



KENNEDY SPACE CENTER'S ANNUAL REPORT **FY12**



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The Vehicle Assembly Building (VAB) is seen during a field-guided boat tour of Kennedy Space Center, part of the center's first-ever Innovation Expo on Sept. 5, 2012. The tour, called "Living Outdoor Laboratory for Environmental Sustainability," gave employees the opportunity to see the unique estuarine ecosystems around the center.

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A bald eagle is perched in a tree near the Shuttle Landing Facility at Kennedy Space Center, which shares a boundary with the Merritt Island National Wildlife Refuge.



CENTER DIRECTOR'S MESSAGE

In Fiscal Year 2012, Kennedy Space Center celebrated five decades of extraordinary accomplishments. We also began gearing up for a vibrant future that has us testing and launching the most complex machines ever built.

The Launch Services Program shared in the tremendous success of NASA's Curiosity rover, a one-ton, mobile scientific laboratory that captured America's imagination in a special way with its pinpoint landing

in August following a flawless liftoff from Cape Canaveral Air Force Station. The team continues to make all of us proud by conducting successful launches of a variety of rockets carrying precious scientific cargo.

When Kennedy began operations July 1, 1962, as the Launch Operations Center, its founders knew that the complex would be a national resource capable of supporting a wide array of vehicles. We're going back to those roots with the help of the Ground Systems Development and Operations Program by revamping existing infrastructure and facilities to give us the flexibility to host a variety of vehicles as we transition to the launch complex of the future.

Throughout the year, our Shuttle Transition and Retirement group prepared our decorated space shuttle orbiters for their new homes in California, Virginia and at our visitor complex where they will inspire the next generation of explorers.

The agency recently entrusted us with its newest human spaceflight program, a first for the center. The Commercial Crew Program is making

tremendous progress with our industry partners as they develop the spacecraft and launch vehicles NASA needs to transport our astronauts to and from the International Space Station. Kennedy also continues to help ensure the station is fully utilized as a world-class research and technology demonstration platform.

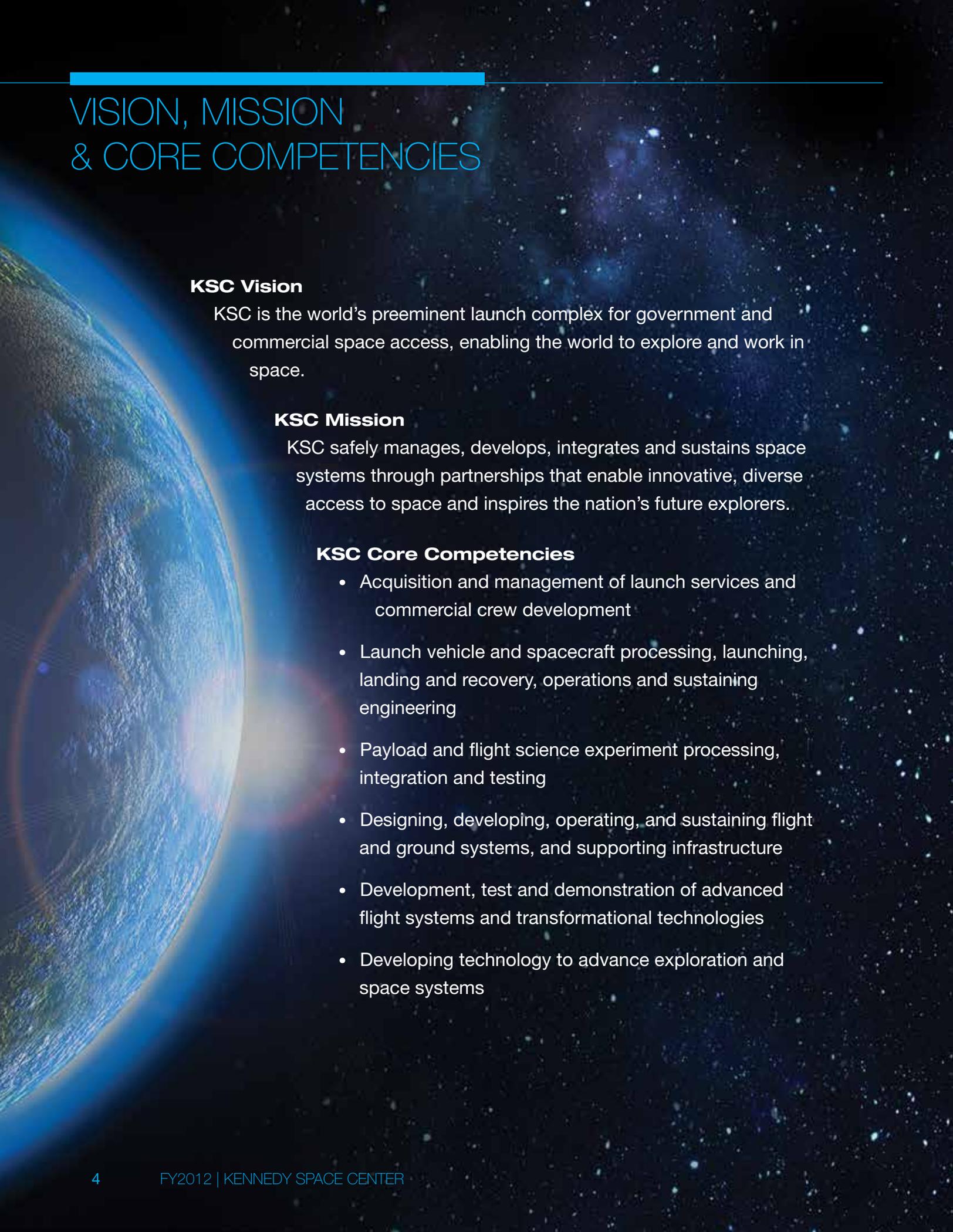
The Center Planning and Development Office continued its efforts to bring dozens of companies to our unique facilities, including signing a deal with Space Florida for The Boeing Company to begin processing its CST-100 spacecraft in Orbiter Processing Facility-3 for future crewed missions to low-Earth orbit. We also signed a five-year agreement with Craig Technologies, which will use and maintain Kennedy's exclusive spaceflight processing and manufacturing equipment until the agency needs to call on it again.

NASA Administrator Charlie Bolden announced this fiscal year that Kennedy's new mobile launcher will be the starting point for NASA's Orion crew capsule and Space Launch System heavy-lift rocket, which will provide an entirely new capability for human exploration beyond low-Earth orbit.

Kennedy, even in its 50th year, is the linchpin to NASA's new and established undertakings because we are, and always have been, the nation's premier launch site.



Robert D. Cabana
Center Director



VISION, MISSION & 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 engineering
- 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
- Developing technology to advance exploration and space systems

SIGNIFICANT EVENTS

1. Oct. 3, 2011: NASA and EDC renew Space Act Agreement

NASA's Kennedy Space Center and the Economic Development Commission of Florida's Space Coast signed a new five-year Space Act Agreement that outlines economic development cooperation aimed at supporting current and future missions.

2. Oct. 4, 2011: Kennedy's Crawlerway Evaluation Project Earns Award

The Society of Civil Engineers presented the Florida Project of the Year award to the crawlerway system evaluation team at Kennedy Space Center.

3. Oct. 28, 2011: NASA's NPP Satellite Launches

A NASA Earth-observing satellite, the National Polar-orbiting Operational Environmental Satellite System Preparatory Project, or NPP, launched aboard a Delta II rocket at 5:48 a.m. EDT from Space Launch Complex 2 at Vandenberg Air Force Base in California.



4. Oct. 31, 2011: NASA Signs Agreement with Space Florida

NASA announced a partnership with Space Florida to occupy, use and modify Kennedy Space Center's Orbiter Processing Facility-3, the Space Shuttle Main Engine Processing Facility and the Processing Control Center. The Boeing Company will lease the facilities from Space Florida to process its CST-100 capsule.

5. Nov. 10, 2011: Pegasus Barge Departs Kennedy Space Center

NASA's Pegasus barge departed the center carrying space shuttle main engine ground support equipment to NASA's Stennis Space Center near Bay St. Louis, Miss. The barge was used to transport external tanks for the space shuttle from Michoud Assembly Facility near New Orleans to Kennedy Space Center.



6. Nov. 26, 2011: NASA's Mars Science Laboratory Launches

NASA's Mars Science Laboratory and car-sized rover named Curiosity launched aboard an Atlas V rocket at 10:02 a.m. EST from Space Launch Complex 41 on Cape Canaveral Air Force Station in Florida.

7. Dec. 25, 2011: Next Step in Developing Commercial Crew Program

NASA's Commercial Crew Program, managed by Kennedy Space Center, announced it would award multiple Space Act Agreements to a larger number of partners with the flexibility to adjust technical direction, milestones and funding.

8. Jan. 10, 2012: NASA Awards Launch Services Program Support Contract

NASA awarded the Launch Services Program's (LSP) Expendable Launch Vehicle Integrated Support 2 (ELVIS 2) contract to a.i. solutions Inc. of Lanham, Md. The LSP is managed by Kennedy Space Center.

9. Jan. 12, 2012: Shuttle Engines Begin Move to Stennis

The first set of space shuttle main engines began their journey from Kennedy Space Center's engine shop to NASA's Stennis Space Center in south Mississippi. All of the shuttle main engines are planned to be repurposed for the agency's Space Launch System.



10. Feb. 17–18, 2012: NASA Celebrates 50 Years of Americans in Orbit

NASA's Kennedy Space Center hosted several events at the Kennedy Space Center Visitor Complex to honor the accomplishments of the Mercury program and its astronauts, including the two surviving members, John Glenn and Scott Carpenter.



SIGNIFICANT EVENTS

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- 11. April 17, 2012: Space Shuttle Discovery Departs for Smithsonian**
Space shuttle Discovery, atop NASA's 747 Shuttle Carrier Aircraft, departed from Kennedy Space Center's Shuttle Landing Facility at about 7 a.m. EDT. Discovery flew above the Central Florida coastline and Brevard County before beginning its ferry flight to Washington, D.C. Discovery is now on display at the Smithsonian National Air and Space Museum's Udvar-Hazy Center in Chantilly, Va.



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- 12. May 5, 2012: Former Shuttle Astronauts Inducted into U.S. Astronaut Hall of Fame**
During a ceremony at the Kennedy Space Center Visitor Complex, three former shuttle astronauts, Franklin Chang-Diaz, Kevin Chilton and Charles Precourt, were inducted into the U.S. Astronaut Hall of Fame.

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- 13. May 22, 2012: SpaceX Launches NASA Demonstration Mission to Space Station**
The SpaceX Falcon 9 and Dragon spacecraft lifted off from Space Launch Complex 40 at 3:44 a.m. EDT on Cape Canaveral Air Force Station in Florida on the second demonstration mission for NASA's Commercial Orbital Transportation Services (COTS) program.



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- 14. May 23-26, 2012: Third Annual Lunabotics Mining Competition**
Kennedy Space Center was host to more than 50 teams of undergraduate and graduate students from the U.S. and eight countries as they participated in NASA's Third Annual Lunabotics Mining Competition at the Kennedy Space Center Visitor Complex.

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- 15. June 4, 2012: International Space University Kicks Off at Kennedy**
Kennedy Space Center and the Florida Institute of Technology in Melbourne, Fla., co-hosted a nine-week intensive course for 125 post-graduate students and professionals representing 31 countries. An astronaut panel discussion on July 11 and the closing ceremonies on Aug. 3 were held at Kennedy's visitor complex.

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- 16. June 12, 2012: Prototype Lunar Prospecting Rover Viewing**
NASA's Regolith and Environment Science and Oxygen and Lunar Volatile Extraction (RESOLVE) payload was installed on the rover Artemis Jr. at NASA's Kennedy Space Center. In July, the RESOLVE team traveled to Hilo, Hawaii, for field tests in terrain similar to the moon.



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- 17. June 13, 2012: NuSTAR Explorer Mission Launches**
NASA's Nuclear Spectroscopic Telescope Array (NuSTAR) launched aboard a Pegasus XL rocket at 12:01 p.m. EDT from the Kwajalein Atoll in the Pacific Ocean.



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- 18. June 26, 2012: NASA Adds Antares Rocket to Launch Services II Contract**
The agency modified its NASA Launch Services (NLS) II contract with Orbital Sciences Corp. of Dulles, Va., to add the Antares launch vehicle for future Launch Services Program missions.

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- 19. June 28, 2012: NASA Selects Contracts for Environmental Remediation Services**
NASA selected three companies to provide architect and engineering professional environmental remediation services at Kennedy Space Center. The companies selected were Geosyntec Consultants of Boca Raton, Fla., Jacobs Engineering Group Inc. of Cape Canaveral, Fla., and Tetra Tech of Pittsburgh, Pa.
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20. July 1, 2012: Kennedy Space Center Celebrates 50th Anniversary

NASA's Kennedy Space Center celebrated 50 years of launching humans and machines to other planets and into low-Earth orbit. For a chart of the center's five-decade history and a video that chronicles some of the center's most impressive milestones, visit <http://go.nasa.gov/yOVdRi>.

21. July 2, 2012: Orion Crew Module Arrives at Kennedy Space Center

NASA's first space-bound Orion spacecraft arrived at Kennedy Space Center and was transported to the Operations and Checkout Building high bay. The first uncrewed mission planned for 2014, Exploration Flight Test-1, will launch atop a Delta IV rocket.



22. July 3, 2012: NASA Signs Agreement for Kennedy Space Center Equipment

NASA signed a new partnership with Craig Technologies of Melbourne, Fla., to maintain an inventory of unique processing and manufacturing equipment at the NASA Shuttle Logistics Depot in Cape Canaveral, Fla., for future mission support at the agency's Kennedy Space Center.

23. July 9, 2012: NASA Partners with Cella Energy on Hydrogen Technology

In a green-energy effort, Kennedy Space Center signed a Space Act Agreement with Cella Energy Inc. that could result in the center's vehicles being powered by hydrogen. Cella has offices in the center's Space Life Sciences Laboratory.

24. July 26, 2012: NASA Selects Contract for Water and Wastewater Revitalization

NASA selected RTD Construction Inc. of Zephyrhills, Fla., to provide construction services for the revitalization of Kennedy Space Center's water distribution and wastewater collection systems.

