National Aeronautics and Space Administration

Kennedy Space Center's Annual Report FY2009

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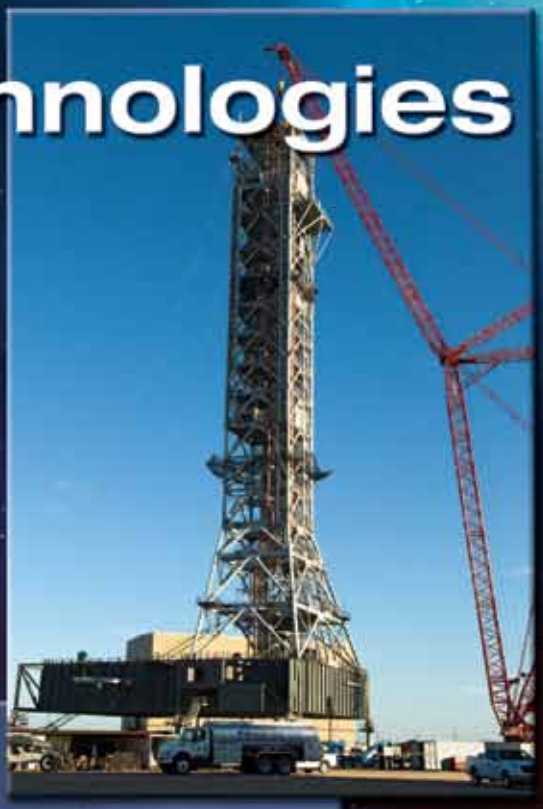
On the cover, from left: Smoke billows around the United Launch Alliance Delta II rocket as it lifts off into space at 8:20 a.m. EDT, on Sept. 25, 2009, carrying the Space Tracking and Surveillance System-Demonstrator spacecraft for the U.S. Missile Defense Agency; on Launch Pad 39A, space shuttle Discovery's payload bay doors begin closing around the Multi-Purpose Logistics Module Leonardo for the STS-128 mission to the International Space Station; shuttle Endeavour is revealed on pad A after the rollback of the rotating service structure for the STS-127 mission to the space station; the Ares I-X rocket stands tall inside the Vehicle Assembly Building as it is prepared for NASA's first flight test for the Constellation Program.

KSC Enabling Technologies



Leading for the Future

Center Director's Message

Robert D. Cabana

This was an extremely rewarding and challenging year for the Kennedy Space Center as we safely executed our assigned missions and prepared to transition to a new era of space exploration.

During this past year, an extremely talented and dedicated workforce launched five Shuttle missions, including the on-orbit repair of the Hubble Space Telescope, and the International Space Station saw the completion of the Japan Aerospace Exploration Agency's Kibo module, paving the way for the orbiting laboratory to become a full-fledged National Laboratory.

The Launch Services Program processed seven expendable launch vehicles and nine spacecraft for launch while managing 25 future missions. Perhaps the most exciting of these was NASA's first return to the moon in more than 10 years with the Lunar Reconnaissance Orbiter and Lunar Crater Observation and Sensing Satellite.

The Constellation Program continued to excel in meeting milestones in preparing the ground operations infrastructure at KSC to meet the needs of future exploration programs. Kennedy also supported the Agency with the integration and test of the Ares I-X test flight vehicle, which successfully launched October 28, 2009. More than 700 sensors on board the rocket relayed ascent data that will help develop a new generation of launch vehicles.

Kennedy employees also excelled in applied technology, strived for environmental leadership, and strengthened partnerships while providing outreach and educating the community. The Center saw the construction and implementation of a one-megawatt solar power generation facility for its electricity needs, and a larger, ten-megawatt facility on the Center will provide electricity to Florida residents.

These are just a few of the activities that Kennedy was involved in during the past year. NASA's core values of safety, integrity, teamwork, and excellence are evident throughout the accomplishments at Kennedy. We have a tremendous workforce, and the employees are the real resource of the Center. I invite you to take the time to read more about the team's achievements of 2009.

