act. The successful working relationship of these agencies to simplify the steps to certify commercial launches makes Kennedy the optimal solution for America's launch needs.

The updated Master Plan website gives stakeholders a user-friendly conduit into the spaceport's future plans, allowing potential partners to tailor their business ideas to accommodate both their and the center's requirements.

In a visible example of a multi-user success story, Blue Origin continued construction on its Orbital Manufacturing Site in the center's Exploration Park, bringing the company one step closer to having the first-ever fully operational launch vehicle manufacturing site on the Space Coast.

Kennedy soon will have a 150,000-square foot spacecraft factory in the center's Exploration Park. In partnership with Space Florida, OneWeb broke ground on a satellite factory in March. OneWeb, in conjunction with a variety of partners, intends to build 2,000 satellites that will form a constellation capable of wirelessly connecting every portion of the world to the Internet. The satellites will launch from the Kennedy spaceport. The development is part of a renaissance built on a philosophy of opening the center's extensive capabilities and workforce to commercial enterprises as well as government operations.

In addition to many commercial partners, government and academic organizations took advantage of Kennedy's technical capabilities, expertise and services.

The U.S. Army Research Lab and the Naval Air Warfare Center Aircraft Division performed corrosion testing and other engineering lab services at the center in conjunction with partners from the University of Dayton Research Institute.

The RUAG Space USA partnership supported testing for satellite structural panels and the Defense Advanced Research Projects Agency, commonly known as DARPA, developed and tested autonomous flight termination systems.

Kennedy partnered with United Launch Alliance by loaning the company its Universal Propellant Servicing System for propellant-loading tests to support development of its new Vulcan launch vehicle, while Micro Aerospace Solutions used the center's testing services for Global Positioning System Receiver operational performance testing.

SpaceX's Services Agreement further allows the company to access services on center.

The University of Puerto Rico as well as the University of the Virgin Islands both host a Regional Educator Resource Center that provides training utilizing Kennedy's curriculum support products to disseminate aerospace knowledge and information.

In addition to universities, NASA programs also extended opportunities to the high-school level. Three new schools entered into High Schools United with NASA to Create Hardware (HUNCH) agreements in support of research and technology activities. The HUNCH program was instituted 13 years ago across multiple NASA centers and provides a national platform to grow and diversify the nation's engineering workforce. For the first time, Kennedy has HUNCH agreements with local counties to provide deliverables used by the International Space Station program. These agreements directly support HUNCH activities as called out in the 2017 National Space Act.

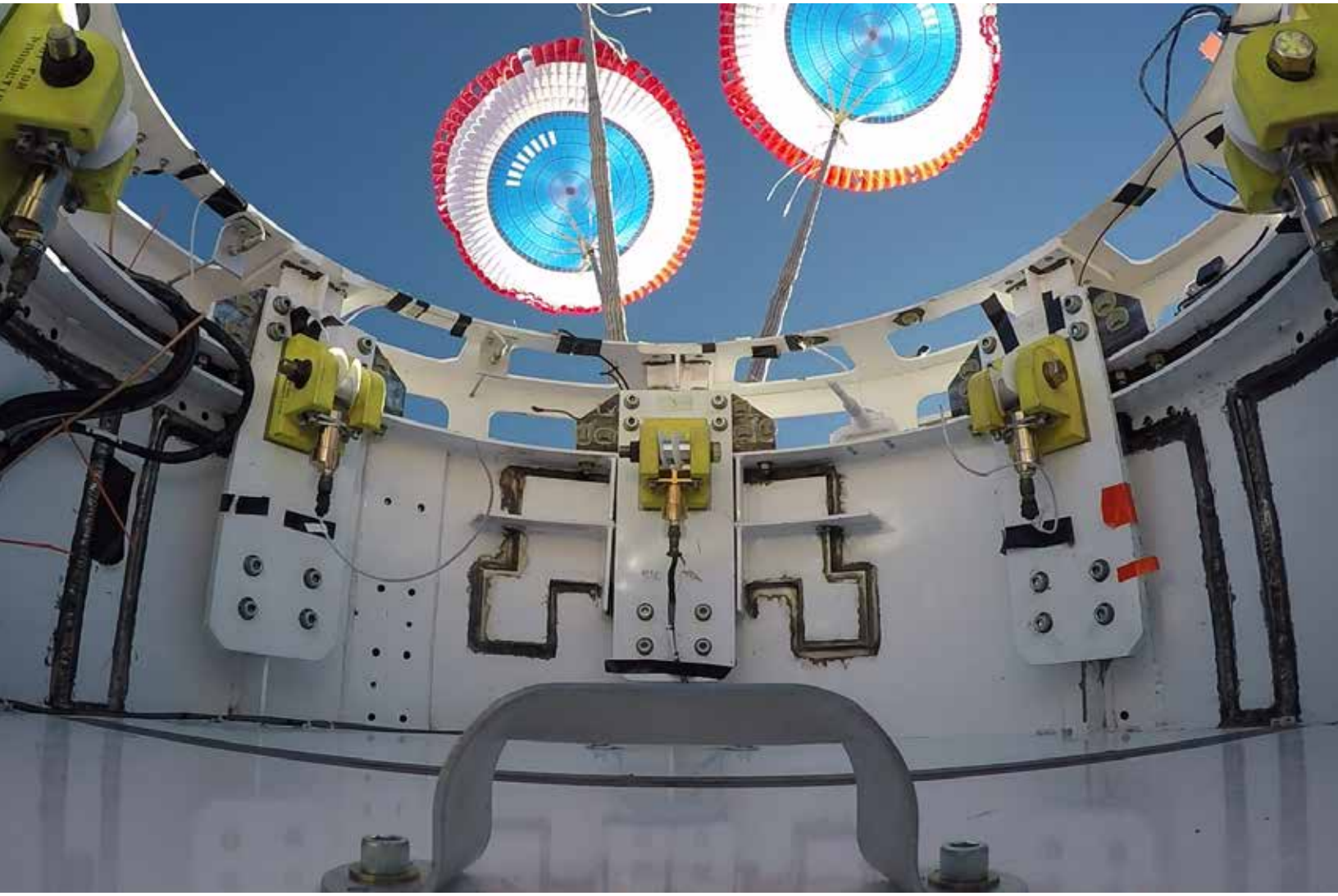
The tireless efforts of CPD paid off by joining forces in partnerships with a host of educational, commercial and governmental entities at Kennedy Space Center. These new partners were anxious to team with the nation's only multi-user spaceport in an environment that fosters creativity, flexibility and exploration. Kennedy has established itself as the go-to center of choice for space industry investments for now and the future.

The Blue Origin construction site at Exploration Park is seen during an aerial survey of the spaceport in September 2017.

Officials break ground for a 150,000-square-foot manufacturing facility for OneWeb Satellites at Kennedy's Exploration Park. From left are John Saul, operations manager of Hensell-Phelps; Kelvin Manning, associate director of NASA's Kennedy Space Center; Brian Holz, CEO of OneWeb Satellites; Rick Scott, governor of Florida; Lynda Weatherman, president and CEO of the Economic Development Council of the Space Coast; Mike Cosentino, president, Airbus Defense and Space; Cissy Procter, executive director of the Florida Department of Economic Activity; Gen. Wayne Monteith, commander of the 45th Space Wing of the U.S. Air Force; and Jim Kuzma, COO of Space Florida.

Students from Space Coast Jr./Sr. High talk to guests at the award ceremony about their toilet paper dispenser design. The students are participating in the HUNCH program, which stands for High school students United with NASA to Create Hardware.

COMMERCIAL CREW PROGRAM



(Above) The parachute deployment is seen from the top hatch of a boilerplate CST-100 Starliner during a drop test of the Starliner's parachute system. Boeing, which is building the Starliner, conducted the test in White Sands, New Mexico, as part of the testing campaign for certification by NASA's Commercial Crew Program. Photo credit: Boeing

NASA's Commercial Crew Program (CCP) and commercial partners, Boeing and SpaceX, made significant strides in FY 2017 to return human spaceflight launch capabilities to the United States. Each company continued to develop and test unique space systems to fly astronauts for the agency to and from the International Space Station.

CCP secured an additional eight crew rotation missions, four each from Boeing and SpaceX. The missions will carry astronauts to and from the International Space Station through 2024. The four additional missions fall under the Commercial Crew Transportation Capability contracts and bring the total number of crew rotation missions awarded to each provider to six. The missions will fly following NASA certification.

The International Space Station continued to prepare for the new commercial spacecraft to arrive. NASA's four astronauts training to fly the test flights on Boeing's Starliner and SpaceX's Crew Dragon spent time lending their unique expertise and evaluating both providers' progress during 2017. The astronauts learned about the systems, were fitted for spacesuits and prepared for flight tests to and from the station.

Boeing's Starliner continued to be manufactured inside the Commercial Crew and Cargo Processing Facility (C3PF) at NASA's Kennedy Space Center. Three crew Starliners and multiple service modules are in production inside the manufacturing facility.

In FY 2017, the Starliner was powered on for the first time inside the C3PF. A Starliner Structural Test Article arrived at the company's Huntington Beach Facility in California, where the spacecraft is undergoing rigorous qualification testing. This includes tests such as shock, separation and vibration on the service module and other hardware of the Atlas V upper stage. Other tests were aimed at simulating the actual pressure that the Starliner will encounter during ascent, orbit and re-entry to Earth's atmosphere.

At the Landing and Impact Research Facility at NASA's Langley Research Center in Virginia, a Starliner mock-up endured a series of land landing qualification tests designed to simulate a crew return to Earth in the western United States.