25. Aug. 3, 2012: New Agreements for Next Phase of Commercial Crew Development

NASA announced new agreements with three American commercial companies to design and develop the next generation of U.S. human spaceflight capabilities through the Commercial Crew Integrated Capability (CCiCap) initiative of the Commercial Crew Program. The CCiCap partners are Sierra Nevada Corp. of Louisville, Colo., Space Exploration Technologies (SpaceX) of Hawthorne, Calif., and The Boeing Company of Houston.



26. Aug. 15, 2012: NASA Awards Contract for Safety and Mission Support Services

NASA selected A-P-T Research Inc. of Huntsville, Ala., to provide mission assurance, engineering and risk assessment services on the Safety and Mission Support Services II (S-MASS II) contract at Kennedy Space Center.

27. Aug. 30, 2012: Radiation Belt Storm Probes Mission Launches

NASA's Radiation Belt Storm Probes, the first twin-spacecraft mission designed to explore Earth's radiation belts, launched aboard an Atlas V 401 rocket, at 4:05 a.m. EDT from Space Launch Complex 41 on Cape Canaveral Air Force Station in Florida.

28. Sept. 6, 2012: Kennedy Space Center Hosts First Innovation Expo

The First Innovation Expo for employees was held at Kennedy Space Center. The Expo showcased innovative and creative ideas from workers, offered tours of facilities and laboratories, and featured speakers from Central Florida companies.



29. Sept. 19, 2012: Space Shuttle Endeavour Departs Kennedy Space Center

Space shuttle Endeavour, atop NASA's 747 Shuttle Carrier Aircraft (SCA), departed from Kennedy Space Center's Shuttle Landing Facility at sunrise to begin its cross-country ferry flight to the Los Angeles International Airport. Endeavour is on display at the California Science Center in Los Angeles.



CENTER PLANNING & DEVELOPMENT

Kennedy Space Center is in the midst of a transformation. What was historically a government-only launch complex is growing into a busy multiuser spaceport that will continue to be a driving force in future spaceflight, serving NASA as well as the local commercial space industry. Kennedy's Center Planning and Development Directorate is leading this vital change by providing a clear vision of the center's future, and establishing the plans and partnerships necessary to achieve this vision.

Created as a center office in 2010, Center Planning and Development was formally named a directorate in August 2012, and its role expanded to include management of Kennedy's research and technology partnerships.

The center's transition into a more varied and robust spaceport requires careful planning. The Center Planning and Development directorate has worked with NASA leadership as well as external stakeholders to develop a future development concept incorporating forward-looking business and operation models based on key guiding principles. This concept provides the foundation for a new master plan for Kennedy Space

Center, which consolidates many separate facilities into one central administrative campus and upgrades infrastructure to support a new generation of launch vehicles and explorers.

Partnerships are an integral part of the spaceport's future. With an expert workforce, unique facilities and an impressive array of available technologies and services, Kennedy Space Center has much to offer commercial, government and

academic partners. The directorate serves as the "front door" for potential partners seeking to do business with Kennedy.

In June 2012, Britain-based Cella Energy reached an agreement to produce micro-bead hydrogen pellets to be used as fuel in cars. Hydrogen produces pure water as a byproduct when burned, helping reduce the amount of carbon emissions. The space center has more than three decades of

experience handling raw hydrogen in its cryogenics and materials labs, and will therefore serve in a consultant role in this partnership. Cella Energy already has offices in the spaceport's Space Life Sciences Laboratory at Kennedy.

In another partnership formed in June, Craig Technologies signed a five-year lease for the loan of 1,600 pieces of shuttle-processing equipment currently housed in the NASA Shuttle Logistics Depot. Now that the agency's shuttle fleet is retired, Craig Technologies will maintain the equipment for future mission support and, with the help of Space Florida, market these unique resources to attract



Working with Kennedy Space Center, UE Systems of Elmsford, N.Y., developed a long-range attachment for a detector that allows users to scan for electrical leaks and compressed air leaks safely and easily.



A new sign on Space Commerce Way marks the entrance to Exploration Park near NASA's Kennedy Space Center in Florida. Managed by Space Florida, about 60 acres of land have been cleared for the first phase of construction. The park encompasses a total of 299 acres just outside the center's security gates and is strategically located near the Space Life Sciences Laboratory to service diverse tenants who will engage in activities to support the space-related activities of NASA, other government agencies and the U.S. commercial space industry.



Dr. Mason Peck, left, NASA's chief technologist, examines an innovative conductive material during a tour of the Space Life Sciences Laboratory on July 30, 2012.

aerospace business to the Space Coast.

Another role of Center Planning and Development is to oversee the research, development and commercialization of new technologies that may support future missions while offering benefits right here on Earth. The directorate encourages cooperative partnerships in which academia and other government agencies may work with Kennedy researchers, addressing NASA's

and the nation's needs. These partnerships enable NASA to impact the fields of health and medicine, transportation, public safety, consumer goods, environmental resources, and computer technology on a global scale.

Kennedy Space Center's Technology Transfer Office signed five patent licensing agreements this fiscal year. One of the licensees, Aviation Technologies, is currently producing a cabin pressure monitoring device for the general aviation industry that will warn pilots of dangerous and deteriorating cabin pressure conditions that could lead to dangerously low levels of oxygen. ■

GROUND SYSTEMS DEVELOPMENT & OPERATIONS PROGRAM

During Fiscal Year 2012, the Ground Systems Development and Operations (GSDO) Program office at Kennedy Space Center continued to lead the way in transforming the center from an historically government-only launch complex to become a spaceport bustling with activity involving government and commercial vehicles alike.

GSDO was tasked with developing and using the complex equipment required to safely handle a variety of rockets and spacecraft during assembly, transport and launch.

Inside the Vehicle Assembly Building, GSDO workers removed hundreds of miles of cables to replace it with state-of-the-art command, control and

communications systems. Workers also removed space shuttle-era work platforms from High Bay 3 to make room for a more flexible concept that can accommodate a variety of spacecraft, including NASA's heavy-lift rocket, the Space Launch System, and the Orion spacecraft.

At Launch Pad 39B, the rotating and fixed service structures were removed so that the pad is clean on top, surrounded by three 600-foot-tall lightning protection towers. Each tower has a complete weather station with four levels for data collection.

Beneath the pad, workers were busy removing more than 1.3 million feet of cables, some dating back to the Apollo era, and replacing them with fiber optics. Shuttle-era systems also have been removed

and upgraded with state-of-the-art hardware.

A new "universal" flame deflector is being designed for use with the SLS, as well as various commercial vehicles. Liquid hydrogen and liquid oxygen propellant storage tanks have been completely drained, refurbished and painted to support launch operations for the next 20 to 30 years.

The Launch Pad 39B team began fabrication of the utility interfaces, including potable water, freeze-protection water, chilled water and fire suppression. Core drilling began to replace five mobile launcher-to-pad interface pipes.

During the year, some of the parts of NASA's trio of mobile launcher platforms were removed to support the agency's SLS rocket and Orion spacecraft. The huge steel structures, which acted as launch bases for Apollo's Saturn flights and every space shuttle mission, will have a part in serving the next American-made vehicles.

The agency's first space-bound Orion spacecraft arrived at Kennedy

Inside the Operations and Checkout Building at Kennedy Space Center, technicians monitor the progress as a crane lowers the Orion Exploration Flight Test 1 crew module toward the base of a birdcage tool, Sept. 5, 2012. The birdcage will be used to continue installation of external components in preparation for Orion's first uncrewed test flight in 2014 atop a Delta IV rocket.





Crawler-transporter 2 was moved along the crawlerway Nov. 8, 2012 to check out recently completed modifications to ensure its ability to carry launch vehicles such as NASA's Space Launch System heavy-lift rocket to the pad.

in June 2012. It now is being processed and tested for flight in the Operations and Checkout Building high bay. The first uncrewed mission of Orion, called Exploration Flight Test-1 (EFT-1), is targeted to launch atop a Delta IV heavy rocket in 2014.

A test of a new kind of “clean room” that could be used to help protect NASA's Orion spacecraft from dirt and dust during processing was performed in the VAB for several weeks in May.

A full-scale Orion model was used for the test that revealed a reduction in airborne particulates. Developed by Astrotech in Titusville, Fla., the room has two 10-foot-high walls of filter-equipped fans positioned 30 feet apart to push and pull the air in one direction across the capsule. Another set of two clear walls completed the box. It has no ceiling.

A full-size Orion spacecraft mock-up was placed atop a model of the service module in the VAB transfer aisle in August. The mock-up stack, which is 27 feet tall, will allow engineers and technicians to determine the exact dimensions of the connectors that will run from the mobile launcher to the spacecraft before liftoff. The Orion model is a replica of the spacecraft and is empty on the inside, except for four model astronaut seats and a hatch.

GSDO engineers are combining heritage technology and new innovations to design the crew access arm for the tower on the mobile launcher that will be used for NASA's Orion spacecraft atop the SLS rocket.

The mobile launcher's new 60-foot-long hydraulic crew access arm will be similar in length and

speed to the arm used during the Apollo missions. It will have two levels and incorporate hardware from NASA's Apollo and Space Shuttle programs. The upper level will include a new “White Room” that provides access to the Orion crew module. The lower-level walkway will provide access to two panels on the spacecraft's service module. The access arm will rotate out to the crew module on giant Apollo-era hinges.

Engineers also completed a system installation and integration of a test umbilical arm for the SLS system. The arm will support cryogenic, or supercold, propellant loading for the new rocket's propulsion systems. It was mounted to the mobile launcher tower simulator at Kennedy's Launch Equipment Test Facility for further



This computer-aided design image highlights the crew access arm that is being developed for the tower on the mobile launcher that will be used for NASA's Orion spacecraft atop the Space Launch System rocket.

checkouts and simulations. When testing is complete, some of the hardware will be reused as part of the Orion service module umbilical on the mobile launcher.

One of NASA's 1960s-era crawler-transporters, CT-2, received several upgrades during the year. After two new Cummins diesel engine generator sets were installed, they were successfully started up in September to verify fluid levels, maintain idle and running speeds, monitor oil pressure and coolant temperatures, check for leaks in the exhaust, coolant and fuel lines, and obtain vibration baseline data.

The tests were performed in order to prepare for CT-2's rollout from the VAB to Launch Pad 39A to validate new upgrades and monitor performance of the giant transporter.

The firing room of the future underwent extensive renovations so that it can support a variety of rocket and spacecraft launches. Inside Launch Control Center Firing Room 1, known as the Young-Crippen Firing Room, old monitors and computers have been replaced with modern off-the-shelf workstations, upgraded servers and modern cabinetry. Old wiring that transmitted images from a single camera were pulled to make way for a tiny fiber-optic cable that carries the signals of more than 570 cameras from the launch pad to the control room.

Modifications to Firing Room 3 began in September. The room is being converted from a Space Shuttle Program support configuration to a development lab area. Crews removed the legacy

consoles, electrical and data cables and raised flooring and are in the process of replacing them with new equipment and raised flooring. New software for the Spaceport Command and Control System that is being developed in Firing Room 3 will be used in the newly modified Firing Room 1 to support testing and launch operations.

GSDO's accomplishments this year brought Kennedy's historic facilities and unique assets closer to the goal of supporting the process and launch of a variety of government and commercial launch vehicles and spacecraft, including NASA's Space Launch System and the Orion multi-purpose crew vehicle. ■

An artist illustration depicts NASA's Space Launch System and Orion capsule on top of the mobile launcher at Kennedy Space Center's Launch Pad 39B.



GROUND PROCESSING

The Ground Processing directorate used 2012 to increase the pace to transform Kennedy Space Center as the space shuttle fleet was processed to serve as inspirational museum exhibits and the facilities around the center that served the shuttles began refurbishment to host new rockets and spacecraft.

With three space shuttles located on center at the beginning of the 2012 fiscal year, much of Ground Processing's work focused on preparing the history-making vehicles for public display and removing elements of the shuttles that could be used in future rockets or spacecraft. The three orbiters were set up as requested by their respective destinations and two of them – Discovery and Endeavour - were flown from the center during 2012 to new homes in Washington, D.C., and Los Angeles, respectively. Atlantis, which is going on display at Kennedy, was processed during Fiscal Year 2012, but was not signed into retirement until FY13.

The transition and retirement effort, as it was known, included the proper disposition of thousands of pieces of shuttle hardware and support equipment. The equipment was screened carefully during disposition to determine whether other programs or agencies might be able to use it. Many elements of shuttle

hardware also were turned over to museums for use in shuttle exhibits showing the impact of NASA's longest-operating crewed space program.

Ground Processing's logistics team transferred more than \$1.1 billion of flight and ground hardware, equipment and material that was no longer required to support shuttle flights and ground processing activities. More than half of these assets were transferred directly for use on other active NASA programs, including International Space Station, Space Launch System, Orion Multi-Purpose Crew Vehicle and Ground Systems Development

and Operations, as well as to other federal government organizations having reutilization potential, such as the Department of Defense. In addition to significantly offsetting programs' costs, some of these items also will provide valuable spare parts that may no longer be in production by the original manufacturer. The remaining excess property items also are being screened as part of KSC's property disposal process to ensure maximizing additional reutilization opportunities.

The directorate came into existence in 2011 to work through the center's major program transition following 30 years of operating the space shuttle fleet. One of the organization's mandates is to adapt the center's unique abilities and equipment from supporting a single spacecraft to a system that efficiently processes and safely launches several different craft, many operated by a private enterprise.

Ground Processing assisted the Orion Program in establishing a critical capability to fabricate thermal protection system components by facilitating manufacturing process development in the Thermal Protection Systems Facility.



Inside Kennedy Space Center's Launch Control Center, workers prepare to remove the Public Affairs console from Firing Room 3, May 1, 2012. The console was moved to the Kennedy Space Center Visitor Complex and will be preserved for use in the space shuttle Atlantis display.



At the Shuttle Landing Facility at Kennedy Space Center during April 2012, the Shuttle Carrier Aircraft is positioned beneath space shuttle Discovery in the mate-demate device. Discovery was lowered and mated to the aircraft in preparation for its departure from Kennedy.

This year, Ground Processing transitioned Orbiter Processing Facility 3 (OPF-3) to Space Florida and its sub-lessee, The Boeing Company. Ground Processing established a solid relationship with both organizations so the OPF can serve as a manufacturing base for Boeing's Crew Space Transportation-100, known as the CST-100.