Significant Events

1. NASA celebrates 50th anniversary
Oct. 1, 2008
Kennedy Space Center celebrated the first 50 years of NASA in 2008. In November, employees and the public enjoyed a fall concert series at the KSC Visitor Complex, as well as the second annual Space and Air Show, featuring an exhibition by the U.S. Navy's Blue Angels.

2. IBEX spacecraft launches
Oct. 19, 2008
NASA's Interstellar Boundary Explorer, or IBEX, spacecraft launched aboard a Pegasus XL expendable launch vehicle from the Kwajalein Atoll in the Pacific Ocean at 1:47 p.m. EDT.

3. New director at Kennedy
Oct. 26, 2008
Former astronaut Robert D. Cabana became Kennedy Space Center's 10th center director, succeeding William W. Parsons. Cabana came to Kennedy from NASA's Stennis Space Center in Mississippi, where he was director.

4. Ares I-X flight hardware arrives
Nov. 3, 2008
The first major flight hardware of the Ares I-X rocket traveled to Kennedy aboard the Delta Mariner barge from NASA's Glenn Research Center in Ohio.

5. Endeavour launches on STS-126 mission
Nov. 14, 2008
Space shuttle Endeavour and its seven-member crew lifted off from Launch Pad 39A at 7:55 p.m. EST on the STS-126 mission to repair and help prepare the International Space Station for a permanent six-person crew.

6. Endeavour lands in California
Nov. 30, 2008
Space shuttle Endeavour and its crew landed at 4:25 p.m. EST at Edwards Air Force Base in California, completing the 15-day journey of more than 6.6 million miles on the STS-126 mission.

7. Ares I-X CM/LAS arrives
Jan. 28, 2009
The simulated crew module and launch abort system that formed the tip of the Ares I-X rocket traveled to Kennedy aboard a C-5 aircraft.

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8. NOAA-N launches from Vandenberg
Feb. 6, 2009
The National Oceanic and Atmospheric Administration's NOAA-N Prime spacecraft launched from NASA's Space Launch Complex-2 at Vandenberg Air Force Base in California aboard a Delta II rocket at 5:22 a.m. EST.

9. Launch Pad 39B lightning towers rise
Feb. 13, 2009
Workers built three, 600-foot-tall lightning towers around Kennedy's Launch Pad 39B. Each tower has a 100-foot-tall fiberglass mast atop to support a catenary wire system for improved lightning protection.

10. OCO satellite launches
Feb. 24, 2009
NASA's Orbiting Carbon Observatory, or OCO, satellite failed to reach orbit after its 4:55 a.m. EST liftoff aboard a Taurus XL launch vehicle from Launch Pad 576-E at Vandenberg Air Force Base in California.

11. Kepler launches aboard Delta II
March 6, 2009
NASA's Kepler mission launched aboard a Delta II rocket from Launch Pad 17-B at Cape Canaveral Air Force Station in Florida at 10:49 p.m. EST.

12. Discovery launches on STS-119 mission
March 15, 2009
Space shuttle Discovery and its seven-member crew lifted off from Launch Pad 39A at 7:43 p.m. EDT on the STS-119 mission to deliver the final set of power-generating solar array wings and a new crew member to the International Space Station.

13. Mobile launcher platform handover
March 25, 2009
Kennedy hosted a ceremony to mark the official handover of Mobile Launcher Platform-1 from NASA's Space Shuttle Program to the Constellation Program. The two-story, steel structure was modified for the Ares I-X flight test.

14. Discovery glides home
March 28, 2009
Space shuttle Discovery and its crew for the STS-119 mission landed at 3:14 p.m. EDT at Kennedy's Shuttle Landing Facility, completing a 13-day journey of more than 5.3 million miles.

15. Orion recovery procedures tested
April 8, 2009
A full-scale mock-up of NASA's Orion crew module was tested for landing in the Atlantic Ocean under real and simulated weather conditions off the coast of Kennedy Space Center.

16. Two shuttles on launch pads
April 17, 2009
Two space shuttles, Endeavour and Atlantis, stood poised on both Launch Complex 39 launch pads, for what was expected to be the last time for the agency's Space Shuttle Program.