(Above) The Environmental Control and Life Support System (ECLSS) module is on display inside SpaceX's headquarters and factory in Hawthorne, California. The module is the same size as the company's Crew Dragon spacecraft and was built to test the ECLSS that is being built for missions aboard the Crew Dragon, including those involving astronauts flying to the International Space Station on flights for NASA's Commercial Crew Program. Photo credit: SpaceX

(Left) Astronauts Bob Behnken, left, and Eric Boe, center, work in a mock-up of the SpaceX Crew Dragon flight deck at the company's Hawthorne, California, headquarters as development of the crew systems continues for eventual missions to the International Space Station. Photo credit: SpaceX

(Below) NASA astronaut Eric Boe wears Boeing's new spacesuit designed to be worn by astronauts flying on the CST-100 Starliner. The suit is lighter and more flexible than previous spacesuits but retains the ability to pressurize in an emergency. Astronauts will wear the suit throughout the launch and ascent into orbit, as well as on the way back to Earth. Photo credit: Boeing

At the Spaceport America facility near the Army's White Sands Missile Range in New Mexico, the Starliner went through a series of choreographed tests of its parachute and landing system, wherein the Starliner deployed its parachute systems to land safely on the ground.

Boeing unveiled the company's new, blue spacesuit astronauts will wear while aboard the Starliner. Designed to meet NASA's safety and functionality requirements, the suit weighs about 20 pounds less than earlier suits, and is more flexible with the use of advanced materials, new joint patterns and zippers.

At Space Launch Complex 41 on Cape Canaveral Air Force Station, an emergency exit system was installed and tested. The system will be available to astronauts and launch support personnel in the unlikely event of an emergency prior to liftoff. Each person on the Crew Access Tower would get into his or her own seat attached to the wire and slide more than 1,340 feet to a safe area. United Launch Alliance also continued to manufacture the Atlas V and qualify the flight hardware for CCP test flights.

SpaceX continued manufacturing the Crew Dragon spacecraft inside the company's headquarters and manufacturing facility in Hawthorne, California. In total, SpaceX has six Crew Dragon modules in various stages of production and testing, including a qualification module, a life support system testing module, the two spacecraft for flight tests and the first two for fully operational missions. This year, SpaceX integrated the Crew Dragon capsule, performed acceptance testing and powered up the avionics aboard the Demonstration Mission 1 module in preparation for the company's uncrewed flight test. Further qualification testing and work on mechanical integration for Demonstration Mission 2, the crewed flight test, is ongoing.

SpaceX built a test version of its Crew Dragon solely for evaluation of the life support system that will provide tight control of parameters that are important to human safety, such as temperature, carbon dioxide levels,

oxygen levels and cabin pressure. The environmental control and life support system (ECLSS) was extensively tested and evaluated at the company's headquarters.

SpaceX, NASA and U.S. Air Force personnel completed full-scale joint recovery trainer exercises to prepare for and ensure crew safety in the unlikely event of a rescue scenario. A full-size model of the spacecraft was used during rescue training. SpaceX followed up the rescue and recovery testing in the Atlantic Ocean with spacesuit-clad astronauts and personnel who will assist upon return to Earth.

SpaceX unveiled the first look at its new spacesuit design that astronauts flying to and from the International Space Station will wear inside the Crew Dragon spacecraft. Suit testing is underway to ensure the suit performs as designed.

In February, SpaceX hosted its inaugural flight from Launch Complex 39A at Kennedy Space Center. At the launch site, multiple Human-in-the-Loop and software simulations were conducted. SpaceX also completed structural upgrades at the site and prepared the company's Crew Access Arm, which will be installed in 2018.

CCP continued work with Blue Origin and Sierra Nevada Corp. in 2017 to develop and refine their respective spacecraft and launch systems. Under these agreements, NASA provides expertise and insight into their spaceflight designs. Sierra Nevada Corp. completed a series of tests of the Dream Chaser in FY 2017, which led to the completion of the company's free flight test in November 2017 under the Commercial Crew Integrated Capability Space Act Agreement, or CCiCap.

(Above) The finishing touches are being made to the SpaceX spacesuit that will be worn by astronauts aboard its Crew Dragon spacecraft (in the background) during missions to and from the International Space Station. SpaceX is developing its Crew Dragon spacecraft and Falcon 9 rocket in partnership with NASA's Commercial Crew Program to carry astronauts to and from the space station. Photo credit: SpaceX

An engineer working with Boeing's CST-100 Starliner monitors a test of the spacecraft's seat design in Mesa, Arizona, focusing on how the seats would protect an astronaut's head, neck and spine during the 240-mile descent from the International Space Station. The company incorporated test dummies for a detailed analysis of impacts on a crew returning to Earth. The Starliner spacecraft is being developed in partnership with NASA's Commercial Crew Program. Credit: Boeing

LAUNCH SERVICES PROGRAM

A United Launch Alliance Atlas V rocket lifts off from Cape Canaveral Air Force Station's Space Launch Complex 41 on Aug. 18, 2017, carrying NASA's Tracking and Data Relay Satellite (TDRS-M).

Since 1998, NASA's Launch Services Program (LSP) has been bringing together those with a payload needing a ride to space with launch vehicle providers. The LSP team at the agency's Kennedy Space Center works to provide reliable, competitive and user-friendly launch services in the commercial arena to satisfy agency-wide space transportation requirements and maximize the opportunities for mission success.

In FY 2017, LSP worked with teams from rocket and satellite providers, including Lockheed Martin, Orbital ATK, SpaceX, United Launch Alliance (ULA) and more to provide launch services. LSP connected these companies with teams from NASA and the National Oceanic and Atmospheric Administration (NOAA) who manage the satellite and mission requirements. Together, these teams launched missions that will improve weather forecasting, help better understand severe weather and bolster the nation's Space Network.

LSP also began work on future missions to strengthen our nation's weather tracking and reporting, to understand Earth's atmosphere where it meets with space and to help develop miniature satellites for education and government. LSP participated in forums that allowed networking for spacecraft customers and rocket providers. In FY 2017, LSP participated in research aboard the International Space Station to better understand how fluids operate in a space environment, which could improve flight safety in future rocket designs.

NASA, NOAA and ULA launched the Geostationary Operational Environmental Satellite (GOES-R) in November on an Atlas V. NOAA'S GOES-R satellite was the first satellite in a series of next-generation weather satellites.

In December, eight small satellites called Cyclone Global Navigation Satellite System (CYGNSS) spacecraft were air-launched over the Atlantic Ocean off the coast of Central Florida on a Pegasus XL rocket. The launch vehicle was taken aloft aboard Orbital ATK's Stargazer L-1011 aircraft. The constellation of CYGNSS satellites are giving scientists advanced technology to see inside tropical storms and hurricanes like never before.

NASA and ULA launched the agency's Tracking and Data Relay Satellite-M (TDRS-M) in August on an Atlas V. TDRS-M is part of

The Orbital ATK L-1011 Stargazer aircraft carries the Pegasus XL rocket with Cyclone Global Navigation Satellite System (CYGNSS) prior to the rocket's release and launch on Dec. 15, 2016. The CYGNSS satellites will make frequent and accurate measurements of ocean surface winds throughout the life cycle of tropical storms and hurricanes.

A United Launch Alliance Delta IV Heavy common booster core is about to be offloaded from the company's Mariner ship at Port Canaveral in Florida on Aug. 30, 2017. The rocket will launch NASA's upcoming Parker Solar Probe mission. The mission will perform the closest-ever observations of a star when it travels through the Sun's atmosphere, called the corona. Liftoff is scheduled for summer 2018.

On Feb. 17, 2017, the first stage motor for the Orbital ATK Pegasus XL rocket was moved inside Building 1555 at Vandenberg Air Force Base in California. In the background are the second and third stage segments. The rocket is being prepared for NASA's Ionospheric Connection Explorer (ICON) mission. It will launch from the Reagan Test Site on Kwajalein Atoll in the Marshall Islands.

the agency's Space Network, providing navigation and high-data-rate communications to the International Space Station, the Hubble Space Telescope, rockets and a host of other spacecraft.

LSP supported ongoing Slosh experiments aboard the International Space Station. These experiments have resulted in a better understanding of how fluids work in high and low gravity environments, which could reduce potential impacts to flight safety in future rockets.

NASA selected SpaceX to provide launch services for the agency's Surface Water and Ocean Topography (SWOT) mission. Launch is targeted for April 2021. Designed to make the first-ever global survey of Earth's surface water, in addition to high-resolution ocean measurements, the SWOT mission will collect detailed measurements of how water bodies on Earth change over time.

NASA selected United Launch Services LLC (ULS) to provide launch services for the Joint Polar Satellite System-2 (JPSS-2) mission for NOAA. JPSS-2 is one of five satellites that will comprise the JPSS constellation. JPSS delivers key environmental observations that provide support for the nation's essential products and services, which includes forecasting severe weather. Launch is targeted for 2021 on an Atlas V.

NASA awarded Spaceflight Inc. a Launch Services contract for University-Class, or U-Class, payloads. These miniature space research satellites are flown by NASA and developed by education and government organizations, typically using commercial, off-the-shelf electronic components. The contract for launch services in 2018 is for 24 payloads, with options to provide launch services for up to 24 additional payloads in 2019 and 2020.

In FY 2017, the LSP team continued work on NASA'S Ionospheric Connection Explorer (ICON) mission. Teams prepared two NOAA weather satellites, the Joint Polar Satellite System-1 and the Geostationary Operational Environmental Satellite-S, for launch, along with continued support for the first-ever mission to approach the Sun – Parker Solar Probe.