Ground Processing was instrumental in coordinating the operational changes to access control, government property removal, facility management and repair across KSC organizations.

The landmark Vehicle Assembly Building (VAB) also was a focus of Ground Processing with the directorate establishing the ability for multiple programs and users to work in the 525-foot-tall building at the same time. Ground Processing also developed a significant operations management function for the VAB.

The directorate also worked closely with ongoing programs, including the International Space Station, Space Launch System and Orion Program, to provide critical engineering and operations support in many diverse areas.

Ground Processing provided critical operations and testing support for many payloads supporting the ISS program. The Stratospheric Aerosol and Gas Experiment (SAGE), Space Test Program - Houston 4 (STP-H4), Nitrous Oxide Fuel Blend eXperiment (NOFBX), GLACIER, OPALS, and Space Communication and Navigation Testbed (SCaN) were among the significant projects supported.

The Ground Processing directorate's Project Control Division worked with numerous customers to develop and integrate products for program, project and institutional customers in 2012. The organization

worked with GSDO, ISS, LSP, CCP, emerging customers, CMO and others in providing expertise in configuration management and integration to ensure Ground Processing internal directorate success, as well as that of the customer programs, and participation in planning, programming, budgeting and execution processes to help ensure appropriate full-time-equivalent contractor and other resources have been identified to

meet customer requirements.

Ground Processing's expertise came into demand from other NASA launch sites, too, as the directorate's staff provided expert test, systems engineering and operations support to Wallops Flight Facility pad testing in support of Orbital Sciences Corp. operational readiness.

The Ground Processing directorate will continue implementing modifications to aid Kennedy's transition to a multiuser spaceport in the coming years. A host of rockets and spacecraft designs are maturing and Kennedy's facilities continue to adjust alongside them. From launch center changes to processing and launching expertise, Ground Processing offers significant expertise in a wide area of spaceflight-related fields to an increasing number of customers within and outside NASA. ■

INTERNATIONAL SPACE STATION GROUND PROCESSING & RESEARCH

In Fiscal Year 2012, the International Space Station (ISS) Ground Processing and Research Project Office at Kennedy Space Center continued its mission to process payloads and hardware for delivery to the space station. The office also focused on sustaining plant biology research capabilities on-board the station, developing robust space-bound experiments, and enabling the space station to serve as a testbed for the development of new technologies.

The office's main goal for two different customers – the

International Space Station Program and the Space Life and Physical Sciences Research and Applications Division at NASA's Headquarters – was to implement their technical, cost, schedule and safety requirements at Kennedy. Several major tasks were completed in order to meet this goal.

First, the office met mission requirements and major milestones by preparing numerous space station spare parts and hardware for the orbiting laboratory. Use of Kennedy's Space Station Processing Facility (SSPF) and other support

facilities helped ensure that space station customers' payloads were successfully prepared for flight on commercial and international vehicles, while leveraging existing commercial partnerships for mission success. This included efforts to prepare and certify a spare flight Cupola Audio Terminal Unit.

Another task was to conduct and enable Kennedy flight experiments in fundamental space biology. The center's ISS research chief scientist participated in the release of a space biology NASA Research Announcement (NRA)

In a processing facility at Space Launch Complex-40 on Cape Canaveral Air Force Station in April 2012, the Space Exploration Technologies Dragon capsule is rotated into a horizontal position for mating with the second stage of the company's Falcon 9 rocket. Known as SpaceX, the launch will be the company's second test flight for NASA's Commercial Orbital Transportation Services program.





Dr. Matthew Mickens, a plant biologist from North Carolina Agriculture and Technical State University, measures Cherry Bomb Hybrid II radish plants harvested from a plant growth chamber Aug. 3, 2012 inside the Space Life Sciences Laboratory at NASA's Kennedy Space Center. The plant experiment at Kennedy is part of the Advanced Exploration Systems program in NASA's Human Exploration and Operations Mission Directorate.

Space Test Program-Houston 4 (STP-H4) payload. Data collected will aid in the further development of the STP-H4 flight hardware currently scheduled to fly on the Japan Aerospace Exploration Agency's HTV-4 mission to the space station.

Ground processing efforts at Kennedy also included transportation container engineering design modifications and intricate logistical execution required to ship the flight hardware from Florida to Tanegashima, Japan.

Kennedy's ISS team provided test equipment to Johnson Space Center in Houston to support the High Definition Earth Viewing payload, which will remain in the Space Station Processing Facility (SSPF) high bay until approximately two months prior to the SpaceX-3 launch. Columbus External Payload Adapter interface cables also were fabricated for shipment to Johnson in support of the payload.

The ISS team also continued with design and fabrication of ground support equipment for the Nitrous Oxygen Systems (NORS) orbital replacement unit. Efforts included activities associated with the Kennedy-designed ground-fill adapter equipment set and the NORS compressed gas trailer.

for projects using the Advanced Biological Research System (ABRS) and Biological Research in Canisters (BRIC) hardware, currently scheduled to be transported on SpaceX flights and operated by future International Space Station research crews.

The office assisted the Center for the Advancement of Science in Space (CASIS) by making 50 percent of Kennedy's space station research hardware available for its customers. CASIS manages the portion of the space station that operates as a U.S. national laboratory.

Hardware Disposition

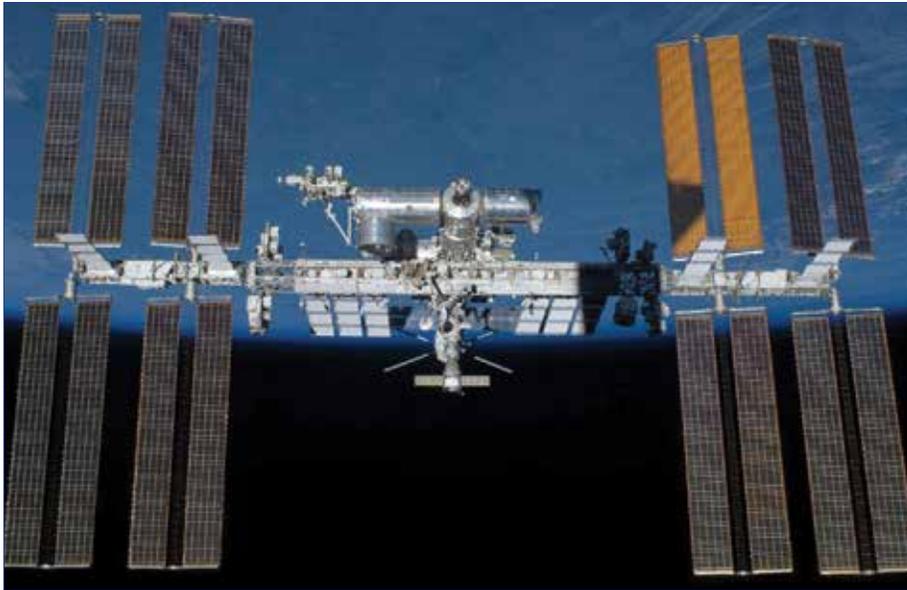
Kennedy's space station Hardware Disposition Project closed out during FY12. There were more than 28,000 line items and approximately 1.5 million piece parts handled by the team. The work included physical inspections; lifting and handling; packing; staging for movement using forklifts, cranes and air pallets; and trucking.

The former United Space Alliance Shuttle Lithium Hydroxide Lab was successfully dismantled, with the critical equipment and flight components retained at the SSPF for future station use.

Payload Processing

The team assisted with launch and landing planning and procedures for double middeck-locker powered General Laboratory Active Cryogenic ISS Experiment Refrigerator (GLACIER) payloads by conducting late-stow dry runs and fit checks with SpaceX's Dragon 9 capsule. Launch site ground processing for NanoRack Module-9 payload "coldbags" also was completed in support of SpaceX's May 2012 launch.

Using the Payload Rack Checkout Unit (PRCU) and Expedite the Processing of Experiments to the Space Station (EXPRESS) Logistics Carrier (ELC), ISS simulators, the team successfully conducted post-shipment functional tests of the



The International Space Station is the largest, most complex scientific project in history and was designated a National Lab in 2005. As a research outpost, the station is a test bed for future technologies and a research laboratory for new, advanced industrial materials, communications technology and medical research.

The Stratospheric Aerosol and Gas Experiment (SAGE)-III payload developers tested a suitcase simulator at Kennedy with the EXPRESS pallet adapter simulator. The data collected will assist the Langley Research Center team in Hampton, Va., to further develop the suitcase simulators so they can be used to test the command and data handling of the SAGE-III hardware. The Kennedy team integrated two Passive Flight Releasable Attachment Mechanism kits and built a lifting sling for installation on the adapter plates and shipped them back to Langley.

The office's accomplishments continue to maintain U.S. leadership in space and in global competitiveness and serve as a driving force for emerging technologies that will enable exploration and research through the space station and other platforms for the benefit of humankind. ■

NASA astronaut Sunita Williams and Japan Aerospace Exploration Agency astronaut Aki Hoshide service the Minus Eighty-degree Laboratory Freezer, in the Destiny laboratory of the International Space Station. Two investigations, Biological Research In Canisters (BRIC)-17-1 and BRIC-17-2 were launched on the second Commercial Resupply Services flight, or CRS-2, to the International Space Station.

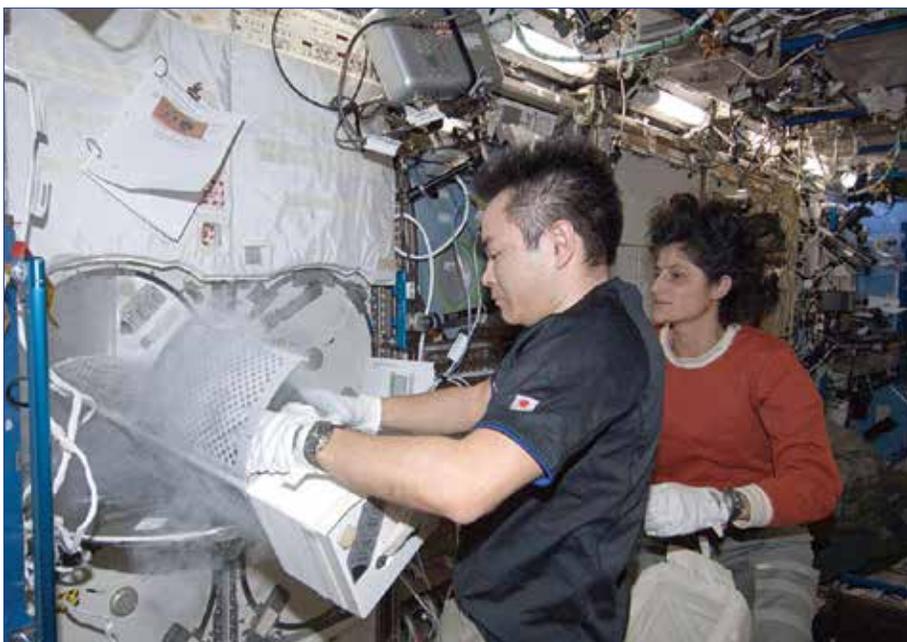
The Optical Payload for Lasercomm Science hardware is an unpressurized experiment scheduled for launch on SpaceX-3, and Kennedy's team tested flight-equivalent avionics for the payload using the PRCU and ELC simulator.

ISS Research

The Kennedy team made great progress with design and fabrication of the Deployable Vegetable System (VEGGIE) for SpaceX-3 deployment

to the station. The team continues to work on science verification testing which included a 28-day grow-out of red lettuce in one of the expandable growth pillows developed by Orbital Technologies Corp. (ORBITEC).

The ISS Research design team continued developing the Advanced Plant Habitat (APH) project. APH will provide the research community a large, environmentally controlled, growth chamber for use on the space station.



Inside the Space Station Processing Facility on Feb. 13, 2013, technicians prepare to move the Space Test Program-Houston 4 experiment before installing the shipping container cover that will enclose it. The experiment is one of the payloads that will be flown to Japan for the HTV-4 launch to the station this summer.



LAUNCH SERVICES PROGRAM

During Fiscal Year 2012, NASA's Launch Services Program (LSP) at Kennedy Space Center launched four missions that support the agency's Science Mission Directorate and Human Exploration and Operations Mission Directorate, continued to support advance planning for about 20 missions that are in the early stages of formulation, and provided integration and launch services for 12 missions already on contract.

NASA's National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) began its five-year mission on Oct. 28, 2011, when it launched aboard a United Launch Alliance (ULA) Delta II rocket at

5:48 a.m. EDT from Space Launch Complex-2 at Vandenberg Air Force Base (VAFB) in California. Six CubeSats were launched as secondary payloads.

NPOESS is the next generation of low-Earth orbiting environmental satellites. The data collected from the satellite as it circles the planet approximately once every 100 minutes will be distributed to meteorologists at the National Oceanic and Atmospheric Administration (NOAA) and the Department of Defense (DoD), as well as to climate researchers around the globe. NPOESS will aid in reducing the potential loss of human life and property by allowing more efficient disaster planning

and response to severe weather conditions such as tornadoes and floods.

NASA's Mars Science Laboratory (MSL), with its car-sized Curiosity rover, launched on a ULA Atlas V rocket at 10:02 a.m. EST, on Nov. 26, 2011, from Launch Complex 41 at Cape Canaveral Air Force Station (CCAFS) in Florida.

MSL's eight-month journey to the Red Planet was a success as the innovative and precise guided entry and powered "sky crane" lowered Curiosity to the Martian surface. During its 23-month mission, Curiosity will analyze samples drilled from rocks or scooped from the ground as it explores, assesses and characterizes the landing site region.



Under the watchful eyes of technicians at the Payload Hazardous Servicing Facility at Kennedy Space Center on Sept. 23, 2011, a rocket-powered descent stage is lowered by an overhead crane and integrated with NASA's Mars Science Laboratory rover, known as Curiosity. During the mission, the descent stage lowered Curiosity to the surface of Mars.



An Orbital Sciences' Pegasus rocket and NASA's Nuclear Spectroscopic Telescope Array, or NuSTAR, are delivered to the U.S. Army's Ronald Reagan Ballistic Missile Defense Test Site on Kwajalein Atoll in June 2012. The Pegasus, mated to its NuSTAR payload, is secured beneath Orbital's L-1011 carrier aircraft. It was launched from the aircraft 117 nautical miles south of Kwajalein.