Significant Events

17. Delta II rocket launches from Vandenberg
May 5, 2009

A Delta II rocket, managed by NASA's Launch Services Program at Kennedy, lifted off from Space Launch Complex-2 at Vandenberg Air Force Base in California at 4:24 p.m. EDT. The rocket carried the Space Tracking and Surveillance System-Advanced Technology Risk Reduction spacecraft, or STSS-ATRR, for the U.S. Missile Defense Agency.

18. Atlantis launches to Hubble on STS-125 mission
May 11, 2009

Space shuttle Atlantis and its seven-member crew lifted off from Launch Pad 39A at 2:01 p.m. EDT on the fifth and final shuttle mission to service NASA's Hubble Space Telescope.

19. Atlantis lands at Edwards
May 24, 2009

Space shuttle Atlantis and its crew landed at 11:39 a.m. EDT at Edwards Air Force Base in California, completing the final Hubble Space Telescope servicing mission of nearly 5.3 million miles.

20. Tranquility node arrives at SSPF
May 26, 2009

The Tranquility node arrived at Kennedy Space Center's Shuttle Landing Facility on May 21, and was transferred to the center's Space Station Processing Facility on May 26. Tranquility is a pressurized module that will provide room for many of the station's life support systems.

21. Solar facility groundbreaking event
May 27, 2009

NASA and Florida Power and Light, or FPL, held a groundbreaking ceremony for new solar power facilities at Kennedy. FPL will build and maintain two solar photovoltaic power generation systems on Kennedy property, one for Kennedy's use and the other for Florida residents.

22. Launch pad transfers to Constellation
May 31, 2009

Kennedy's Launch Pad 39B was officially transferred from the Space Shuttle Program to the Constellation Program for the Ares I-X flight test.

23. First lunar launch in 10 years
June 18, 2009

NASA's Lunar Reconnaissance Orbiter and Lunar Crater Observation and Sensing Satellite, or LRO/LCROSS, launched at 5:32 p.m. EDT aboard an Atlas V rocket from Launch Complex-41 at Cape Canaveral Air Force Station in Florida.

24. GOES-O launches
June 27, 2009
The latest Geostationary Operational Environmental Satellite, GOES-O, soared into space on a Delta IV rocket at 6:51 p.m. EDT from Space Launch Complex-37 at Cape Canaveral Air Force Station.

25. Endeavour launches to space station
July 15, 2009
Space shuttle Endeavour and its seven-member crew for the STS-127 mission launched at 6:03 p.m. EDT from Kennedy's Launch Pad 39A.

26. Apollo 11 40th anniversary celebration
July 16, 2009
Kennedy Space Center celebrated the 40th anniversary of the Apollo 11 launch to and first steps on the moon with a ceremony at the KSC Visitor Complex.

27. Endeavour glides home
July 31, 2009
Space shuttle Endeavour and its crew ended a 16-day journey of more than 6.5 million miles with a 10:48 a.m. EDT landing at Kennedy's Shuttle Landing Facility.

28. Ares I-X stacked in Vehicle Assembly Building
Aug. 13, 2009
For the first time in more than a quarter-century, a new space vehicle, the Ares I-X rocket, stood ready in Kennedy's Vehicle Assembly Building. The rocket, with its simulated crew module and launch abort system, was assembled atop a mobile launcher platform.

29. Discovery launches to space station
Aug. 28, 2009
Space shuttle Discovery and its seven-member crew launched at 11:59 p.m. EDT from Kennedy's Launch Pad 39A on the STS-128 mission to deliver supplies, equipment and a new crew member to the International Space Station.

30. Discovery lands in California
Sept. 11, 2009
Discovery lands at Edwards Air Force Base in California at 8:53 p.m. EDT due to unpredictable weather conditions at Kennedy's Shuttle Landing Facility, bringing to an end the 13-day, 5.7-million-mile mission.