In the International Space Station's Kibo laboratory on June 18, 2014, NASA astronauts Steve Swanson (top) and Reid Wiseman, conduct test runs of the SPHERES-Slosh experiment, using the soccer ball-sized, free-flying satellites known as Synchronized Position Hold, Engage, Reorient, Experimental Satellites, or SPHERES. The SPHERES-Slosh investigation uses small robotic satellites on the space station to examine how liquids move around inside containers in microgravity.

On Sept. 15, 2016, technicians and engineers secure the Geostationary Operational Environmental Satellite (GOES-R) in the vertical position inside the Astrotech payload processing facility in Titusville, Florida, near NASA's Kennedy Space Center.

GROUND SYSTEMS DEVELOPMENT AND OPERATIONS

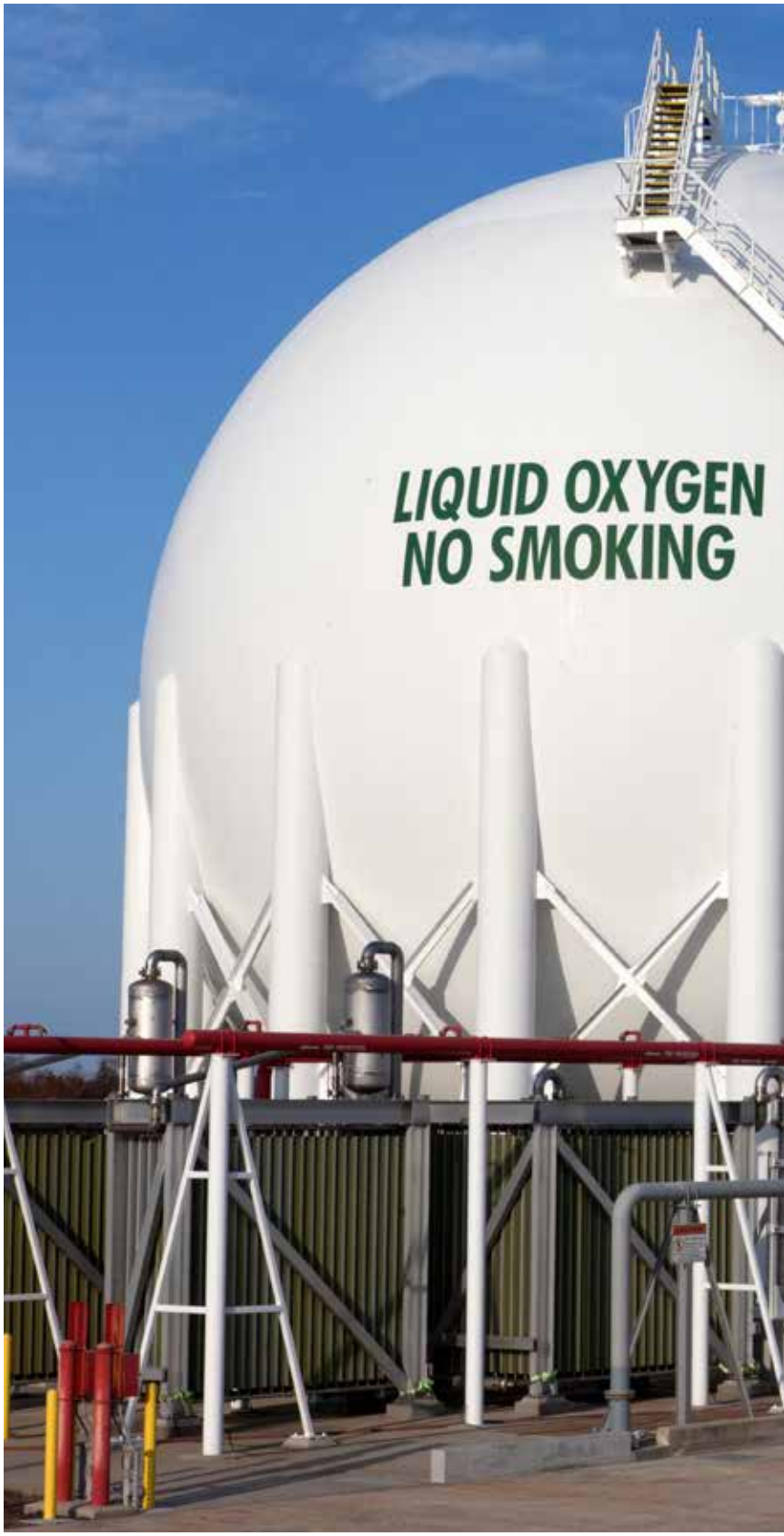
During FY 2017, Ground Systems Development and Operations (GSDO) continued to make steady progress toward completing the launch infrastructure and building the ground processing team that will check out and launch the agency's Space Launch System (SLS) rocket and Orion spacecraft on Exploration Mission-1 (EM-1).

The year kicked off with GSDO and the U.S. Navy conducting Underway Recovery Test 5, where the team demonstrated and evaluated recovery processes, procedures, hardware and personnel that will be necessary for recovery of the EM-1 Orion crew module into the well deck of a Navy ship after it splashes down in the Pacific Ocean.

Throughout the year, many upgrades were made to Launch Pad 39B – the launch pad for SLS and Orion. A new, 60,000-gallon liquid hydrogen separator tank arrived to support new requirements for Exploration Mission-1 and future launches. The final brick was installed on the north side of the flame trench beneath Pad 39B in May, marking the completion of a yearlong project to upgrade the walls of the flame trench to withstand temperatures up to 2,000 degrees Fahrenheit. Also in the flame trench, cranes moved large segments of the support hardware for a new flame deflector into position, about six feet south of the shuttle-era flame deflector's position. During liftoff of the SLS and Orion, the rocket's flame and energy will be diverted to the north side of the flame trench.

The first major integrated operation at the pad began with the initial tanking of liquid oxygen into a giant sphere at the northwest corner of the pad, one of the steps needed to bring the center closer to supporting the launch of Orion atop the SLS. In May, GSDO celebrated the 50th anniversary of the pad — the site that served as the liftoff point for one Apollo/Saturn V launch, three Skylab missions, one Apollo-Soyuz Test Project mission and 58 space shuttle launches.

In January, the final work platform in the Vehicle Assembly Building's High Bay 3 was lifted and installed, allowing access to SLS and Orion during processing for missions. In August, two new service platforms for the SLS booster engines arrived at Kennedy by flatbed trucks and were stored inside the VAB. The platforms will be used for processing and checkout of the engines for the rocket's twin five-segment solid rocket boosters.



Several Praxair trucks carrying their loads of liquid oxygen (LO2) arrived Sept. 26, 2017, at Launch Pad 39B. The trucks began offloading LO2 slowly into a giant storage sphere located at the northwest corner of the pad to gradually chill it down from normal temperature to about negative 298 degrees Fahrenheit during the first major integrated operation to prepare for the launch of the agency's Orion spacecraft atop the Space Launch System rocket.

The test team holds a signed banner marking testing complete on the Core Stage Forward Skirt Umbilical for NASA's Space Launch System on Jan. 24, 2017, at Kennedy's Launch Equipment Test Facility. Behind them are some of the test structures used to test several launch umbilicals. The center's Engineering Directorate and the Ground Systems Development and Operations Program manage processing and testing of the umbilicals.

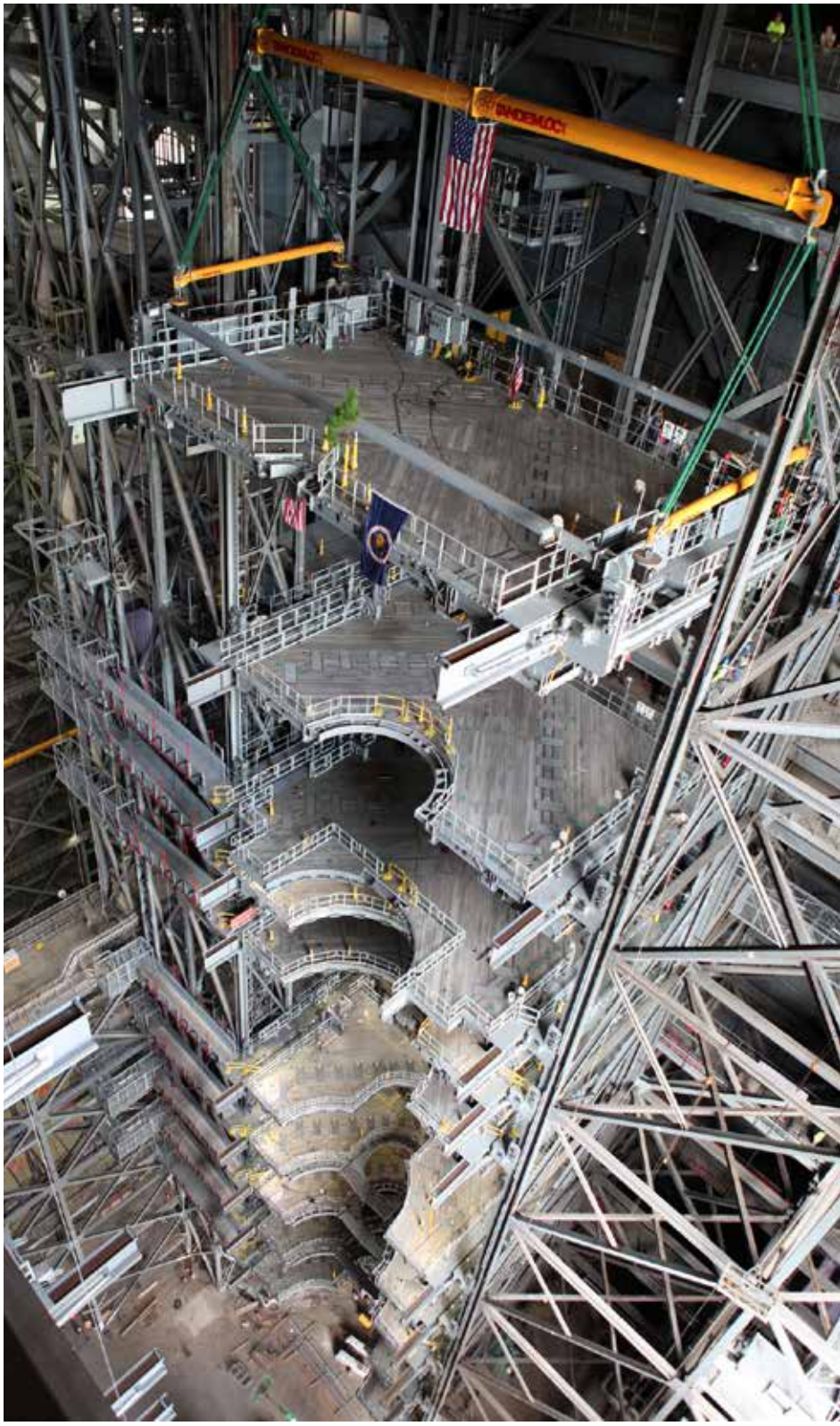
Launch Complex 39B current and past NASA and contractor workers gathered at Pad B to mark the 50th anniversary of the launch complex. Upgrades to the surface of Pad B, as well as the systems below and surrounding the pad will support the new processing and launch requirements for NASA's Space Launch System (SLS) and the Orion spacecraft for deep space missions, including to the Moon, Mars and beyond. The modifications and improvements to processing and launch facilities will support Kennedy as a multi-user spaceport for government and commercial launches for years to come.