The mobile laboratory will provide new data for understanding Mars as a potential habitat for life, past or present.

The Nuclear Spectroscopic Telescope Array (NuSTAR) explorer mission launched from an Orbital Sciences Pegasus XL rocket on June 13, 2012, at 12:01 p.m. EDT from the Kwajalein Atoll in the Pacific Ocean.

NuSTAR is the first focusing hard X-ray telescope to orbit Earth and allow astronomers to study the universe in high energy X-rays. The telescope will undertake a broad range of scientific investigations, from observing the Milky Way to searching for the remnants of exploded stars and peering into galaxy clusters.

The Radiation Belt Storm Probes (RBSP) mission, part of NASA's

Living with a Star Program, began on Aug. 30, 2012, when the twin spacecraft, RBSP A and B, launched aboard a ULA Atlas V rocket at 4:05 a.m. EDT from Launch Complex 41 at CCAFS.

The two spacecraft will make measurements within the Van Allen Radiation Belts, two donut-shaped regions encircling the Earth, to help us further understand the sun's influence on the Earth and near-Earth space by studying the planet's radiation belts on various scales of space and time.

In November 2012, NASA renamed the RBSP mission to the Van Allen Probes in honor of the late pioneering astrophysicist James Van Allen.

In January 2012, NASA awarded the Expendable Launch Vehicle Integrated Support 2

(ELVIS 2) contract to AI Solutions Inc. of Lanham, Md. The ELVIS 2 contract will support LSP and LSP-sponsored missions, activities and strategic initiatives for multiple NASA programs, the DoD, and other government agencies and commercial launch activities.

The program continued to procure launch services for future NASA missions aboard ULA Atlas V rockets, and added the ULA Delta II, Orbital Sciences Antares and Space Exploration Technologies (SpaceX) of Hawthorne, Calif., Falcon 9 rockets.

In April 2012, NASA selected United Launch Services LLC (ULS) of Englewood, Colo., to launch the Geostationary Operational Environmental Satellites-R and S, or GOES-R and GOES-S. The spacecraft will launch in



In Orbital Sciences' hangar on Vandenberg Air Force Base in California, technicians have reinstalled half of the Pegasus fairing around NASA's Nuclear Spectroscopic Telescope Array, or NuSTAR, and prepare to reinstall the other half.

October 2015 and February 2017, respectively, aboard Atlas V rockets from Launch Complex 41 at CCAFS.

In July 2012, NASA also selected ULS to launch the Orbiting Carbon Observatory-2, Soil Moisture Active

Passive, and Joint Polar Satellite System-1 spacecraft. They are scheduled to launch in July 2014, October 2014 and November 2016, respectively, aboard Delta II rockets from VAFB.

launch vehicle certification approach and processes. LSP partnered with the NRO for a Poly-Picosatellite Orbital Deployer, or CubeSat mission, that successfully launched four NASA-sponsored CubeSats on NROL-36 aboard a ULA Atlas V rocket, Sept. 13, 2012, at 2:39 p.m. PST, from Space Launch Complex-3 at VAFB.

The term "CubeSat" is used to denote nano-satellites which are generally very tiny and are a viable option for schools and universities across the world. About 50 CubeSats are manifested to launch during 2013 and 2014.

For more information about the Launch Services Program at Kennedy, visit <http://www.nasa.gov/centers/kennedy/launchingrockets/index.html>. ■

Also in July, NASA selected SpaceX to launch NOAA's Jason 3 spacecraft. It is scheduled to launch in December 2014, aboard a Falcon 9 rocket from Complex 4 at VAFB.

LSP continued its partnerships with the U.S. Air Force and the National Reconnaissance Office (NRO), particularly for

The United Launch Alliance Atlas V rocket carrying NASA's Radiation Belt Storm Probes, or RBSP, lifts off Space Launch Complex 41 on Cape Canaveral Air Force Station on Aug. 30, 2012. RBSP will explore changes in Earth's space environment caused by the sun – known as "space weather."





On Cape Canaveral Air Force Station in November 2011, the 197-foot-tall United Launch Alliance Atlas V rocket moves away from the Vertical Integration Facility during the vehicle's rollout to the launch pad at Space Launch Complex 41. Atop the rocket is NASA's Mars Science Laboratory.

COMMERCIAL CREW PROGRAM

As the first human spaceflight program to be based at NASA's Kennedy Space Center, the Commercial Crew Program (CCP) in Fiscal Year 2012 continued partnerships with a number of American companies to achieve significant milestones in the development of safe, reliable and affordable low-Earth orbit transportation capabilities.

Working from Space Act Agreements signed in Fiscal Year 2011, seven companies accelerated their spacecraft and launch vehicle designs by collaborating with CCP during Commercial Crew Development Round 2 (CCDev2).

Blue Origin of Kent, Wash., matured its Biconic Space Vehicle, Pusher Escape System and Reusable Booster System through a \$22 million agreement; Sierra Nevada Corp. (SNC) Space Systems of Louisville, Colo., advanced its Dream Chaser spacecraft through a \$105.6 million agreement; The Boeing Company of Houston put its CST-100 capsule through rigorous testing through a \$112.9 million agreement; and Space Exploration Technologies (SpaceX) of Hawthorne, Calif., invited NASA astronauts to check out the interior of its Dragon capsule and tested its launch abort engines through a \$75 million agreement.

NASA also provided limited technical assistance, gained during its more than 50 years of

human spaceflight experience, to United Launch Alliance (ULA) of Centennial, Colo., for its Atlas V rocket; Alliant Techsystems Inc. (ATK) of Promontory, Utah, for its Liberty Launch Vehicle; and Excalibur Almaz Inc. of Houston for its spacecraft during unfunded CCDev2 partnerships.

Then in August of FY12, CCP made another stride in its quest to invest in commercial human spaceflight systems that could be called on by government or commercial customers in the future.

Initially, the program was on track to begin awarding contracts in FY12. However, the program refined its course and issued additional Space Act Agreements to adapt to budget circumstances while maintaining a high level of competition. Through NASA's Commercial Crew Integrated Capability (CCiCap) initiative, CCP re-established partnerships with three companies to advance fully integrated crew transportation systems, each of which encompasses a spacecraft, launch vehicle and ground and mission operations plans.

Until May 2014, Boeing, SNC and SpaceX will work through paid-for-performance milestones to complete their designs, test their hardware,



NASA astronaut Rex Walheim checks out a Space Exploration Technologies (SpaceX) Dragon spacecraft prototype during a crew accommodation milestone in Hawthorne, Calif., in 2012. The primary goal of the milestone was to determine whether the layout will allow astronauts to maneuver effectively in the vehicle.

and then showcase how they would operate and manage missions from launch through orbit and landing. The work performed during CCiCap is expected to set the stage for a crewed orbital demonstration mission in the middle of the decade. Under the Space Act Agreements, partners have the potential to receive up to the full award amount.

Boeing could receive up to \$460 million to begin to finalize the design of its CST-100 spacecraft and how to integrate it with an Atlas V. Work already is under way in a former orbiter processing facility and adjacent engine facility at Kennedy to house the production and processing of the spacecraft. Engineering support is set to be based at the Processing Control



The Boeing Company's mock-up CST-100 spacecraft goes through water landing development tests at Bigelow Aerospace's headquarters outside of Las Vegas in 2012. Engineers with Bigelow dropped the capsule-shaped spacecraft into an outdoor pool from a crane more than four times to assess whether the airbags will stabilize the capsule during landings as planned.

Center, also in Kennedy's Launch Complex 39 area. The company partnered with ULA to launch its spacecraft atop an Atlas V rocket from Space Launch Complex 41 at Cape Canaveral Air Force Station (CCAFS), a little more than seven miles away from Kennedy. As progress is made with Boeing's CST-100, ULA will work to outfit its launch pad with the structures and systems necessary to support crewed missions, such as crew access walkways and emergency escape systems.

SpaceX could receive up to \$440 million for its crewed Dragon spacecraft and Falcon 9 rocket combination. The next-generation Falcon rocket will feature the company's Merlin 1D engine to provide greater lift capability to support the heavier weight of an astronaut crew plus cargo. SpaceX's CCP mission control will be based at its headquarters facility in Hawthorne, while launches will take place from Space Launch Complex

40 at CCAFS. During CCIcap, SpaceX will work toward a pad abort test and in-flight abort test to show it can get a crew away from the pad or the rocket safely in emergency situations.

SNC could receive up to \$212.5 million to further advance its Dream Chaser spacecraft, which resembles NASA's space shuttle but is smaller and based on improvements to the agency's HL-20 lifting-body design. It, too, has partnered with ULA to loft its spacecraft from Space Launch Complex 41. As the only winged spacecraft under development for crew transportation, the Dream Chaser could utilize Kennedy's unique Shuttle Landing Facility for traditional runway landings. The company is gearing up for the flight-test phase of development to demonstrate the spacecraft's aerodynamics and controllability during the approach-and-landing phase that culminates in a hard-surface runway landing and runway rollout. Tests are planned to take place at NASA's Dryden Flight Research Center in Edwards, Calif.

The NASA teams within CCP are ready to carry the torch of preserving America as a spacefaring nation by certifying

these commercial systems are safe and reliable enough to transport astronauts to and from the International Space Station. They're continuing to work with the Federal Aviation Administration on commercial space statutes, regulations, licensing processes, safety reviews and range integration. NASA's Astronaut Office at Johnson Space Center in Houston also is instrumental in making sure crew safety concerns and human factor checks are incorporated into designs.

Beginning in FY13 and running concurrently with CCIcap will be the Certification Products Contract (CPC) phase, the first of two planned certification phases. CPC will allow companies to be innovative in fully meeting agency safety and performance requirements as they work with the agency to test and verify systems and subsystems. CPC and follow-on certification efforts are set to maintain NASA's momentum in providing a U.S.-based commercial crew launch capability to the space station at the earliest possible time. ■

An Erickson Air-Crane helicopter lifts Sierra Nevada Corporation (SNC) Space Systems' Dream Chaser full-scale test vehicle to verify proper aerodynamic flight performance near the Rocky Mountain Metropolitan Airport in Jefferson County, Colo., in 2012. Data from the captive-carry test provided SNC an early opportunity to evaluate and prove hardware, facilities and ground operations in preparation for future approach-and-landing tests.



Celebrating 50 Years: 1962 – 2012



Three days after his history-making orbital flight in 1962, astronaut John Glenn gives a double thumbs-up as he accompanies President John F. Kennedy to Launch Complex 14 at Cape Canaveral Air Force Station.



Cape Kennedy's Mission Control Center during the unpiloted Gemini 1 flight on April 8, 1964.



As the build-up for the Apollo missions to the moon continues, the Vehicle Assembly Building and Launch Umbilical Towers are under construction on Merritt Island.



Kennedy Space Center Director Kurt Debus (pointing), Marshall Space Flight Center Director Wernher von Braun and others react with excitement to the May 25, 1965 launch of Saturn-8.



Gemini 8 lifts off on March 16, 1966, with astronauts Neil Armstrong and David Scott aboard. They completed the first-ever docking in Earth orbit.



The 500,000th visitor to take a NASA escorted bus tour, Donald A. Jackson of Sabina, Ohio, was welcomed at the new Visitor Information Center on Merritt Island on Aug. 1, 1967 by Kennedy Deputy Director Albert F. Siepert, left. Jackson toured the center with his wife Sue and their three children, Cheryl, Craig and Doug.



The first rocket launched from the Kennedy Space Center, Apollo 4, rolls out to Launch Pad 39A on Aug. 26, 1967.



Lifting off with 7.5 million pounds of thrust, Apollo 4's Saturn V rises off Launch Complex 39A on Nov. 9, 1967.



Apollo 7 lifts off atop a Saturn IB rocket from Cape Kennedy on October 11, 1968, with Walter Schirra, Donn Eisele and Walter Cunningham aboard.



The Apollo 8 crew of Frank Borman, James Lovell and William Anders depart the crew quarters at the Manned Spacecraft Operations Building (now the Operations and Checkout Building) for launch on Dec. 21, 1968. They were the first astronauts to be launched from the Kennedy Space Center.



In December 1968, the first stage of the Apollo 10 Saturn V space vehicle is hoisted above the transfer aisle in preparation for stacking on a mobile launcher in High Bay 2 of the Vehicle Assembly Building.



An American flag heralds the launch of Apollo 11, the first lunar landing mission. The Apollo 11 Saturn V space vehicle lifted off July 16, 1969, with astronauts Neil Armstrong, Michael Collins and Buzz Aldrin aboard.



Kennedy Space Center's government-industry launch team members rise from their consoles in the Launch Control Center on July 16, 1969 to watch the Apollo 11 liftoff through a window.



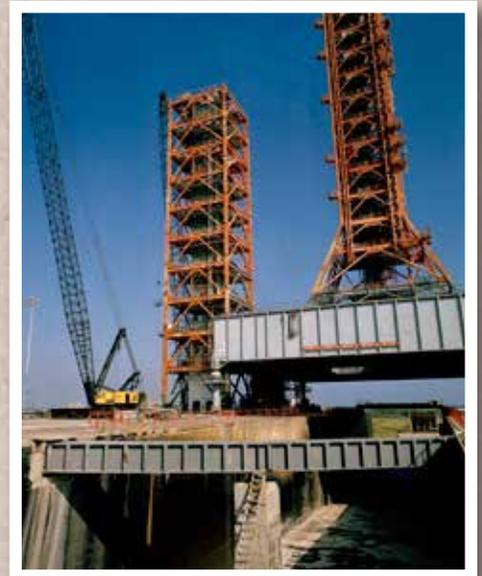
Apollo 15 Lunar Module Pilot James Irwin and Commander David Scott participate in training exercises at Kennedy Space Center on July 7, 1971.



The Saturn V rocket for Apollo 17 is poised beneath a full moon on Launch Pad 39A during the launch countdown. Astronauts Eugene Cernan and Harrison "Jack" Schmitt became the sixth crew to land on the lunar surface in December 1972, while astronaut Ronald Evans remained in orbit in the command module.



The Skylab Orbital Workshop is lifted in the Vehicle Assembly Building in preparation for mating with its Saturn V launch vehicle. NASA placed the space station component into Earth orbit in May 1973.



In October 1976, transition from the Apollo era to the space shuttle is underway as the fixed service structure, left, is assembled at Launch Pad 39A.