31. Young-Crippen Firing Room transfer
Sept. 25, 2009
A ribbon cutting officially turned over the Launch Control Center's Young-Crippen Firing Room from the Space Shuttle Program to the Constellation Program. The newly refurbished and outfitted control room was used for NASA's Ares I-X flight test in October 2009.

32. STSS-Demo Launch
Sept. 25, 2009
The Space Tracking and Surveillance System – Demonstrator, or STSS-Demo, spacecraft launched on a Delta II rocket from Cape Canaveral Air Force Station in Florida, at 8:20 a.m. EDT, for the U.S. Missile Defense Agency.

Launch Vehicle Processing

NASA's human spaceflight program is built around safely launching, flying and landing its space shuttle fleet. The efforts of Kennedy Space Center's launch vehicle processing team to prepare and integrate the agency's three orbiters -- Atlantis, Discovery and Endeavour -- with external fuel tanks and solid rocket boosters are critical in accomplishing this national mission.

During this fiscal year, the team processed five shuttles, leading to the delivery of crucial elements and supplies to the International Space Station, and the completion of on-orbit repairs to NASA's Hubble Space Telescope. Twenty-one astronauts orbited Earth more than 1,100 times, totaling about 30 million miles. Poor weather conditions at Kennedy required space shuttles to land at Edwards Air Force Base in California three times.

In addition to processing and launching shuttles, the team spent the year modifying Launch Pad 39B and preparing the Ares I-X rocket for its flight test. The fiscal year also saw the completion of several significant shuttle transition and retirement milestones.

Mission STS-126/Endeavour

Space Shuttle Endeavour originally rolled to Launch Pad 39B on Sept. 11, 2008, as the launch on need flight for the STS-125 mission. Endeavour then rolled around to Launch Pad 39A on Oct. 23, 2008, when the launch of STS-125 was delayed due to an on-orbit failure with NASA's Hubble Space Telescope, which resulted in a roll back of shuttle Atlantis to the Vehicle Assembly Building.

Endeavour's STS-126 mission launched Nov. 14, 2008, at 7:55 p.m. EST. During their 15 days in orbit, crew members delivered equipment and supplies to the International Space Station and serviced the solar alpha rotary joints.

Due to poor weather at Kennedy, Endeavour concluded the 124th shuttle mission by landing at Edwards Air Force Base in California on Nov. 30, 2008, at 4:25 p.m. EST.

Mission STS-119/Discovery

Space shuttle Discovery's original launch date was postponed to allow engineers to replace suspect flow control valves after a failure of one of Endeavour's during STS-126. Then, Discovery's first launch attempt on March 11, 2009, was scrubbed due to a leak in its external fuel tank liquid hydrogen vent line.

Following testing of the vent line and a "go" to launch, Discovery lifted off from Launch Pad 39A on March 15, 2009, at 7:43 p.m. EDT, carrying a crew of seven astronauts and one small bat. The bat was seen clinging to the shuttle's external tank as it cleared the

Space shuttle Endeavour nears the end of its 3.4-mile trek from Launch Pad 39B to 39A on May 31, 2009, at Kennedy Space Center in Florida. Endeavour was on standby on pad B in the unlikely event that a rescue mission was necessary during space shuttle Atlantis' STS-125 mission to NASA's Hubble Space Telescope.

launch tower on the 125th shuttle mission.

The crew successfully delivered and assembled the fourth starboard integrated truss segment, S6, along with the fourth set of solar arrays and batteries, to the International Space Station during the almost 13-day mission. Discovery landed at Kennedy's Shuttle Landing Facility on March 28, 2009, at 3:14 p.m. EDT.

NASA's modified 747 Shuttle Carrier Aircraft with space shuttle Discovery securely mounted on top soars into the sky after takeoff from Edwards Air Force Base on Sept. 20, 2009. Discovery landed at Edwards on Sept. 11 after the STS-128 mission to the International Space Station.