(Left) Just north of the Vehicle Assembly Building at NASA's Kennedy Space Center, the Core Stage Forward Skirt Umbilical was installed on the tower of the mobile launcher on June 30, 2017. The mobile launcher is designed to support the assembly, testing and check-out of the agency's Space Launch System rocket and the Orion spacecraft.

Much work also was completed on the mobile launcher (ML) throughout the year as GSDO tested launch umbilicals that will connect from the ML tower to various attach points on the SLS and Orion. In March, the Orion Service Module Umbilical (OSMU) was the first umbilical installed on the ML tower. It will connect from the ML to the service module and transfer liquid coolant for the electronics and purge air/gaseous nitrogen for environmental control to the service module and the Launch Abort System. In July, the Core Stage Forward Skirt Umbilical was installed at about the 220-foot level on the ML tower. The umbilical will swing into position to provide connections to the SLS core stage forward skirt, providing conditioned air and gaseous nitrogen, and swinging away before launch.

Significant structural modifications to the Launch Complex 39 turn basin wharf were underway in June to accommodate arrival of the SLS 212-foot-long core stage and its ground support and transportation equipment. The core stage, which is more than 50 feet longer and about 600,000 pounds heavier than the space shuttle external tank, will arrive by barge from the Michoud Assembly Facility in New Orleans.

Just after FY17, the very successful 21st Century Program that implemented many of the investments that enabled Kennedy to become the multi-user spaceport it is today came to an end. At the same time, GSDO officially transitioned to a new name, Exploration Ground Systems (EGS), to better align with the program's congressional appropriation. Drawing on five decades of experience and excellence in processing and launch, EGS will continue the steady progress forward as it works with the SLS and Orion teams to pave the way to the spaceport's future and unlock access to deep space.



(Above) High up in the Vehicle Assembly Building, a crane lowers the final work platform, A North, for installation in High Bay 3 on Jan. 12, 2017. The platform will be installed and secured on its rail beam high up on the north wall of the high bay. In view on the platform are the American flag and a small tree. In view below are the nine levels of previously installed platforms.

EXPLORATION RESEARCH AND TECHNOLOGY PROGRAMS

NASA Kennedy Space Center's Exploration Research and Technology (ER&T) Programs Directorate continues to create new capabilities and leverage innovation. The team's accomplishments are helping to fulfill NASA's mission of supporting the evolution of the world's premier multi-user spaceport, inspiring a new generation of innovators and providing tangible benefits for the nation.

A primary mission of the organization is ongoing support to the International Space Station by servicing Orbital Replacement Units, providing logistical support and enhancing station utilization by creating new capabilities to enable life sciences research and other flight experiments. The team was instrumental in the success of four station resupply missions launched from our local spaceport, as well as from Wallops Island in Virginia and the Tanegashima Space Center in Japan.

Kennedy's Space Station Processing Facility (SSPF) is a world-class processing laboratory. All space station cargo and each experiment for the orbiting laboratory is prepared and checked out in the SSPF, a crucial part of a premier multi-user spaceport.

Agency scientists and engineers also are developing new technologies and advanced concepts to address critical issues and challenges that require resolution for future long-duration missions to deep space, such as radiation protection, thermal management and the use of autonomous robotics to enhance future operations.

Food is another concern for deep space travelers. ER&T scientists are studying plant growth aboard the International Space Station. During 2017, station astronauts could eat fresh produce grown on board, utilizing capabilities developed and processed in the SSPF.

During the past year, NASA astronauts also installed the station's new Advanced Plant Habitat (APH). Once activated, APH will augment other onboard food-production capabilities, allowing for more comprehensive and larger-scale life sciences research.

The ER&T team carried out a variety of technology development projects and capability demonstrations. Additionally, team members were invited to support the agency's initial concept development of the Deep Space Gateway and Transport initiative with planning and formulation activities for concepts, including the Next Space Technologies for Exploration Partnerships (NextSTEP) for Habitation Systems. Lockheed Martin will be working out of the SSPF, using the Multi-Purpose Logistics Module "Donatello" as the basis for their habitation demonstration article slated for next year.

ER&T also is providing expertise and capabilities to commercial space, such as the multi-use, portable Universal Propellant Servicing System (UPSS) consisting of liquid oxygen and liquid methane. The UPSS provides capabilities for servicing small-class

Outredgeous red leaf lettuce, Mizuna mustard and Waldmann's green lettuce are growing in the Veggie control system in the International Space Station environment simulator chamber in the Space Station Processing Facility.

In the high bay of Kennedy's Space Station Processing Facility, Chris Hardcastle, left, of Stinger-Ghaffarian Technologies, performs a sharp-edge inspection of the integrated Total and Spectral Solar Irradiance Sensor-1 (TSIS-1) payload and the EXPRESS Pallet Adapter. Hardcastle is joined by Dwayne Swieter, right, a TSIS-1 payload team member from the Laboratory for Atmospheric and Space Physics, a Research Institute at the University of Colorado (Boulder). Designed to measure the Sun's energy input into Earth, TSIS-1 launched on SpaceX's 13th commercial resupply mission to the International Space Station.

rockets and serves as an operational test bed for concepts and capabilities that can help improve ground-system availability while reducing ground operations and maintenance costs.

The Swamp Works team supported the Additive Construction with Mobile Emplacement (ACME) project. Led by Marshall Space Flight Center, the project team included NASA Kennedy, the U.S. Army Corps of Engineers, Contour Crafting Corp. and the Pacific International Space Center for Exploration Systems. The team developed a new 3-D printing system for constructing infrastructure using an automated concrete materials delivery system capable of 3-D printing barracks for soldiers. Techniques proven with ACME could be used to construct future landing pads, radiation shelters and planetary habitats for astronaut crews.

NASA scientists and engineers within ER&T continued to play a critical role in payload management for the Resource Prospector Mission, led by NASA's Ames Research Center, as well as in payload development for the mission. The team worked with Glenn Research Center to complete an integrated payload test using Glenn's VF-13 thermal vacuum chamber, as well as radiation testing.

Researchers working at Kennedy's Cryogenics Test Laboratory continue to provide technical solutions and create innovative advancements in the cross-cutting area of cryogenic engineering and research. In support of local Kennedy programs, the laboratory developed several thermal insulation systems and related technologies now utilized by new cryogenic piping umbilicals recently installed on the mobile launcher for the SLS. The lab team also led the development of the state-of-the-art system for the storage of cryogenic hydrogen at Launch Pad 39B using vacuum-jacketed composite tanks.

The ER&T team engages closely with academia, utilizing a variety of research grants, internships, fellowships, work assignments and technical challenges to inspire interest in STEM and the space program.

A 3-D printed building is constructed using the Additive Construction with Mobile Emplacement (ACME) project. Techniques proven with ACME could be used to construct future landing pads, radiation shelters and planetary habitats for astronaut crews.

Kennedy Space Center's Cryogenics Test Laboratory is helping the cryogenics industry establish its standards. Kennedy conducted a cold vapor test to help with these standards with observers from several countries on hand. The results were later taken to an International Organization for Standardization meeting in Dubai. The cornerstone of the lab's offerings is being one of the best in the world to advance and improve energy efficiency to benefit all mankind.

ORION PROCESSING

The Orion production team of engineers and technicians achieved several major processing milestones during FY 2017 as they continued to prepare the Orion crew module for its uncrewed flight test atop the agency's first Space Launch System (SLS) rocket on Exploration Mission-1 (EM-1). The work was performed inside the Neil Armstrong Operations and Checkout Building (O&C) high bay at Kennedy Space Center.

In October 2016, technicians prefitted tile blocks around the Orion crew module heat shield inside the high bay. The heat shield is one of the most critical elements of Orion and will protect it and future astronauts inside from searing temperatures experienced during re-entry through Earth's atmosphere when they return home.

In November, the Orion crew module adapter (CMA) for EM-1 was lifted on Nov. 11 during its processing flow inside the high bay. Technicians with Lockheed Martin, the Orion crew module manufacturer, lowered the adapter onto a test stand for secondary structure outfitting. The CMA was then moved into a temporary clean room at the end of the month for propellant and Environmental Control and Life Support System (ECLSS) tube installation and welding.