The first space shuttle, Columbia, launches on the STS-1 mission with John Young and Robert Crippen aboard, from Launch Pad 39A April 12, 1981.



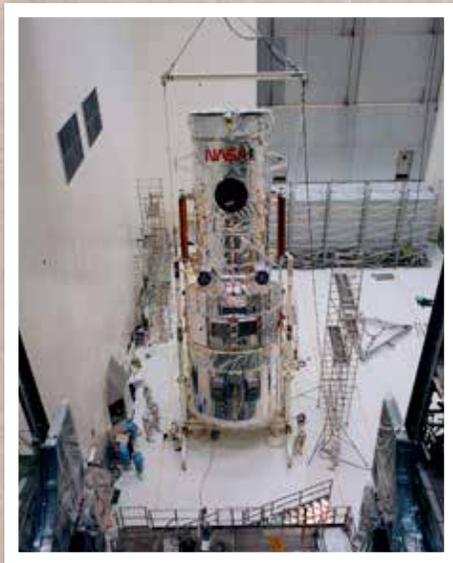
Shortly after sunrise on Feb. 11, 1984, the space shuttle Challenger touches down on Kennedy's runway at 7:16 a.m. EST. The historic first landing at Kennedy brought to a conclusion the nearly eight-day STS-41B mission.



The crew of STS-41B, the first spaceflight in history to begin and conclude a mission at the same site, leaves shuttle Challenger to be greeted by George Abbey, NASA's director of Flight Crew Operations.



Space shuttle Discovery lifts off from Launch Pad 39A for its maiden flight, STS-41D, August 30, 1984.



The Hubble Space Telescope is lifted into a vertical position in Kennedy's Vertical Processing Facility and prepared for launch on Discovery's STS-31 mission in 1990.



In Kennedy's Spacecraft Assembly and Encapsulation Facility-2, Jet Propulsion Laboratory workers close up the metal "petals" of the Mars Pathfinder lander.



STS-135 Commander Chris Ferguson, left, and NASA Kennedy Space Center Director Bob Cabana express their gratitude to the thousands of workers who processed, launched and landed the space shuttles for more than three decades during an employee appreciation event, July 21, 2011, after the final shuttle landing.



The International Space Station module Node 2, called Harmony, is lifted from its workstand in the Space Station Processing Facility at Kennedy in February 2005.



With NASA's Mars Science Laboratory spacecraft sealed inside its payload fairing, the United Launch Alliance Atlas V rocket rides smoke and flames as it rises from the launch pad at Space Launch Complex-41 on Cape Canaveral Air Force Station on Nov. 26, 2011.

SPACE SHUTTLE TRANSITION & RETIREMENT

On July 21, 2011, space shuttle Atlantis returned from orbit for the final time, landing at NASA's Kennedy Space Center in Florida completing an unprecedented record of space shuttle achievements. Utilizing the world's first reusable spacecraft, shuttle crews conducted cutting-edge research, regularly deployed, retrieved and serviced satellites – including great observatories such as the Hubble Space Telescope – and built the largest structure in space, the International Space Station.

During Fiscal Year 2012, Kennedy's Space Shuttle Transition and Retirement Directorate, working closely with space program operations contractor United Space Alliance, continued work to prepare the shuttles for display and deliver them to museums around the country. As the shuttles are taking up residence in museums from New York to Los Angeles, they begin a new mission of inspiring future generations.

PREPARING SPACE SHUTTLES FOR MUSEUMS

As each shuttle completed its last flight, work began in the orbiter processing facilities to deservice the spacecraft instead of reservicing it for future missions. That work to deservice or decommission the orbiters included the crucial task of



In an overhead view, technicians work inside the aft compartment of space shuttle Endeavour during the installation of three replica shuttle main engines in Orbiter Processing Facility-2.

removing containers that once held toxic propellants such as hydrazine and oxidizers. This effort ensured all dangerous commodities were completely drained, making the orbiters safe for public display.

Space Shuttle Main Engines

During the processing of each orbiter, realistic-looking replica shuttle main engines (RSMEs) were installed. The replica engines were prepared by Pratt&Whitney Rocketdyne in Kennedy's Space Shuttle Main Engine (SSME) shop.

NASA is reassigning the actual SSMEs for use with the new Space Launch System heavy-lift rocket.

Orbital Maneuvering System Pods and Forward Reaction Control System

The orbital maneuvering system (OMS pods) and forward reaction control system (FRCS) were removed and shipped to NASA's White Sands Test Facility in Las Cruces, N.M., for cleaning and deservicing. This work ensured the potentially harmful hypergolic propellants used in the OMS engines and thrusters were completely removed.

Like the SSMEs, the OMS pods engines were removed and replaced with replica nozzles after the shuttles arrived at their display sites.

Discovery

Following its final mission, STS-133 in February and March 2011, shuttle Discovery began its final preparations for its ferry flight. The orbiter was towed from Kennedy's Vehicle Assembly Building to the Mate-Demate Device on April 14, 2012, where it was mounted atop NASA's Shuttle Carrier Aircraft, or SCA, a modified 747 jetliner.

Three days later, Discovery and the SCA took off from Kennedy's Shuttle Landing Facility for the trip to the nation's capital. The popularity of the historic space vehicle was evident as tens of thousands of people gathered on the national mall in Washington, along the District of Columbia's highways and at Washington-Dulles International Airport in Virginia to watch the Discovery-SCA flyover and landing.

Prior to each shuttle orbiter reaching its new location, a Kennedy

off-load team of about 40 NASA and United Space Alliance employees arrived three weeks ahead to prepare the site.

Once the orbiters were removed from the SCA, the team completed preparations for display. The work included removing the aerodynamic tail cone and configuring the replica main engines and installing the mock-up orbital maneuvering system nozzles.

Discovery now is on display in the Smithsonian's National Air and Space Museum, Steven F. Udvar-Hazy Center in Chantilly, Va. Discovery is set up as if sitting on the runway just after landing, allowing visitors to walk around the perimeter of the spacecraft.

Enterprise

The prototype shuttle orbiter Enterprise was used in NASA's Approach and Landing Tests in 1977. Since 2003, it has been on

display at the Smithsonian's Udvar-Hazy Center.

With the arrival of Discovery, NASA transferred title and ownership of Enterprise to the Intrepid Sea, Air and Space Museum in New York City in December 2011.

The Intrepid museum is located aboard the retired World War II aircraft carrier USS Intrepid. The aircraft carrier was the prime recovery ship for astronaut Scott Carpenter following his Mercury 7 orbital flight in May of 1962, and the ship also retrieved astronauts Gus Grissom and John Young after they splashed down following Gemini 3 in March 1965.

When Enterprise was flown to New York, thousands watched as the shuttle-SCA combination flew near many of the city's well-known landmarks. Following landing at John F. Kennedy Airport, the shuttle was delivered by barge on the Hudson River to the Intrepid museum. Enterprise now is displayed 10 feet off the surface allowing visitors to walk directly under the shuttle.

Endeavour

The STS-134 mission, flown between May 16 and June 1, 2011, was the last flight of Endeavour. Following more than a year of deservicing, shuttle Endeavour was towed to the mate-demate device on Sept. 14, 2012, and lifted atop the SCA for its flight to Los Angeles. After a one-day weather delay, the Endeavour-SCA combination took off early on Sept. 19, stopping overnight at Ellington Field near NASA's Johnson Space Center in Houston.



NASA's Shuttle Carrier Aircraft, with space shuttle Endeavour mounted atop, makes a low-level pass over Kennedy's Shuttle Landing Facility as it begins its ferry flight to California, Sept. 19, 2012. Endeavour was transported to Los Angeles where it was placed on public display at the California Science Center.



Space shuttle team members proudly display an Atlantis flag as the spacecraft paused during its move from Orbiter Processing Facility-1 into the nearby Vehicle Assembly Building. The work was part of the Space Shuttle Program's transition and retirement processing of the space shuttle fleet.

Kennedy Space Center Visitor Complex.

On Aug. 16, Atlantis moved out of the Vehicle Assembly Building switching places with Endeavour, which had been in Orbiter Processing Facility-2. The transfer also was an opportunity for a “nose-to-nose” photo opportunity.

Scores of Kennedy employees and news media were on hand to take pictures during the activity.

Throughout the next three months, technicians completed final work for Atlantis' display. Following these preparations, Atlantis was transported to a new 65,000-square-foot facility being constructed in the heart of the Kennedy Space Center Visitor Complex's Space Shuttle Plaza. Inside, the 87-ton shuttle Atlantis will be mounted at a 43.21 degree angle with payload bay doors open in front of a large screen featuring views of the Earth from space. Guests will have an up-close view of Atlantis as it appeared in orbit.

Complementing the orbiter display will be numerous interactive features reflecting major accomplishments of the Space Shuttle Program, including exhibits focusing on the Hubble Space Telescope and the International Space Station. ■

As the Endeavour-SCA continued west, the combination made a low pass over Tucson, Ariz., as former NASA astronaut Mark Kelly and his wife, former U.S. Rep. Gabrielle Giffords, watched from a rooftop at the University of Arizona. Kelly commanded Endeavour's final mission, STS-134. The shuttle continued on to the space agency's Dryden Flight Research Center at Edwards Air Force Base. After an overnight stay, the SCA conducted low-level flybys around the Sacramento and San Francisco Bay areas giving residents a once-in-a-lifetime opportunity to see a shuttle fly over their communities.

Following passes over NASA's Ames Research Center, Vandenberg Air Force Base and NASA's Jet Propulsion Laboratory, thousands in the Los Angeles area turned out for a view of the shuttle. Finally, the SCA and Endeavour landed at Los Angeles International Airport. The Kennedy team removed Endeavour from the SCA and placed it on the Overland Transporter. This specially

built transporter was used early in the Space Shuttle Program to move orbiters from their manufacturing site in Palmdale, Calif. to Edwards Air Force Base for ferry transport to Kennedy.

Endeavour traveled through Los Angeles streets on a two-day, 12-mile trip from the airport to the California Science Center. In its new home, Endeavour will be on display along with the Space Shuttle Program's history to inspire future generations. Along with the orbiter, the California Science Center pavilion will feature artifacts such as the galley and the tires from STS-134, along with the Spacehab module flown in Endeavour's payload bay on STS-118.

Atlantis

Atlantis flew the final mission of the Space Shuttle Program between July 8 and 21, 2011. Atlantis will remain on Florida's Space Coast joining NASA rockets, spacecraft and artifacts from the Mercury, Gemini and Apollo eras at the



Space shuttle Discovery, mounted atop a NASA 747 Shuttle Carrier Aircraft, flies over the Washington skyline as seen from a NASA T-38 aircraft on April 17, 2012. Discovery was transferred to the National Air and Space Museum's Steven F. Udvar-Hazy Center in Chantilly, Va., to begin its new mission to commemorate past achievements in space and to educate and inspire future generations.

ENGINEERING & TECHNOLOGY

Developing and improving spaceflight technologies, designing and testing hardware, and upgrading the command-and-control infrastructure to meet tomorrow's launch needs -- all of these vital tasks are the domain of Kennedy Space Center's Engineering and Technology Directorate. This dynamic organization also works to sustain the unmatched expertise of the center's research and technology workforce.

The directorate operates the Launch Equipment Test Facility (LETF), a one-of-a-kind, world-class structure allowing engineers to test large-scale ground systems and ground support equipment needed

for spaceflight hardware processing and launch operations. For example, the directorate had a commercial off-the-shelf mast climber installed on the facility's east tower to check the climber's viability for a project under way in the 525-foot-tall Vehicle Assembly Building. Also fabricated and installed at the LETF were typical services required by launch vehicles, such as power, water, gaseous nitrogen, timing tests and more, in order to test their operational feasibility. This concept was proven as a viable option to service future launch vehicles.

In any launch operation, one of the most complex, critical and costly activities is the loading of chilled propellants, called cryogenics, into the vehicle.

At Kennedy, cryogenic-handling operations have remained largely unchanged through the past 50 years. In an effort to mature and advance these processes, the Engineering and Technology team is managing two Ground Operations Demonstration Units. The Liquid Oxygen (LO2) Team successfully performed a cryogenic loading test of a composite tank, marking the first time

this type of tank was filled with liquid nitrogen at the center's Cryogenic Lab. Meanwhile, the Liquid Hydrogen (LH2) Team took significant steps forward in demonstrating "zero boil-off" integrated technologies, in which refrigeration technology keeps the commodity cold, instead of allowing it to boil away to keep the remaining propellant at the required temperature. The LH2 Team also made advances in automation of the valve and sensor controls used during loading operations.

Another of the directorate's endeavors is the modernization of Kennedy's infrastructure, with the goal of providing an end-to-end command and control system for government and commercial customers using the center's ground processing and launch capabilities. The team provided support to early Launch Pad 39B ground subsystems testing, and delivered capabilities to handle information flow within the system, Integrated Launch Operations Applications software, math models, and simulation systems development.

The directorate supported production activity on the NASA Multi-Purpose Crew Vehicle's Exploration Flight Test (EFT-1) crew module, manufactured by Lockheed Martin in Kennedy's Operations



Electrodynamic dust shield devices are tested in a vacuum chamber during reduced gravity flights aboard one of NASA's aircraft. The simulations took place as the aircraft flew steep dives creating brief periods of gravity similar to the moon and Mars.

and Checkout Building. Kennedy engineers acted as the central point of contact for production-related activities to Johnson Space Center's design engineers.

The Regolith and Environment Science and Oxygen and Lunar Volatile Extraction mission, better known as RESOLVE, is a drilling and chemistry laboratory designed to help look for hydrogen or water from aboard a lunar rover. The project passed several notable milestones during Fiscal Year 2012, including a full integrated test completed with all three scientific instruments aboard the Canadian Space Agency (CSA) rover Artemis Jr. The directorate provided hardware systems design, development and fabrication for the Lunar Advanced Volatile Analysis (LAVA) instrument, avionics design and fabrication, and the system software, including network communications.

At the Engineering Development Laboratory (EDL), the directorate established Kennedy's new Swamp Works, an incubator for rapid, innovative and cost-effective solutions for exploration missions. With help from partners across NASA, industry and academia, concepts will start small – but build up fast. Kennedy's Swamp Works relies on lean development processes and a hands-on approach, with early-stage testing to drive design improvements. Swamp Works includes the Granular Mechanics and Regolith Operations Laboratory, Electrostatics and Surface Physics Laboratory, an indoor regolith simulant pit, robotics integration, and a checkout and assembly area.

Always striving to maintain the spaceport's cutting-edge workforce, the directorate created "Rocket



Technicians with the Institutional Services Contract test the performance of a hypergol flight prototype pump at a facility on Cape Canaveral Air Force Station in Florida. Kennedy engineers are developing and testing a high-technology gas pump system for integration to a Goddard Space Flight Center-led project for bringing a tow truck with robotic servicing capabilities to satellites in space.

University," a training curriculum developed especially for Kennedy's engineers that provides more than one hundred engineers an opportunity to learn from a variety of technical experts in everything from systems engineering and structural analysis, to the latest in avionics design. The skills obtained in these courses were put to the test in lab activities involving sounding rockets, high-altitude balloons and uncrewed aerial systems. During 2012, Rocket University participants completed two high-altitude balloon missions carrying payloads they designed, built and tested. The payloads included GPS, temperature sensors, recording media and command capabilities, and all were successfully tracked and recovered in both missions.

NASA's Academy of Program/Project & Engineering Leadership (APPEL) partnered with Kennedy Space Center and the Office of the Chief Engineer to reutilize classroom facilities no longer being used by the contractor workforce after shuttle retirement. Classrooms and office space were repurposed to create APPEL's Academy Center for

Excellence (ACE).

ACE serves as a multidisciplinary learning center for NASA civil servants and partners in industry, academia, other government agencies, professional associations and foreign space agencies. ACE hosts many of APPEL's project management, engineering and systems engineering training courses and knowledge sharing forums. The partnership fostered collaborations with other organizations, including the European Space Agency, Japan Aerospace Exploration Agency, Florida Institute of Technology, Disney Imagineering and Kennedy's Rocket University.

Since its October 2011 opening, ACE has hosted more than 326 events and supported more than 202 APPEL courses agencywide.

Kennedy's unique capabilities and talented workforce will remain critically important as America's premier spaceport transforms into a versatile, multi-user launch center. The center's Engineering and Technology Directorate is playing a critical role in this transition, helping to set the stage for the explorers and discoveries to come. ■

ENVIRONMENTAL LEADERSHIP

Kennedy Space Center remained in the forefront of ecological leadership during Fiscal Year 2012 with its ongoing commitment to preserve and protect the environment.

In line with the federal government's mandate and NASA's Strategic Sustainability Performance Plan, the center continued executing its first-ever Sustainability Plan, which includes hundreds of ways to reduce its footprint and conserve the environment inside Kennedy's gates. Sustainability goals include reducing greenhouse gas emissions; designing and building sustainable buildings, facilities and infrastructure; conserving and managing water resources; minimizing waste and preventing pollution; purchasing sustainable products and services; managing electronic equipment and data centers responsibly; and integrating sustainability into local and regional planning.

In FY12, implementation of the Sustainability Plan was well under way with numerous projects that spanned those goals. Examples of projects funded with recycling proceeds include: development of a recycling tracking database with integrated mobile Quick Response codes, waste concrete processing, solar powered signage at a badging station, and evaluation of recycling spent blast media. Quarterly meetings were held with the plan's



Kennedy Space Center's Earth Day was held on April 14, 2012, during the center's annual All-American Picnic. Workers and guests met NASA astronauts and visited vendor booths promoting green, sustainable products and services.

steering and core teams to review the progress of projects.

Kennedy also expanded its waste diversion and recycling programs by diverting nearly half of all its waste for reuse and recycling. Materials diverted from landfill disposal and reutilized for other purposes included about 3,257 tons of concrete from construction projects; 1,539 tons of scrap metals; 951,445 pounds of mixed office paper; 436,660 pounds of cardboard; 8,502 pounds of glass; 9,009 pounds of aluminum cans; 23,096 pounds of plastic bottles; and 41,408 pounds of electronic waste from operations. Spent toner cartridges were processed through Kennedy's recycling contractor with 60 locations being serviced and 350 cartridges collected through September 2012. The Alkaline

Battery Recycling Program has collected 1,216 pounds since November 2011.

Kennedy's 2012 Earth Day was held April 14 during the center's annual All-American Picnic. NASA hosted vendors promoting green, sustainable products and services for commercial and residential use. Five unique stations located throughout the park took participants on a journey explaining how Kennedy's Environmental Office aides in picnic greening. An adventure called "Green-A-Teering" was designed to educate children, from ages four to 17, about the center's greening efforts. Adults also learned about products and services at vendor display stations. Overall, Kennedy collected 1,100 pounds of compostable material and 500 pounds of glass, aluminum and

plastic, which were subsequently sent to a recycler.

During Kennedy's first Innovation Expo, the Earth Systems Modeling and Data Management Lab was open to the workforce. Ecological Program field tools such as traps, transmitters, receivers, binoculars, snake protection and other personal protection equipment were on display. Live rattlesnakes and other examples of wildlife, information pamphlets and the Ecological Program web page were highlighted. A series of boat tours showcased the protected area of the Banana River, and emphasized the unique relationship that Kennedy has with the regional ecosystem as a "living outdoor laboratory" and its value to the community.

Kennedy continues to remain a top performer for the agency by exceeding federal energy reduction goals. The center far exceeded the 21 percent goal from the 2003 baseline by achieving a 35 percent energy intensity reduction in Fiscal Year 2012. This reduction was the result of increased awareness at the center, periodic meetings and communications within the Energy Working Group, further collaborations with Kennedy's Construction of Facilities Office, increased efficiency investments, and facility condition audits and assessments.

A one-megawatt solar power generation facility constructed by Florida Power & Light at Kennedy continues to provide power back to the center. This facility saves Kennedy more than \$160,000 in energy costs and reduces greenhouse gas production by more than 1,000 tons annually.

Kennedy partnered with the

United States Air Force 45th Space Wing to dispose of more than 1,100 excess ordnance items at the Cape Canaveral Air Force Station Explosive Ordnance Disposal Range during 2012. This local disposal saved the Space Shuttle Transition and Retirement Program an estimated several hundred thousand dollars in off-site shipping and disposal costs.

Kennedy's Environmental Compliance Program continues to perform well. State and local regulatory agencies conducted formal environmental compliance inspections at Kennedy in the areas of hazardous waste, air emissions, landfill compliance, petroleum storage tanks, stormwater management, industrial wastewater and septic systems with no significant findings or violations. Kennedy's environmental staff conducted more than 600 internal inspections in 2012 to proactively identify and correct environmental compliance issues.

Kennedy continued its robust Environmental Remediation Program to identify and clean up environmental contamination from past programs. Kennedy's environmental remediation actions concluded soil cleanups initiated in 2011, removing more than 1,193 tons of soil contaminated with metals, polynuclear aromatic hydrocarbons and polychlorinated biphenyls at

five sites: Area 2 Repeater Building, Fire Station No. 6, Instrumentation Facility Building Area, Operations Support Building Area and the Pole Barn northwest of Jerome Road. Kennedy also treated more than 24 million gallons of groundwater to remove 10,744 pounds of volatile organic compounds at 12 remedial systems.

The Florida Department of Environmental Protection provided regulatory approval on 56 work plans and reports from ongoing site investigations and cleanups. Remediation staff co-authored paper and poster presentations given at the International Conference on Remediation of Chlorinated and Recalcitrant Compounds in 2012. Workshop participants included scientists, engineers, regulators and other environmental professionals representing government agencies, universities, consultants and research, development and service firms from around the world. ■



A Kennedy worker gets hands-on experience with a plant experiment in the Operations Support Building II during the center's 2012 Innovation Expo, Sept. 6, 2012.

EDUCATION

During Fiscal Year 2012, Kennedy Space Center's Education Office team pursued multiple avenues in its quest to introduce as many people as possible to the adventure of exploration and the wonders of space.

Whether managing agencywide programs, forming strategic partnerships or planning entertaining, family-oriented events, their goal to promote science, technology, engineering and mathematics – the STEM disciplines – to every student or teacher who crossed their paths was at the forefront.

In all, Kennedy hosted 65 college- or university-level interns. Another 59,904 students and teachers were reached through formal K-12 educational programs.



High school teams tinker with their robots during the regional FIRST robotics competition at the University of Central Florida in Orlando, Fla. in March 2012. More than 60 teams took part in the competition called “For Inspiration and Recognition of Science and Technology” (FIRST) in hopes of advancing to the national robotics championship.

Projects that Kennedy manages for the agency are the Experiment Program to Stimulate Competitive Research (EPSCoR), Minority University Research and Education Programs (MUREP) Small Projects (MSP), the NASA Lunabotics Mining Competition and the Interdisciplinary Science Project Incorporating Research and Education (INSPIRE). In addition, Kennedy shared oversight for Motivating Undergraduates in Science and Technology (MUST) with NASA's Glenn Research Center.

Among the events sponsored through these programs was

EPSCoR's Minority-Serving Institution (MSI) Faculty Engagement competition, to promote strong and meaningful partnerships between research universities and minority-serving institutions.

Minority Innovation Challenges Institute (MICI), an MSP grantee managed by Florida A&M University, generated the participation of 13 minority-serving institutions. Currently, 269 faculty and 1,324 students are enrolled in MICI, representing 425 colleges including 126 MSIs.

NASA's Lunabotics Mining Competition is designed for

Rocket University participants prepare to launch a high-altitude balloon flight and instrument package. Taking place in July 2012, the test flight was used to evaluate the stability of an instrumented capsule as it fell to Earth before its parachute opened.



At the Kennedy Space Center Visitor Complex, Lunabotics UAM Team students from the Universidad Autonoma Metropolitana in Mexico transport their lunabot to the Lunarena during NASA's Lunabotics Mining Competition. The mining competition is sponsored by Kennedy's Education Office for the agency's Exploration Systems Mission Directorate.

Anniversary Scout Show.

Workshops presenting techniques to stimulate student involvement in STEM were held for educators from the International Space University and Links Incorporated.

Other partnerships were formed with the National Institute of Aerospace (NIA), Revolutionary Aerospace Systems Concepts Academic Linkage (RASC-AL), the LEGO "Build the Future Event," the Tom Joyner Morning Show Family Reunion, and Florida Afterschool Network (FAN) Board Meeting.

The Kennedy Education staff engaged an additional 91,858 teachers and students through less formal, family-oriented activities throughout the year. ■

university-level students to design and build an excavator, or Lunabot, to mine and deposit a minimum of 10 kilograms of lunar simulant within 10 minutes. In the third annual competition, 55 U.S. and international teams competed during the six-day event.

Others were the Human Exploration and Operations Mission Directorate (HEOMD) Senior Design Project for engineering students and the Exploration Space Grant Faculty Workshop to prepare instructors to implement NASA's Exploration senior engineering design course.

The annual MUST symposium provided student attendees with 21st century leadership skills workshops and a Career Pathways session with representatives from NASA and key aerospace contractors.

Kennedy also participated in National Laboratory Day, as well as Morpheus Education and Public Outreach activities.

Education supported an

International Space University (ISU) team project to answer the question "What can space contribute to global STEM education?" with a hands-on microgravity educator workshop June 15. Kennedy also provided an astronaut panel discussion July 11 for all 134 ISU participants of the intensive nine-week aerospace program. Kennedy co-hosted the 2012 ISU session with the Florida Institute of Technology.

Kennedy's Education Office partnered with nationally recognized organizations and service groups to provide support and hands-on activities for events such as the University of Scouting and the 100th

During Brevard County Space Week at the Kennedy Space Center Visitor Complex, teams of five students use kits with plastic pieces to build a space station-like truss. Following construction, weights were added to determine how much weight their truss would support.



OUTREACH TO THE WORLD

Kennedy Space Center's events and launches garnered world attention during Fiscal Year 2012. As NASA's three space shuttles were retired and transitioned for display at locations in California, Washington, D.C. and Florida, Kennedy focused its attention on NASA's Space Launch System, expendable launch vehicle missions, the Commercial Crew Program and new technology development.

Communication efforts enabled the center to provide timely and accurate information to the media, elected officials, community leaders, students, educators and the general public.

Using media releases, traditional and social media, special events, speakers, educational events, briefings to legislators and exhibits, Kennedy's accomplishments are communicated to the broadest audience in an effort to inform, educate and inspire.

News Media Operations

Kennedy Space Center remains a primary focus for news organizations in the United States and around the world that report on the ongoing exploration of space. Reporters, television personalities and photographers offered their audiences updates and detailed features relating to the launches of missions to Mars and the radiation belt around Earth. The first operational SpaceX mission to deliver cargo to the space station



The international news media takes part in a question-and-answer session with Mercury astronauts John Glenn and Scott Carpenter at the Kennedy Space Center Visitor Complex in Florida, Feb. 17, 2012. The astronauts were taking part in events celebrating 50 years of Americans in orbit, an era that began with John Glenn's Mercury/Friendship 7 mission on Feb. 20, 1962.

also gained noted attention from the news media. Numerous research topics also were covered during 2012, along with the departure of NASA's retired space shuttles to museums.

Information was channeled via live and taped interviews, news conferences, media updates, printed fact sheets and newsletters, exhibits and social media outlets, including websites, blogs and Twitter updates. Other avenues of communication included Kennedy's high-definition NASA TV broadcasting of launches, conferences and events; streaming video of Kennedy events; digital imagery on the multimedia gallery, and a full-service office catering to professional journalists. Video

news releases, still photographs, video footage, tapes, CDs and DVDs were distributed to media outlets showcasing NASA's future plans.

The staff of the news media operation also adjusted so NASA could take advantage of interest in the space agency from people deeply involved in social media reporting. Kennedy opened its media services to more than 200 attendees of various NASA Social events in 2012.

Kennedy Web Presence

The Kennedy Space Center Web site continued to draw a worldwide audience during 2012. The center's home page at www.nasa.gov/kennedy attracted close to 2 million

views, outpacing the performance of other NASA centers, government agency websites and many commercial sites.

The Kennedy Web team detailed the retirement of NASA's space shuttle fleet and highlighted the program's accomplishments for the public using the shuttle section at www.nasa.gov/shuttle, which received more than 12 million views during the past year. Kennedy's Web team created the Space Shuttle Era collection of feature stories and videos documenting space shuttle operations. This section highlights the technology and people who supported this program for the past 30 years and can be found at http://www.nasa.gov/mission_pages/shuttle/flyout/index.html

Kennedy's social media presence, under the username NASA Kennedy, became a standard for many to find out the latest news from the space center increasing the fan base to more than 220,000 likes on Facebook, and roughly 379,000 followers on Twitter. YouTube climbed to more than 27,000 subscribers with more than 3.5 million video views.