At the start of 2017, the Orion crew module was moved for proof pressure testing in the high bay. Welding of propulsion and ECLSS tubing on the crew module was completed, and the spacecraft was moved from a clean room to the proof pressure cell on Jan. 26 to prepare for testing.

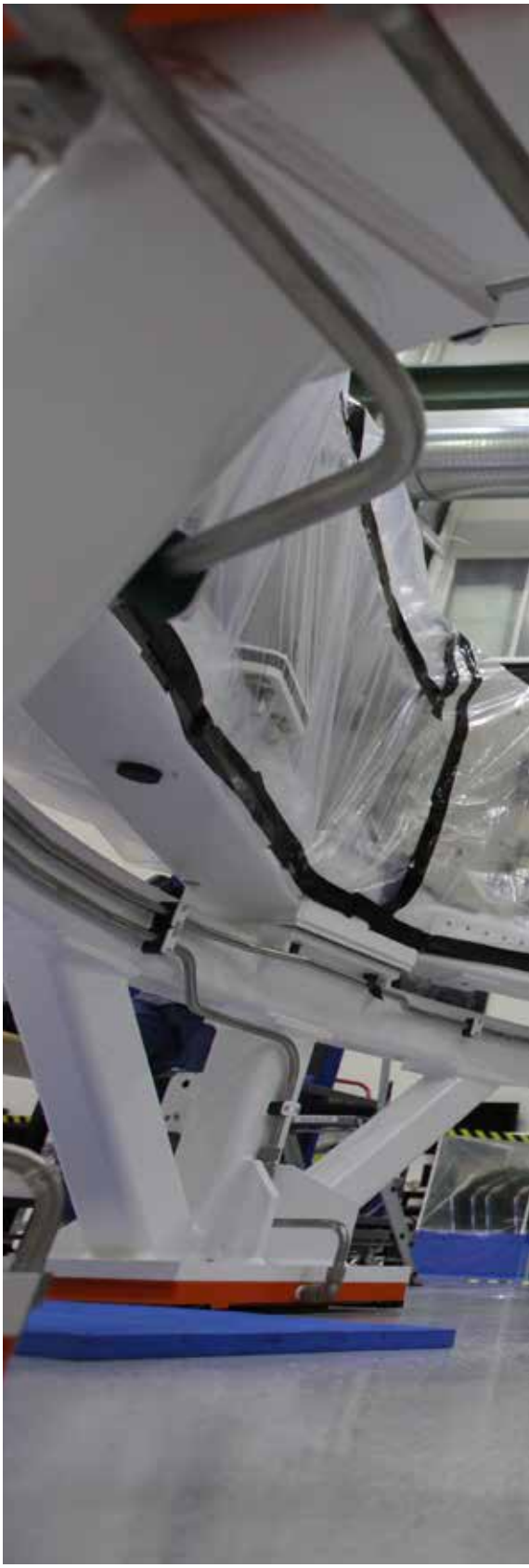
Engineers and technicians with NASA and Lockheed Martin completed a series of proof pressure and leak tests to confirm the welded joints of Orion's propulsion and ECLSS tubing are solid and capable of withstanding launch, re-entry and landing.

In April, engineers and technicians completed a series of verification and validation tests of the pneumatic systems that are critical to preparing Orion. Testing was successfully completed on April 4 inside and outside of the Multi-Purpose Payload Facility (MPPF). The MPPF is the location where fuel and commodities will be provided for the Orion spacecraft prior to launch. Orion also will be defueled in this facility and its components prepared for potential use on future missions.

In May, the crew module was moved from a clean room to a work station inside the high bay to prepare for the next additions to the spacecraft. In the clean room, engineers and technicians completed the welding of the tanks to the propulsion and ECLSS tubing. They also completed welding to install the propellant, pressurant and post-landing coolant tanks. The pressurant is used to maintain the flow of propellant and coolant in the propulsion and ECLSS systems, respectively.

On Aug. 18, the Orion EM-1 spacecraft was successfully powered up for the first time inside Orion's spacecraft factory in the O&C. These tests are done to ensure everything performs as planned.

During the past fiscal year, the Orion spacecraft production team made great strides in the assembly and preparation of the spacecraft to prepare it for the journey beyond the Moon and back to Earth.



The Orion crew module for NASA's Exploration Mission-1 (EM-1) is secured in a work station May 11, 2017, in the Neil Armstrong Operations and Checkout Building high bay at NASA's Kennedy Space Center. Orion will undergo additional processing to prepare it for launch on its first integrated flight atop the Space Launch System rocket on EM-1.

Inside the Neil Armstrong Operations and Checkout Building high bay at NASA's Kennedy Space Center, Lockheed Martin technicians secure a protective cover around the Orion crew module adapter (CMA) for Exploration Mission-1. The CMA was moved to a clean room to undergo propellant and environmental control and life support system tube installation and welding. The adapter will connect the Orion crew module to the European Space Agency-provided service module.

NASA ENGINEERING

The year was met with tremendous effort from the team in the Engineering Directorate at NASA's Kennedy Space Center. Engineering has continued to advance engineering and technology developments that have firmly established the center as a premier, multi-user spaceport, enabling research, processing and launch site operations for government and commercial customers.

Kennedy's engineering capabilities support all of the programs at the center. The skills and expertise of engineering are evident in the many successes over this past year. Engineering made significant progress on the delivery of ground support equipment hardware to the Ground Systems Development and Operations Program, including the completion of Launch Equipment Test Facility umbilical testing with subsequent delivery of multiple umbilicals and vehicle support posts for installation on the mobile launcher. Engineering has had a banner year preparing for the grounds equipment systems that will support the Space Launch System (SLS) to help enable fulfillment of NASA's goals and objectives to send humans to a range of destinations.

Engineering's Construction of Facilities team had another successful year, providing superior leadership and technical prowess in the design and construction of both institutional and programmatic facilities. In 2017, the installation of new platforms in High Bay 3 of the Vehicle Assembly Building was completed. The platforms will enable final assembly and checkout of the SLS vehicle. At Launch Complex 39B, the catacomb roof structure was reinforced to increase its maximum structural capacity to handle the heavier SLS. On the institutional front, the electrical power infrastructure is being revitalized and upgraded, and construction of a second solar plant is nearing completion. This will enable Kennedy's new headquarters building to achieve net-zero energy consumption while also satisfying the center's commitment to meeting the agency's renewable energy goals. All four projects are critical to achieving the goal of transforming the center into a versatile multi-user spaceport.

In support of the ISS Program, the engineering team provided technical expertise and support for several experiments and launches. The Advanced Plant Habitat, launched on the SpaceX CRS-11 resupply mission, was successfully assembled and

A view from below the mobile launcher shows a crane positioning the bracket for the Orion Service Module Umbilical (OSMU) high up for installation on the mobile launcher tower.

(Above) Kennedy Space Center's C5 power substation is seen in this wide-angle photo. The spaceport's electrical power infrastructure is being revitalized and upgraded.

(Page Opposite) The Core Stage Inter-tank Umbilical for NASA's Space Launch System is attached to the "C" tower of the Vehicle Motion Simulator 2 test fixture at the Launch Equipment Test Facility on Nov. 30, 2016. The center's Engineering Directorate and the Ground Systems Development and Operations Program provided oversight of the processing and testing of the umbilicals.

Construction of a second solar plant is nearing completion. This addition will enable the center's new Headquarters building to achieve net-zero energy consumption while also satisfying Kennedy's commitment to meeting the agency's renewable energy goals.

powered up aboard the International Space Station. The Thermal Vacuum Chamber was delivered and installed at Kennedy for orbital replacement unit testing. The Payload Rack Checkout Unit/Express Logistics Carrier Simulator testing was successfully performed on several payloads, including the Neutron Star Interior Composition Explorer and Multiple User System for Earth Sensing Facility. The Vapor Containment Facility was activated, tested and used to successfully fill the Pump Flow Control System with ammonia. Ground support equipment was designed, built and certified to fill the Portable Breathing Apparatus bottles. Engineering also successfully supported six launches to the station.

The Commercial Crew Program (CCP) continues to advance toward restoring U.S. capabilities of launching astronauts to the orbiting laboratory, and Kennedy Engineering supported ongoing progress toward certification of CCP partner SpaceX, and its Crew Dragon and Falcon 9, including qualification and acceptance testing. There are currently six Crew Dragon modules in various stages of production and testing, including two ground test and qualification articles and the first four flight vehicles. The first flight vehicle that will dock with the International Space Station, Demonstration Mission 1, has been powered up for the first time. Additionally, CCP partner Boeing completed the Land Landing Qualification Test Series, which included 14 total drop tests at the Langley facility.

The Launch Services Program continued to show tremendous accomplishment. The successful launches of JPSS-1 and TDRS-M demonstrated engineering's technical contribution to the program, helping ensure LSP meets its mission in providing on-time, on-orbit and on-cost launch services.

For six decades, Kennedy has been the epitome of innovation as technologies have evolved, new destinations have been charted and the paradigm has shifted in how the agency works with private partners. Engineering will continue to provide technical expertise and innovative ideas to ensure customer success so that the center is prepared and postured for future explorations.

SPACEPORT INTEGRATION AND SERVICES

Kennedy Space Center's Spaceport Integration and Services Directorate (SI) sets the standard for excellence with its superior focus on customer service and conscientious stewardship of center infrastructure and natural resources, and strives to provide five-star service.