During the year, the Web team provided launch processing and countdown coverage for three expendable launch vehicle missions, Mars Science Laboratory, RBSP and NuStar, along with a SpaceX demonstration flight and SpaceX's first operational resupply mission to the International Space Station. An international Internet audience was kept up-to-date during countdowns and landings with frequent updates to the mission's main page along with photo and video galleries. NASA's Launch Blog provided live commentary and up-to-the-

minute information straight from a control room console to the reader. Kennedy's Web video products included feature videos and podcasts, as well as highlights of launches and landings.

Display Management Team

During Fiscal Year 2012, the Display Management Team (DMT) that supported 44 events reached out to about 1 million people. The events took place in six regions of Florida and Georgia. DMT also

local, national and international visitors. In partnership with NASA, the visitor complex's operator, Delaware North Companies Parks & Resorts, engaged in dynamic, transformative projects bringing the new era of space exploration to its visitors, while honoring the past accomplishments of the American space program.

The visitor complex developed, marketed and implemented innovative programs to increase attendance. Special launch



Kennedy's Display Management Team took the NASA message to the National Basketball Association's All-Star Jam in Orlando, Fla., Feb. 22-26. Attendees waited in line to experience the inflatable planetarium and learn how NASA plays a part in their favorite sport.

supported several nationwide agency events. In all of the outreach efforts, DMT looked to highlight the many contributions that the shuttle program has made to the U.S. and the world, while emphasizing what's to come in the near future.

KSCVC

Kennedy Space Center Visitor Complex shared NASA's story with more than a million people during 2012, an audience that included

viewing opportunities were offered for rockets blasting off from the Cape Canaveral Air Force Station. Three new "Up Close" special interest tours were introduced with overwhelming success. The tours take visitors behind-the-scenes to areas that were previously restricted to the general public for more than 30 years, including the Vehicle Assembly Building, the Launch Control Center and for the first time Launch Pad 39A.

Construction progressed steadily during 2012 on the permanent home of space shuttle Atlantis, the cornerstone project of the complex's transformative master plan for the next 10 years. When the massive new exhibit hall is completed, visitors to the attraction will be immersed in the history, stories and science of the Space Shuttle Program through state-of-the-art interactive exhibits including galleries dedicated to the Hubble Space Telescope and the International Space Station.

Delaware North continued to make progress on the overall master plan, including completing a new front entrance to the complex. The new entrance configured to bring guests into the iconic rocket garden opened in September. A complimentary new dining option located in the Rocket Garden also opened. The new restaurant includes exciting menu options and expansive outdoor seating.

The complex collaborated with several partners to plan and deliver exciting events to engage the public. In January, the complex commemorated the 50th anniversary of U.S. orbital flight with a celebration featuring Mercury astronauts John Glenn and Scott Carpenter. Other events throughout the year included a day-long celebration of Kennedy's 50th anniversary, the third annual Lunabotics Mining Competition, induction of the 11th group of Space Shuttle Program astronauts into the U.S. Astronaut Hall of Fame, and a weekend of exhibits and special presentations leading up to the landing of the "Curiosity" rover on Mars. The visitor complex also offered "fly-



out" viewing opportunities to the general public for shuttles Discovery and Endeavour as they departed Kennedy for museums in Washington, D.C., and Los Angeles where they now are displayed permanently.

The visitor complex continued to successfully operate two retail stores in the Orlando International Airport and offered a variety of robust educational programs geared toward inspiring the next generation of explorers. More than 17,000 students participated in Camp KSC, Overnight Adventures and the Astronaut Training Experience. For more than 45 years, the visitor complex has operated as a self-supporting entity funded solely through revenues earned through admission, retail and food sales.

Government Relations

Elected officials from federal, state and local levels toured Kennedy facilities to learn more about the wide range of activities happening at the center in 2012,

Atlantis will be displayed at a new 90,000-square-foot facility being constructed at Kennedy Space Center Visitor Complex. Inside, the 87-ton shuttle Atlantis will be mounted at an angle with payload bay doors open in front of a large screen of views of the Earth from space. Guests will have an up-close view of Atlantis as it appeared in orbit. Image credit: PGAV Destinations for Delaware North Companies Parks & Resorts.

including the three programs headquartered at the center. Elected officials also attended the launch of the first SpaceX Commercial Orbital Transportation Services (COTS) demonstration flight, flyout events for both Discovery and Endeavour, and significant events such as the signing ceremony of Orbiter Processing Facility-3 from NASA to Space Florida for production of The Boeing Company's CST-100 capsule. Officials also attended a ceremony in the Operations and Checkout Building to mark the arrival of the Orion spacecraft that will fly the Exploration Flight Test-1 mission, known as EFT-1. U.S. Sen.

Bill Nelson was a keynote speaker at the 50th anniversary of U.S. orbital flight, honoring Sen. John Glenn and Scott Carpenter, hosted at Kennedy in February.

The center's senior management team participated in numerous forums and meetings throughout Florida concerning the future of Kennedy and the space industry.

During the year, Kennedy Director Bob Cabana spoke before the League of Cities meeting hosted by the City of Cape Canaveral, and the Brevard County Board of Commissioners, where he accepted a Brevard County Resolution celebrating Kennedy's 50th anniversary on behalf of the center. Senior management and industry representatives joined Cabana to visit with state legislators during Florida Space Day in the state's capital.

Cabana met with members of the Florida Congressional Delegation in Washington, D.C., in support of NASA's Office of Legislative and Intergovernmental Affairs' annual "Day on the Hill" event and detailed Kennedy's plans and activities to the Brevard legislative delegation.

Guest Operations

Kennedy's Guest Operations staff enabled more than 9,000 guests of NASA and its center partners to safely participate in behind-the-scenes Kennedy tours, including educational briefings provided by center engineers and operational experts in 2012.

As Kennedy prepared space shuttles Discovery and Endeavour for departure to museums across the country, more than 2,500 employees and special guests were given the opportunity to view the orbiters and

witness their departures from Kennedy atop the Shuttle Carrier Aircraft.

Kennedy, in partnership with the Florida Institute of Technology, hosted the 2012 International Space University 25th Space Studies Program for 134 students from 31 countries for the nine-week program.

Kennedy also held events for past and present employees and the community to honor and recognize their great achievements during Kennedy's 50th anniversary celebrations.

Guest Operations continued to inspire and engage the public by hosting more than 12,000 guests for exciting Launch Services Program science missions and a COTS demonstration mission to the International Space Station. Launches of the "Curiosity" rover and its landing on Mars, Radiation

Belt Storm Probes (RBSP), and SpaceX COTS demonstration were viewed by members of Congress, business and agency leaders, medical and legal professionals, teachers and students.

Speakers Bureau

Kennedy's extensive network of professional engineers, technicians and other experts in rocketry took part in the center's speakers program. In 2012, they attended more than 300 events throughout Florida, Georgia and Puerto Rico. They reached more than 57,000 children and adults through career days, community events and professional talks. Kennedy employees reached an additional 85,000 people through 400 non-Speakers Bureau outreach opportunities. ■



NASA Administrator Charlie Bolden and Leland Melvin, NASA associate administrator for Education, talk to agency social media followers at Kennedy Space Center, Aug. 23, 2012, during the second day of NASA Social activities revolving around the Radiation Belt Storm Probes mission.

KENNEDY BUSINESS REPORT

Budget Highlights

The Kennedy Space Center FY 2012 budget was more than \$1.8 billion. The center also performed \$78.5 million in reimbursable work with other government and commercial entities.

The Space Shuttle Transition and Retirement Program (T&R), including total Space Program Operations Contract (SPOC) impacts, executed an \$88 million budget, and enabled the successful safing and transfer of NASA's four space shuttles to various museums across the country. FY 2012 activity also included the safing, disposition and/or transfer of shuttle hardware and facilities. This involved the overseas Trans-Atlantic Abort Landing sites, as well as the dispositioning or

retention of Space Shuttle Program records. Where possible, the Transition and Retirement Program transferred functional shuttle hardware and facilities to other NASA programs or partners.

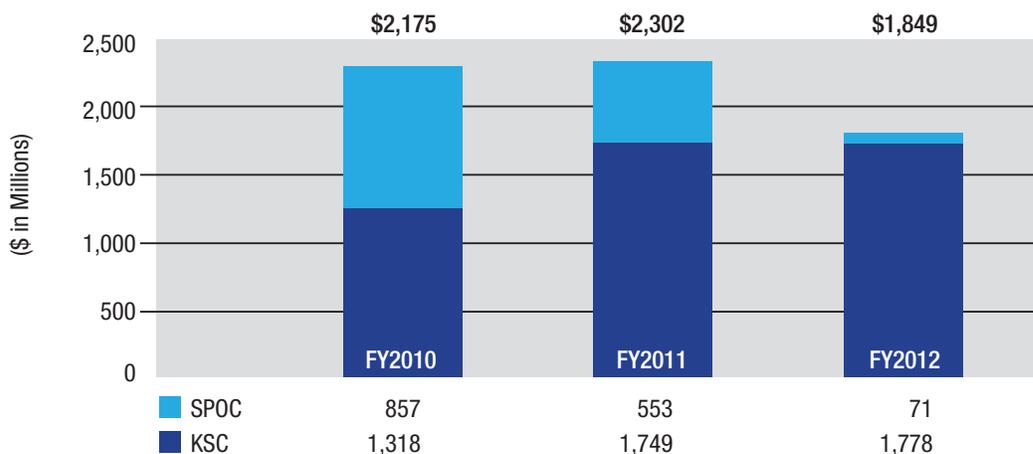
The Commercial Crew Program (CCP) partnered with multiple aerospace companies in Fiscal Year 2012, investing \$310 million to advance the development of crew space transportation systems for future missions to low-Earth orbit, including the International Space Station. Space Act Agreements are enabling CCP's partners to work through paid-for-performance milestones to complete their designs, test their hardware and then showcase how they would operate and manage missions from launch through orbit and landing.

The International Space Station (ISS) Program provided \$73 million in budget to Kennedy, which allowed for continued success toward achieving and maintaining the ISS 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 ISS. In addition, the budget provided for ongoing development of hardware intended to promote full utilization of the ISS through the establishment of fundamental biological research capabilities.

The Launch Services Program (LSP) executed a \$448 million budget, both direct and reimbursable. LSP supported

continued on page 46

NASA/KSC Budget Authority Summary FY 2010 through FY 2012 (\$ in Millions)

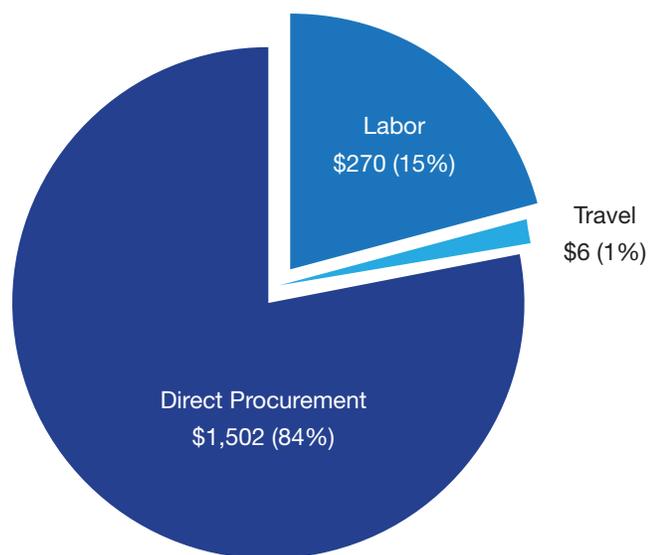


Kennedy Space Center FY 2012 Budget Authority (\$ in Millions)

Space Shuttle	\$17
Space Station	\$73
Launch Services/Science	\$403
Ground Systems Development and Operations	\$373
Commercial Spaceflight	\$368
Center Management & Operations	\$377
Other	\$167
Total KSC*	\$1,778

** Excludes Space Program Operations Contract (SPOC)*

FY 2012 KSC Budget by Elements (\$ in Millions)



ECONOMIC IMPACT

To fulfill its mission, NASA and its contractors and partners require a range of goods and services, both technical and non-technical, from expendable launch vehicles, propellants and computer systems, to motor vehicles, facilities and office supplies. To meet NASA's demand, local contractors employ workers, produce products, fund payrolls and generate output. These workers and contractors generate additional impacts as they spend their income and place orders with other local or regional firms for materials and services. Salaries paid to employees create and generate business in the communities where they live. Further economic activity

is generated through tourism and out-of-state visitors to the Kennedy Space Center Visitor Complex, its support of NASA launches, and aerospace business travel to the region. Each round of spending recirculates NASA's initial demand among Florida's businesses and households, multiplying the direct impact on the economy.

Kennedy periodically conducts an economic impact analysis to measure NASA's effect on the economy at the local, regional and state levels. The assessment found that in FY 2012, of the \$17.8 billion NASA budget, Kennedy and other NASA centers spent \$1.3 billion in wages and commodity

purchases within the state of Florida. This monetary injection into the local Space Coast and state economy of Florida induced a total economic impact of \$2.15 billion and generated 16,500 jobs. The report concludes that every space-related dollar spent in Florida results in another dollar of output, and every space-related job creates an additional job within the Florida economy. While the overall NASA impact was found to be significantly lower in FY 2012 from its FY 2009 peak, Kennedy remains by far the major economic driver in Brevard County and a major contributor to the economic health of Florida. ■

continued from page 44

four successful mission launches: Mars Science Laboratory (MSL) and Radiation Belt Storm Probes (RBSP) from Cape Canaveral Air Force Station in Florida, Suomi National Polar-orbiting Partnership (NPP) from Vandenberg Air Force Base in California, and Nuclear Spectroscopic Telescope Array (NuSTAR) from Kwajalein Atoll in the Marshall Islands. The program also procured launch vehicle services and other support for several manifested missions scheduled to launch in FY 2013 and beyond.

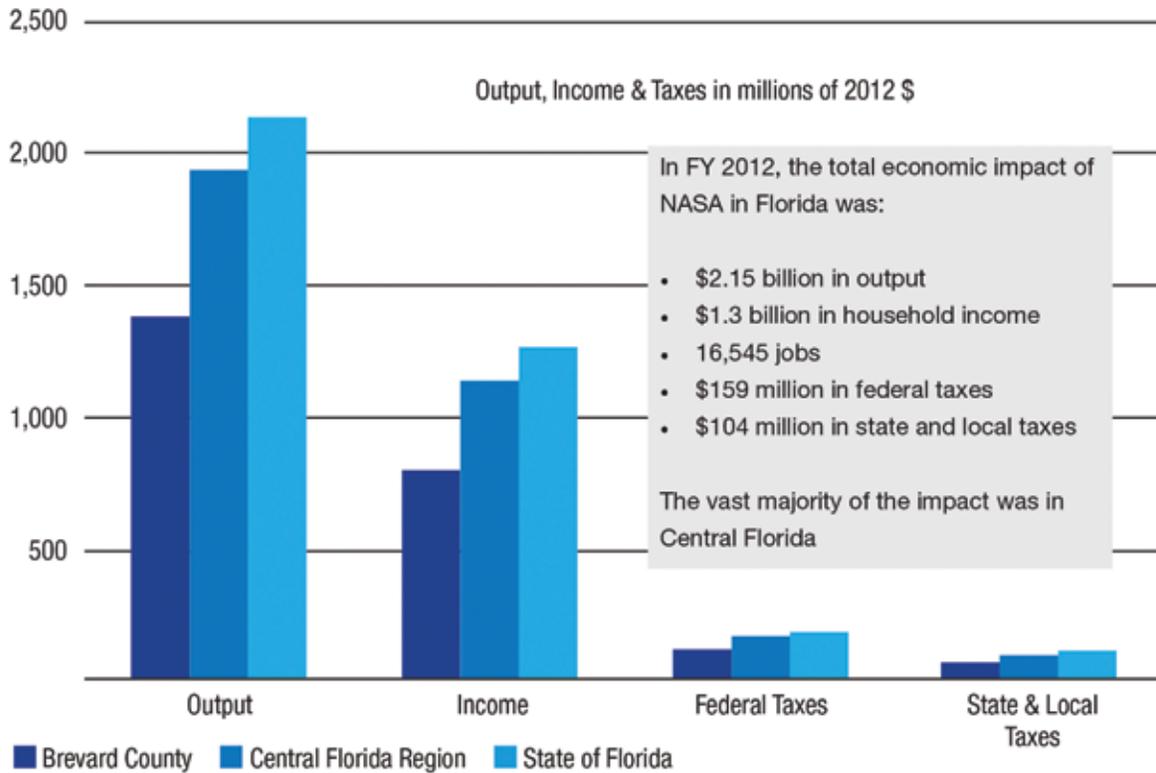
The Ground Systems Development and Operations (GSDO)

Program budget of \$373 million included both Exploration Ground Systems and the 21st Century Space Launch Complex. It provided for the modernization and augmentation of current and future ground systems design, development and ground operations infrastructure to facilitate the activities of future customers and stakeholders, including government agencies, commercial industry, and current and future programs such as the Space Launch System and Orion Multi-Purpose Crew Vehicle. Other key projects included enhancements to the range, payload processing capabilities and environmental

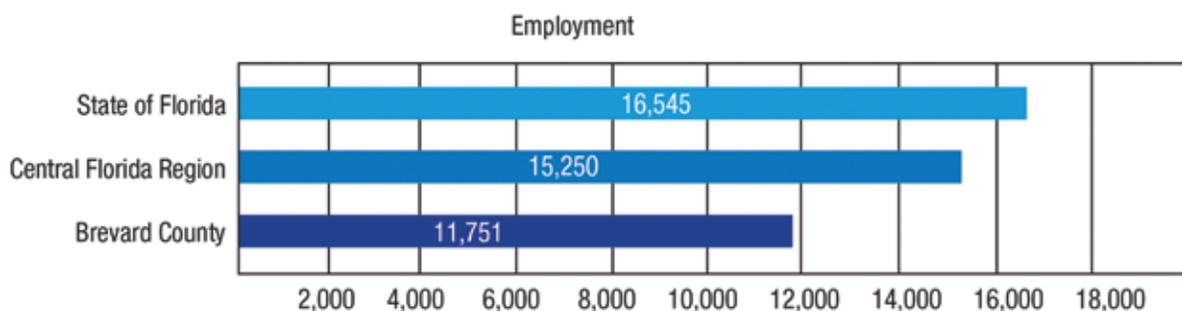
cleanup activities.

Kennedy's Center Management and Operations (CMO) budget provided \$377 million in FY 2012 to maintain the center's essential infrastructure and core technical capabilities. It also sustained the center's safety and engineering technical authorities. The budget allowed for the implementation of agency Chief Information Officer initiatives, provision of business systems support with improved internal controls, and enabling of NASA's future missions. ■

FY 2012 Total Economic Impact of All NASA Activities in Florida by Geographic Area



Area of Economic Impact	Millions of 2012 \$			
	Output	Income	Federal Taxes	State & Local Taxes
Brevard County	1,346	797	98	68
Central Florida Region	1,911	1,150	147	93
State of Florida	2,149	1,273	159	104



For every job at Kennedy, an additional job is created elsewhere within the state of Florida, each dollar of wages was multiplied into \$2.02 in total income and each dollar of total direct spending for commodity purchases and wage payments was multiplied into \$1.99 of output production.

WORKFORCE OVERVIEW

Kennedy Space Center is the most broadly based, complex and successful launch center in the world. Both NASA and contractor 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 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, 2012, the total Kennedy population was 8,319. This includes 2,009 NASA civil servants,

94 NASA students, 4,913 on-site and near-site contractor employees, 913 tenants and 390 construction employees on the center. There was an 11 percent decrease in the contractor workforce during fiscal year 2012. 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 9/30/12)	
Civil Servants	2,009
Co-ops and Students	94
Total Civil Servants	2,103
Civil Servant Skill Mix	
Scientific, Technology, Engineering and Mathematics	68%
Clerical and Professional Administrative	32%
On-site Contractor Employees	4,664
Off-/Near-site Contractor Employees	249
Total Contractor Employees	4,913
Total Construction Employees	390
Total Tenants	913
TOTAL KSC POPULATION	8,319

PROCUREMENT REPORT

The companies listed below were some of Kennedy Space Center's top support contractors or launch services contractors in terms of dollars obligated in Fiscal Year 2012. Following is a brief description of their work for the agency:

United Launch Services LLC

United Launch Services LLC (ULS), a subsidiary of United Launch Alliance, brought The Boeing Co., Delta Launch Services Inc. and Lockheed Martin Commercial Launch Services together. ULS provided launch services to NASA using the Delta II and Atlas V vehicles under two of three existing multiple-award, indefinite-delivery, indefinite-quantity task order contracts. The principal location for the Delta II vehicle assembly is Decatur, Ala. The Atlas vehicle is assembled in Denver, Colo. Both vehicles launch from Cape Canaveral Air Force Station (CCAFS) in Florida and Vandenberg Air Force Base (VAFB) in California.

URS Federal Technical Services Inc.

URS Federal Technical Services Inc. provided base operations support for Kennedy. URS was responsible for operations, maintenance and engineering for specific Kennedy facilities, systems, equipment and utilities, as well as calibration and

propellants handling at the center.

Space Exploration Technologies Corp.

Space Exploration Technologies Corp. (SpaceX) supported NASA's goal to foster activity leading to the development of orbital commercial crew transportation systems. Under its funded Commercial Crew Development 2 (CCDev2) Space Act Agreement, SpaceX is developing an integrated launch abort system design for the Dragon spacecraft and evaluating crew accommodations.

QinetiQ North America - Mission Solutions Group

QinetiQ North America - Mission Solutions Group (QNA) provided engineering products and services to Kennedy's Engineering and Technology Directorate and other center and agency operational customers. QNA provided laboratory and developmental shop maintenance and operations, technical services, spaceflight systems engineering and engineering development. QNA also conducted technology outreach to foster awareness and utilization of Kennedy's unique capabilities.

Boeing Space Operations

Boeing Space Operations was the prime contractor for the Checkout, Assembly and Payload Processing

Services (CAPPS) contract.

Boeing's primary purpose was to support all aspects of payload processing for the International Space Station, space shuttle and expendable launch vehicles (ELVs). As a partner in NASA's CCDev2 initiative, Boeing supports NASA's goal to foster activity leading to the development of orbital commercial crew transportation systems. Under its funded CCDev2 Space Act Agreement, Boeing is continuing development of the CST-100 crew capsule, including maturation of the design and integration of the capsule with a launch vehicle.

Sierra Nevada Corp.

As a partner in NASA's CCDev2 initiative, Sierra Nevada Corp. supports NASA's goal to foster activity leading to the development of orbital commercial crew transportation systems. Under its funded CCDev2 Space Act Agreement, the company is maturing the design and development of the Dream Chaser space system.

Abacus Technology Corp.

Abacus Technology Corp. 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, such as space shuttle, payloads, launch services and the International Space Station. Services provided include hardware and software integration development, computer administration and maintenance, voice and data transmission, library, graphics, publications, printing and reproduction, and IT security.

Chenega Security & Support Solutions LLC

Chenega Security & Support Solutions LLC (CS³), teamed with G4S as its subcontractor to provide protective services support for NASA at the center under the Kennedy Protective Service Contract. These comprehensive and cohesive services include physical security operations, Emergency Response Teams, personnel security, badging, 911 dispatch center, fire and rescue, fire prevention and fire protection engineering, aircraft rescue and firefighting, advance life support

ambulance services and emergency management. The company also manages NASA's Protective Services Training Academy and instruction for federal law enforcement training for all NASA centers.

AI Solutions Inc.

Under the Expendable Launch Vehicle Integrated Services 2 (ELVIS 2) contract, AI Solutions Inc. was responsible for performing and integrating the overall programmatic expendable launch vehicle (ELV) business and administrative functions, including program and project planning, risk management, evaluation and information technology. Services provided include the management, operation, maintenance and sustaining engineering of NASA's ELV communications and telemetry stations located at CCAFS and VAFB. AI Solutions Inc. also provided engineering services and studies, and technical services

for various ground and flight ELV systems, missions and payloads.

RTD Construction Inc.

RTD Construction Inc. provided construction services for the revitalization of Kennedy's water distribution and wastewater collection system. RTD services included the replacement of more than 125,000 linear feet of existing asbestos cement potable water mains with ductile iron pipe, and the replacement of more than 25,000 linear feet of sewer force main via open cut and pipe bursting. The company also made manhole lining repairs, installed associated electrical and communications equipment and wiring, as well as a radio frequency communications system for lift stations.



Local business representatives attend NASA's Historically Underutilized Business Zone (HUBZone) Industry Day and Expo, Oct. 16, 2012, at Cruise Terminal 4 at Port Canaveral in Florida. The annual trade show was sponsored by Kennedy Space Center's Prime Contractor Board, the U.S. Air Force 45th Space Wing and the Canaveral Port Authority. It featured about 175 large and small businesses and government exhibitors from Brevard County and across the nation.

Your Procurement Dollars at Work Geographical Distribution by State (Fiscal Year 2012 Obligations)

STATE	TOTAL DOLLARS	STATE	TOTAL DOLLARS
ALABAMA	2,705,422	MISSOURI	31,455
ARIZONA	101,510	MONTANA	14,943
ARKANSAS	36,441	NEVADA	1,216,162
CALIFORNIA	152,898,420	NEW HAMPSHIRE	219,125
COLORADO	412,793,464	NEW JERSEY	3,204,723
CONNECTICUT	4,290,049	NEW MEXICO	746,762
DELAWARE	88,170	NEW YORK	639,471
DISTRICT OF COLUMBIA	319,646	NORTH CAROLINA	3,588,340
FLORIDA	194,078,927	OHIO	2,829,370
GEORGIA	632,731	OKLAHOMA	7,433
HAWAII	13,350	OREGON	241,513
ILLINOIS	289,267	PENNSYLVANIA	10,299,789
INDIANA	276,048	RHODE ISLAND	23,560
IOWA	95,682	SOUTH CAROLINA	304,382
KANSAS	845,489	TENNESSEE	3,154,053
KENTUCKY	500,333	TEXAS	144,624,677
LOUISIANA	11,183,845	UTAH	120,197
MARYLAND	301,327,987	VERMONT	5,231
MASSACHUSETTS	950,375	VIRGINIA	231,331,105
MICHIGAN	1,267,704	WASHINGTON	121,007
MINNESOTA	245,990	WISCONSIN	971,727
		TOTAL	\$1,488,638,875

Top 25 KSC Business Contractors for FY 2012

Contractor	Dollars
UNITED LAUNCH SERVICES, LLC	314,903,100
BOEING SPACE OPERATIONS COMPANY	182,830,277
URS FEDERAL TECHNICAL SERVICES, INC.	179,555,600
SPACE EXPLORATION TECHNOLOGIES CORP.	144,351,849
QINETIQ NORTH AMERICA, INC.	140,846,994
SIERRA NEVADA CORPORATION	96,100,100
ABACUS TECHNOLOGY CORPORATION	90,538,007
CHENEGA SECURITY & SUPPORT SOLUTIONS, LLC	30,964,834
AI SOLUTIONS, INC.	25,602,289
RTD CONSTRUCTION, INC.	22,313,170
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION	17,852,263
SPEEGLE CONSTRUCTION II, INC.	14,129,127
REYNOLDS SMITH AND HILLS INCORPORATED	14,016,809
JONES EDMUNDS & ASSOCIATES INC	10,679,104
AIR LIQUIDE LARGE INDUSTRIES U.S. LP	10,040,696
REDE-CRITIQUE	9,670,710
INOMEDIC HEALTH APPLICATIONS, INC.	9,523,856
CANAVERAL CONSTRUCTION CO., INC.	8,770,995
INNOVATIVE HEALTH APPLICATIONS, LLC	8,589,009
SPACE GATEWAY SUPPORT	8,275,188
SPACE GATEWAY SUPPORT, LLC	7,729,489
MILLENNIUM ENGINEERING AND INTEGRATION CO	7,434,981
BREVARD ACHIEVEMENT CENTER, INC.	7,128,034
TETRA TECH NUS, INC.	5,538,561
ANALEX CORPORATION	5,359,440
TOTAL	\$1,372,744,482



National Aeronautics and Space Administration
John F. Kennedy Space Center
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