The Spaceport Management and Integration Division has been integral in Kennedy's evolution to a multi-user spaceport. The division is leading the efforts to create governance models, policies and processes to enable our commercial space partners to operate as independently as possible, efficiently obtain essential services and successfully conduct an ever-increasing tempo of Federal Aviation Administration-licensed launches from America's spaceport. In FY 2017, this included processes for integrated master scheduling, prioritizing test and launch milestones and carefully coordinating outages, hazardous operations and demands for center commodities and services. A key to this success was determining the responsibilities of the Federal Aviation Administration while preventing overlap with NASA's requirements, and communicating those changes across the center. These actions paid off with the first commercial launch from historic Launch Complex 39A.

SI's Medical and Environmental Services Division is an agency leader with respect to health, environmental stewardship and sustainability, which are essential to managing resources and protecting Kennedy's unique natural environment. Its robust remediation program coordinated the excavation and disposal of 20,574 tons of contaminated soil from five sites throughout the center, and implemented groundwater cleanups at three sites, including a 270-well air sparge system at Launch Complex 39B, which was the largest groundwater remedial system installed to date. These remedial actions are important steps to achieve unrestricted reuse of the land and give the multi-user spaceport flexibility for future growth.

The center scored almost all "green" on its annual Sustainability Scorecard by meeting or surpassing its goals in areas such as reduction of greenhouse gas emissions, use of renewable energy and alternative fuels, and reductions in energy and potable water usage, which contributed to a total cost savings of $1M to the agency. In addition, the center diverted from the landfill more than 50 million pounds of waste in FY 17.

The north side of Kennedy's Launch Complex 39 area is seen during an aerial survey. In the foreground is the mobile launcher for NASA's Space Launch System rocket; in the background, from left to right, are the Launch Control Center, Vehicle Assembly Building and Boeing Commercial Crew and Cargo Processing Facility.

WASTE DIVERSION

Kennedy's sustainability efforts included educating and engaging the workforce through outreach events, including the annual Earth Day Expo, featuring demonstrations by more than 50 sustainable exhibitors, and the center's America Recycles Day event, in which a total of 12,500 pounds of employees' personal materials were collected and donated to charitable organizations.

46 million pounds of SOIL dredged from roadside ditches

2.2 million pounds of STEEL from Launch Complex 39A

1.8 million pounds of COMPOST

310,497 pounds of OFFICE PAPER

33,640 pounds of FURNITURE

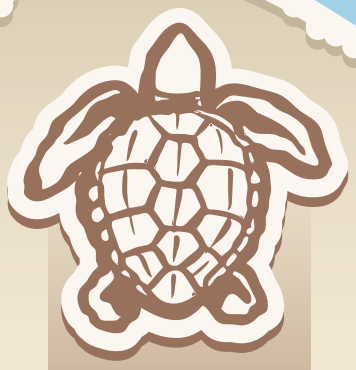
24,200 pounds of RECYCLED glass, aluminum and plastic cans/bottles

RECORD NUMBER OF NESTS AT KSC

The spaceport had a record nesting season for green sea turtles. The center's beaches along the Canaveral National Seashore and Merritt Island National Wildlife Refuge accounted for 23 percent of the state's total nests, and dark skies helped to make it a highly productive hatching season as well.

GREEN

8,937



LOGGERHEAD

5,782

LEATHERBACK

28

The Center Services Division's Logistics Branch received recognition for significant achievement by the NASA Headquarters Compensating Controls Review Board, with best practices identified for possible implementation across the agency. The branch also helped supplement Kennedy's budget by reducing new procurements through reutilization of $4 million in excess property and generating $1 million in proceeds from surplus sales. It successfully implemented a Radio Frequency Identification (RFID) program for government property, which increased inventory efficiency and reduced reconciliation efforts, resulting in Kennedy's FY 17 equipment loss rate of .09 percent, the lowest in more than 20 years and well below the agency's benchmark of .5 percent.

SI's Protective Services Office serves in one of the center's most critical roles. The team employs the latest technologies and techniques to maintain safety and security on a day-to-day basis as well as during high-profile events, such as Vice President Mike Pence's visit to Kennedy in July 2017. Additionally, Kennedy's emergency manager was inducted into the Space Coast Public Service Hall of Fame, which represented the highest honor for his outstanding service to the Space Coast community, and the center's Emergency Response Team finished fifth out of 51 teams worldwide in the 34th annual SWAT Roundup International Competition.

Finally, the entire directorate was instrumental in the center's recovery from Hurricane Matthew, the most intense hurricane to ever impact Kennedy operations. SI responded with Herculean efforts, leading both the Ride-out Team and the Damage Assessment and Recovery Team, and coordinated support from both internal staff and multiple external organizations to assess damage, complete emergency mitigation actions such as restoration of essential utilities, and reopen the center following the devastating storm. Efforts continued throughout the year to contract for and repair the millions of dollars in damages from Hurricane Matthew.

(Above) Vice President Mike Pence, left, and U.S. Senator Marco Rubio (R-FL) step off Air Force Two on the Shuttle Landing Facility at Kennedy in July 2017.

(Below) Members of the Disaster Assessment and Recovery Team (DART) repair a section of roof atop Kennedy's Operations Support Building II, part of the spaceport's recovery from Hurricane Matthew.

COMMUNICATION AND PUBLIC ENGAGEMENT

Journalists hear from Kennedy Space Center Director Bob Cabana before viewing the 10 levels of new work platforms in High Bay 3 inside the Vehicle Assembly Building.

Journalists came to NASA's Kennedy Space Center in Florida during FY 2017 to participate in the 79 media projects that took place throughout the year. Seven launches and four media day events brought in more than 470 members of the media.

Through Twitter, Facebook, Instagram and YouTube, Kennedy engaged and informed millions of people online about the exciting missions and science taking place every day.

Through hundreds of posts and Tweets, the center reached 22.4 million Twitter users and 11.6 million Facebook users. On YouTube, KSC posted 90+ videos which had more than 1.4 million views and 1.8 million minutes watched in FY 17.

NASA Social events brought more than 240 participants to the Florida spaceport to cover six launches: four commercial resupply missions to the International Space Station, the Geostationary Operational Environmental Satellite-R, and Tracking and Data Relay Satellite-M.

The center exhibits program supported 68 events across the nation and spread NASA's messages to over 2 million people. Additionally, the Speakers Bureau put on 365 events and reached more than 130,000 people.

OTHER HIGHLIGHTS FROM THE YEAR INCLUDED:

Part of American Education Week, "Educator for a Day" encouraged schools to embrace members of the community and allow them to educate students about their careers. This year, the directorate partnered with the NASA Digital Learning Network (DLN) for the Great American Teach-In, reaching more than 12,000 students. Experts from a variety of disciplines spoke about their careers and took part in live Q&A interaction with schools.

NASA recognizes its need to empower women and utilize the full range of the talented students who will someday enter the workforce. On "Introduce a Girl to Engineering Day," in partnership with the DLN, a host of female technical experts and scientists shared their career experiences as women in a science, technology, engineering or math (STEM) field, introducing more than 25,000 students to the world of engineering. The event was held in conjunction with National Engineers Week.

NASA astronauts Nicole Mann, left, and Steve Bowen speak to members of social media in the Press Site auditorium. At right is Emily Furfaro of the NASA Social Media Team. The briefing focused on preparations to launch NASA's Tracking and Data Relay Satellite, TDRS-M.

NASA is a leader in innovation and has a diverse workforce that makes its contribution to an event like this truly unique. Schools, organizations and individuals from around the globe tuned in for the Inclusion Drives Innovation Webcast to learn from NASA employees with disabilities who exemplified how inclusion drives innovation. Over 11,400 students tuned in for the event, part of National Disability Employment Awareness Month.

The Kennedy Space Center Visitor Complex welcomed more than 1.6 million guests. Even with a six-day closure due to Hurricane Irma, the visitor complex saw a 2.2 percent increase in attendance. The visitor complex opened several new exhibits, including one honoring the crew of Apollo 1, as well as additions to the NASA NOW exhibit, such as the Lockheed Martin EFT-1 Orion capsule, Boeing's CST-100 Starliner, a United Launch Alliance Atlas V Rocket, a Vector Class B Rocket, CubeSAT payload engineering models and a Mars Rover.

Topping off a successful year, visitor complex social media accounts ranked #1 in attraction popularity within driving distance of Orlando – surpassing those of Walt Disney World, Universal Studios, Sea World and Legoland.

EDUCATION PROJECTS AND YOUTH ENGAGEMENT

Kennedy Space Center's Education Projects and Youth Engagement division continued its proven management of two agencywide programs.

The Established Program to Stimulate Competitive Research (EPSCoR) sets partnerships with government, higher education and industry in jurisdictions that historically have not participated in competitive aerospace and aerospace-related research activities.

Minority University Research and Education Program (MUREP) STEM Engagement, or MSE, is designed to encourage STEM involvement. MSE provides financial assistance to minority-serving institutions to recruit and retain underrepresented and underserved students into STEM fields. Kennedy's annual Swarmathon competition is MSE's flagship program.

The directorate also collaborated with hundreds of community organizations, schools, museums and civic groups. Outreach events, projects and programs hosted in the Southeast and Puerto Rico trained educators, engaged students and shared with the public how NASA missions improve life on Earth. These events included:

More than 440 local students and their chaperones were treated to a special preview of the soon-to-be hit film Hidden Figures, followed by a Q&A with the lead actresses and the film's composer, recording artist Pharrell Williams.

Through the Fairchild Tropical Botanic Gardens, students from 121 schools in south Florida are participating in the Growing Beyond Earth Challenge,

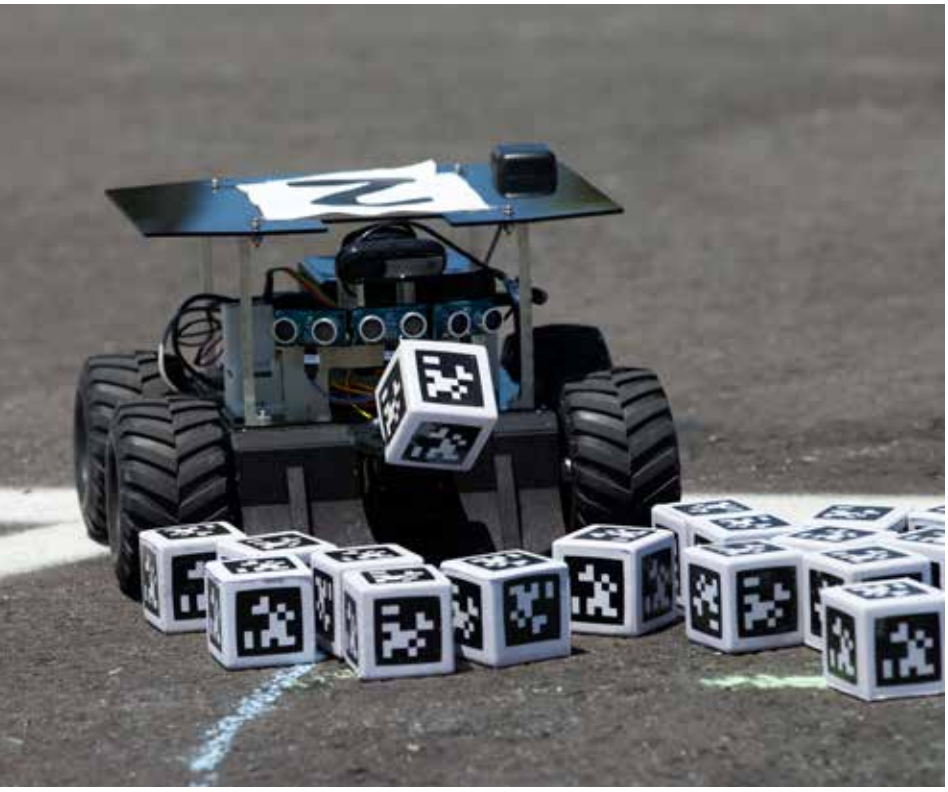
Kennedy scientists Trent Smith, left, and Dr. Gioia Massa speak to middle and high school teachers at Fairchild Tropical Botanic Garden in Miami during the kickoff of the 2017-2018 Fairchild Challenge-Growing Beyond Earth.

In the IMAX Theater of the Kennedy Space Center Visitor Complex, cast and crew members of the motion picture "Hidden Figures" participate in a question-and-answer session on Dec. 12, 2016. From the left are Ted Melfi, writer and director of "Hidden Figures;" Octavia Spencer, who portrays Dorothy Vaughan in the film; Taraji P. Henson, who portrays Katherine Johnson; Pharrell Williams, musician and producer of "Hidden Figures;" and Janelle Monáe, who portrays Mary Jackson. The film was released in January 2017.

During the countdown for the launch of NOAA's Geostationary Operational Environmental Satellite, or GOES-R, Stephanie Martin of NASA Communications, right, interviews Al Roker, weather forecaster on NBC's "Today Show."

(Page to right) Because Kennedy Space Center shares its borders with the Merritt Island National Wildlife Refuge, nature thrives alongside high-tech space hardware and facilities. From top to bottom, black skimmers fly just above the waterline on the hunt for fish; a Florida whitetail deer ventures out of a wooded area; an otter swims through one of the spaceport's many waterways; and a purple passionflower blooms amid bright green marsh grasses.

(Above) Members of the news media view the Orbital ATK Cygnus spacecraft before encapsulation in the United Launch Alliance Atlas V payload fairing inside Kennedy's Payload Hazardous Servicing Facility on March 9, 2017.



In the spaceport's second annual Swarmathon, 20 teams representing 22 minority serving universities and community colleges were invited to develop software code to operate these innovative robots known as "Swarmies" to help find resources when astronauts explore distant locations, such as the Moon or Mars.

testing factors that may influence plant growth, flavor and nutrition in environmental conditions mimicking those aboard the International Space Station. Their research will provide scientists from NASA's VEGGIE program at Kennedy with supplemental data to determine the best food to grow on long-duration missions in space.

Thanks to Girls STEM Day, hundreds of fifth through 12th grade girls can now better answer the question, "What do I want to be when I grow up?" More than 20 women from various professions, including science, health care and education, discussed their jobs and how they chose them. The Kennedy Networking Opportunities for Women (KNOW) helped sponsor the event in celebration of Women's History Month.

Teams of more than 90 Native American students from tribal and traditional U.S. colleges and universities competed in the Eighth Annual First Nations Launch Competition (FNL) held in Kansasville, Wisconsin, by launching their self-built rockets. Managed at Kennedy through the Wisconsin Space Grant Consortium, FNL inspires indigenous students to consider obtaining college degrees that can "launch" careers in a STEM field.

KENNEDY BUSINESS REPORT

CFO REPORT

The Kennedy Space Center Fiscal Year 2017 budget was $2.59 billion. The center also performed $160.6 million in reimbursable work with other government and commercial entities.

During FY 2017, the Commercial Crew Program (CCP) and partners Boeing and Space Exploration (SpaceX) achieved a substantial amount of progress through the Commercial Crew Transportation Capability (CCtCap) contracts. Both partners continued to successfully complete key development, design and testing milestones en route to making significant progress toward a NASA certification of their Crew Transportation Systems (CTS).

CCP secured an additional four crew rotation missions from Boeing and SpaceX. The missions will carry astronauts to and from the International Space Station through 2024. The four additional missions bring the total number of crew rotation missions awarded to each provider to six. These missions will fly following NASA certification.

In addition to the work being achieved under CCtCap, CCP also is working with Blue Origin and Sierra Nevada to develop and refine their respective spacecraft and launch systems. Under these Commercial Crew Development Program Round 2 (CCDev2) and Commercial Crew Integrated Capability (CCiCap) agreements, NASA provided expertise and insight into their spaceflight designs.

In FY 2017, the Launch Services Program supported three successful mission launches: Geostationary Operational Environmental Satellite-R (GOES-R), Cyclone Global Navigation Satellite System (CYGNSS), and Tracking and Data Relay System-M (TDRS-M) all launched from Cape Canaveral Air Force Station in Florida. The program also procured launch vehicle services and other support for several manifested missions scheduled to launch in FY 2018 and beyond.

The Ground Systems Development and Operations Program budget included both Exploration Ground Systems and the 21st Century Space Launch Complex. In support of the modernization and compatibility efforts for the launch of NASA's Space Launch System rocket carrying the Orion spacecraft on Exploration Mission-1, key accomplishments included continuation of the mobile launcher ground support equipment installation, Vehicle Assembly Building platform construction, Launch Complex 39B flame trench construction, and development of the Spaceport Command and Control System. In addition, enhancements for the 21st Century Space Launch Complex continued for the development of ground operations infrastructure to facilitate the activities of future customers and stakeholders, including government agencies, commercial industry, and current and future NASA programs.

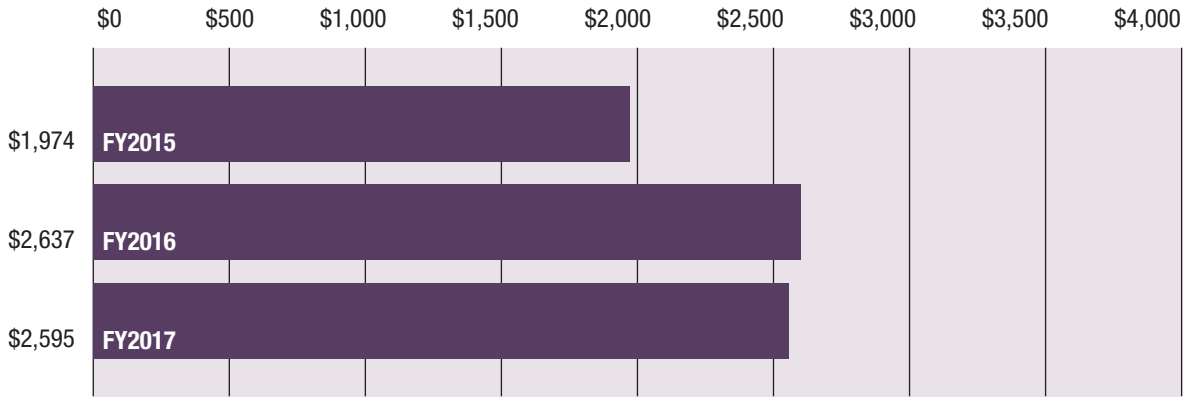
The International Space Station Program allowed for continued success toward achieving and maintaining the space station program mission of fully utilizing a permanent human outpost in space. Kennedy mission efforts afforded provisions for ground processing support for experiment hardware, as well as orbital replacement units needed to maintain the space station. The budget also provided for ongoing development of hardware intended to promote full utilization of the space station through the establishment of fundamental biological research capabilities.

Kennedy's Center Management and Operations maintained the center's essential infrastructure, its core technical capabilities, and sustained necessary safety and engineering technical authorities to support NASA's mission and enable multi-user spaceport readiness. Kennedy's Hurricane Matthew emergency supplemental budget funded windstorm damage assessments, facility stabilizations, and subsequent ongoing repairs to ensure all underlying center capabilities and critical infrastructure are ready and able to help fulfill NASA mission objectives and spaceport partner requirements.

KENNEDY SPACE CENTER
FY 2017 BUDGET AUTHORITY ($ IN MILLIONS)

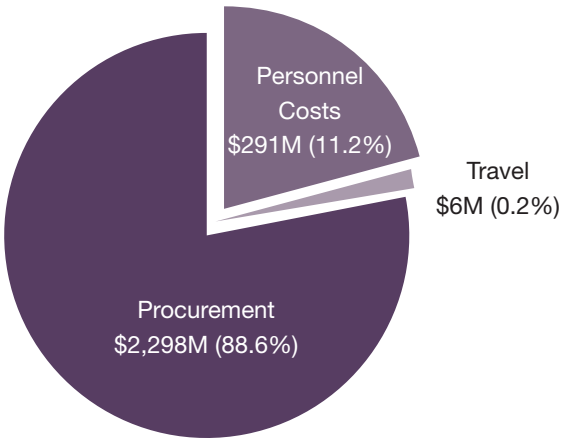
Commercial Crew Program	$1,110
Launch Services/Science	$358
Ground Systems Development and Operations	$487
Space Station	$62
Center Management & Operations	$328
Other	$250
Total KSC	$2,595

NASA/KSC BUDGET AUTHORITY SUMMARY
FY 2015 THROUGH FY 2017 ($ IN MILLIONS)



FY 2017 KSC BUDGET BY ELEMENT ($ IN MILLIONS)

TOTAL $2,595M



WORKFORCE OVERVIEW

Kennedy Space Center is the most broadly based, complex and successful spaceport in the world. Both NASA and contract personnel working at the center are essential to the success of Kennedy.

The workforce includes people with many skills who are dedicated to supporting the nation's space program and NASA's future explorations to destinations including the Journey to Mars. To accomplish the agency's various missions, these individuals fulfill a multitude of tasks.

At the end of each year, the center takes a snapshot of its workforce. This picture includes all federal and contractor employees chartered to work for Kennedy. Other organizations, such as the European Space Agency and Patrick Air Force Base, have roles here but are not reflected in these numbers.

As of Sept. 30, 2017, the total Kennedy population was 8,824. This includes 1,906 NASA civil servants, 75 NASA Pathways interns, 4,452 on-site contractor employees, 109 off-/near-site contractor employees, 1,711 tenants and 571 construction workers. The civil servant skill mix includes those in science, technology, engineering and mathematics positions and those in professional administrative and clerical positions.

KENNEDY SPACE CENTER WORKFORCE PROFILE

(through 9/30/17)

Civil Servants	1,906*
NASA Pathways Interns	75
Total Civil Servants	1,981
*includes 10 part-time permanent and 1 full-time temporary employees	
Civil Servants Skill Mix	
Scientific, Technology, Engineering and Mathematics	68%
Clerical and Professional Administrative	32%
On-site Contractor Employees	4,452
Off-site/Near-site Contractor Employees	109
(Excludes construction workers)	
Total Contractor Employees	4,561
Total Construction Workers	571
Total Tenants	1,711
TOTAL KSC POPULATION	8,824

PROCUREMENT REPORT

Industry Partners at a Glance

The companies listed below were some of Kennedy Space Center's top support or launch services contractors in terms of dollars obligated in FY 2017. Following is a brief description of their work for the agency:

THE BOEING COMPANY

The Boeing Company participated in NASA's goal of developing orbital commercial Crew Transportation Systems. Under the Commercial Crew Transportation Capability (CCtCap) contract for NASA's Launch America initiative, The Boeing Company was tasked with developing safe, reliable and cost-effective crew transportation to and from the International Space Station on American spacecraft launched from the United States.

SPACE EXPLORATION TECHNOLOGIES CORP.

Space Exploration Technologies Corp. (SpaceX) participated in NASA's goal of developing orbital commercial Crew Transportation Systems. Under the Commercial Crew Transportation Capability (CCtCap) contract for NASA's Launch America initiative, SpaceX was tasked with developing safe, reliable and cost-effective crew transportation to and from the International Space Station on American spacecraft launched from the United States. SpaceX also participated via a Space Act agreement supporting the agency's Commercial Crew Integrated Capability (CCiCap) initiative.

UNITED LAUNCH SERVICES LLC

United Launch Services (ULS), a subsidiary of United Launch Alliance, is a joint venture between The Boeing Company and Lockheed Martin Commercial Launch Services. ULS provided commercial launch services to NASA using the Delta and Atlas launch vehicles under the NASA Launch Services (NLS) II multiple-award, indefinite delivery, indefinite quantity task order contract. Principal location for the Delta and Atlas vehicle assembly is Decatur, Alabama. Both vehicles launch from Cape Canaveral Air Force Station in Florida and Vandenberg Air Force Base in California.

JACOBS TECHNOLOGY INC.

Jacobs Technology Inc., prime contractor for the Test and Operations Support Contract (TOSC), is responsible for the overall management and implementation of ground systems capabilities, flight hardware processing and launch operations at NASA's Kennedy Space Center. Specific services provided by Jacobs Technology under TOSC include launch vehicle, spacecraft, and payload integration and processing; operations and development of associated processes for ground systems to support integration, processing and launch; servicing and testing of flight hardware; and launch of development and operational flights at Kennedy.

VENCORE SERVICES AND SOLUTIONS INC.

Vencore provided engineering products and services to Kennedy's Engineering and Technology Directorate and other center and agency operational customers. Support also included laboratory and developmental shop maintenance and operations, technical services, spaceflight systems engineering and engineering development. Vencore also provided technology outreach to foster awareness and utilization of Kennedy's unique capabilities.

URS FEDERAL TECHNICAL SERVICES INC.

URS Federal Technical Services provided base operations support for Kennedy. URS Federal Technical Services was responsible for operations, maintenance and engineering for specific Kennedy facilities, systems, equipment and utilities. URS Federal Technical Services also was responsible for calibration and propellants handling at the center.

J.P. DONOVAN CONSTRUCTION INC.

J.P. Donovan Construction Inc. provided general contracting management and construction services for the Ground Systems Development and Operations mobile launcher ground support equipment installation effort. The mobile launcher modifications are necessary to meet NASA's beyond Earth orbit mission. J.P. Donovan Construction Inc. also was the prime contractor for the flame trench deflector and refurbishment and the reinforcement of the Launch Complex 39B catacomb structure efforts.

ABACUS TECHNOLOGY CORP.

Abacus provided communication and information technology services under the Information Management and Communications Support (IMCS) contract. Abacus supported the majority of these requirements at Kennedy, which included support to agency programs, payloads and launch services. Services provided included IT security, hardware and software integration development, computer administration and maintenance, voice and data transmission, library, graphics, publications, and printing and reproduction.

YOUR PROCUREMENT DOLLARS AT WORK
GEOGRAPHICAL DISTRIBUTION BY STATE
(Fiscal Year 2017 Obligations)

STATE	TOTAL DOLLARS
ALABAMA	14,156,865
ARIZONA	1,386,975
CALIFORNIA	580,879,183
COLORADO	298,052,518
CONNECTICUT	3,483,632
FLORIDA	188,307,680
GEORGIA	7,435,339
ILLINOIS	10,550
INDIANA	2,108,849
KANSAS	61,867
LOUISIANA	140,696
MARYLAND	215,475,006
MICHIGAN	22,845
MINNESOTA	74,529
MISSOURI	1,183,725

STATE	TOTAL DOLLARS
NEVADA	1,471,429
NEW HAMPSHIRE	4,500
NEW JERSEY	54,718
NEW MEXICO	4,822,281
NEW YORK	499,771
NORTH CAROLINA	688,097
OKLAHOMA	5,411,137
PENNSYLVANIA	11,349,520
SOUTH DAKOTA	440,506
TENNESSEE	149,450,053
TEXAS	596,024,903
VIRGINIA	200,150,469
WASHINGTON	1,688,000
WISCONSIN	2,265,427
TOTAL	**$2,287,101,070**

TOP 25 KSC BUSINESS CONTRACTORS FOR FY 2017

Contractor	Dollars
SPACE EXPLORATION TECHNOLOGIES CORP.	594,778,922
BOEING COMPANY	585,672,981
UNITED LAUNCH SERVICES LLC	297,861,923
JACOBS TECHNOLOGY INC.	142,312,672
VENCORE SERVICES AND SOLUTIONS INC.	139,904,325
URS FEDERAL SERVICES INC.	135,927,011
J.P. DONOVAN CONSTRUCTION INC.	67,948,672
ABACUS TECHNOLOGY CORP.	49,750,004
AI SOLUTIONS INC.	39,006,873
CHENEGA INFINITY INC.	31,868,701
SAUER INC.	22,571,000
INTEGRATED MISSIONS SUPPORT SERVICES LLC	16,859,982
MILLENNIUM ENGINEERING AND INTEGRATION CO.	13,198,861
FLORIDA POWER AND LIGHT COMPANY INC.	12,517,179
SWORD & SHIELD ENTERPRISE SECURITY INC.	12,119,809
ORBITAL SCIENCES CORP.	11,534,126
ASTROTECH SPACE OPERATIONS INC.	10,572,483
A-P-T RESEARCH INC.	8,638,670
AIR LIQUIDE LARGE INDUSTRIES U.S. LP	7,490,364
AIR PRODUCTS AND CHEMICALS INC.	6,745,125
BREVARD ACHIEVEMENT CENTER INC.	6,156,071
FLORIDA DREDGE AND DOCK LLC	5,963,815
REYNOLDS SMITH AND HILLS INC.	5,888,501
ASRC FEDERAL DATA SOLUTIONS INC.	5,652,651
BRPH ARCHITECTS ENGINEERS INC.	5,601,336
TOTAL	**2,236,542,057**

National Aeronautics and Space Administration

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Public Affairs Directorate

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