Mission STS-125/Atlantis

Originally scheduled to launch Oct. 14, 2008, space shuttle Atlantis' STS-125 mission was delayed due to a failed Science Instrument Command and Data Handling Unit on NASA's Hubble Space Telescope. Atlantis rolled back to the Vehicle Assembly Building on Oct. 20, 2008, was destacked and rolled back to an orbiter processing facility, where a replacement unit was added to the payload.

Following its mate to a new external tank and solid rocket booster stack, Atlantis again rolled out to Launch Pad 39A on March 31, 2009. Atlantis launched on the fifth and final shuttle servicing mission to Hubble on May 11, 2009, at 2:01 p.m. EDT. STS-125 was the first in more than six years and the final shuttle launch not targeted for the International Space Station.

The crew outfitted Hubble with two new instruments, the Cosmic Origins Spectrograph and Wide Field Camera 3. During their five spacewalks, the crew also replaced a Fine Guidance Sensor, six new gyroscopes and two battery unit modules. New thermal blanket insulating panels to provide improved thermal protection and a soft-capture mechanism to aid in the eventual safe deorbiting of the telescope also were added.

An IMAX camera was used by the crew to document the mission for a future IMAX movie. The mission was declared a complete success. The upgrades to Hubble will allow it to make even greater discoveries and should allow it to operate through at least 2014. Atlantis completed the 126th space shuttle mission with a landing at Edwards Air Force Base on May 24, 2009, at 11:39 a.m. EDT.

A United Space Alliance technician removes and replaces a hub tile on space shuttle Discovery before its STS-119 mission to deliver the S6 truss segment to the International Space Station.

Mission STS-127/Endeavour

Space shuttle Endeavour originally rolled out to Launch Pad 39B to serve as the launch on need vehicle for Atlantis' STS-125 mission. It was the 19th time that NASA had two shuttles on Launch Pad 39A and B at the same time.

Following the successful launch of STS-125, Endeavour moved from Launch Pad 39B to A on May 31, 2009, for the launch of STS-127 and the 127th shuttle mission. Two launch attempts in June 2009 were delayed due to gaseous hydrogen leaks from the shuttle's external tank Ground Umbilical Carrier Plate, or GUCP, similar to those seen on STS-119. Engineers corrected an alignment issue with the GUCP and performed a successful tanking test.

Three more launch attempts in July were scrubbed due to weather. Endeavour finally launched on July 15, 2009, at 6:03 p.m. EDT after a record-tying sixth cryogenic propellant loading. During launch, pieces of foam were observed falling off of the shuttle's external tank, but on-orbit inspections revealed only minor damage to the thermal protection system.

Once docked to the International Space Station, the crew delivered and installed the Japanese Experiment Module Exposed Facility and the Experiment Logistics Module Exposed Section. The mission tied a record for the most humans in space at any one time -- 13.

Kennedy Space Center Director Robert D. Cabana, left, and NASA Administrator Charles Bolden walk to welcome home the crew of the space shuttle Endeavour shortly after landing, July 31, 2009, at the Shuttle Landing Facility, completing a 16-day journey of more than 6.5 million miles.

The 29th shuttle mission to the station concluded its 16-day flight by landing safely at Kennedy's Shuttle Landing Facility on July 31, 2009, at 10:48 a.m. EDT.

Mission STS-128/Discovery

Kennedy's launch vehicle team had to overcome several challenges prior to the launch of Discovery's STS-128 mission. Because of the foam liberation seen during the STS-127 launch, extensive pull tests were performed in the Vehicle Assembly Building on the space shuttle's external tank foam insulation.

Heavy rainfall the night before rollout forced the crawler-transporter to pause several times during the four-mile trek to the pad for mud to be removed from its treads and bearings. Once at the pad, modifications to a broken vital check valve filter assembly were made to the left solid rocket booster.

The first launch attempt was scrubbed due to weather concerns. A second attempt was scrubbed due to an issue with a liquid hydrogen fill-and-drain valve inside Discovery's aft compartment.

Finally, Discovery lifted off from Launch Pad 39A on the 128th shuttle mission, Aug. 28, 2009, at 11:59 p.m. EDT. In addition to delivering the Multi-Purpose Logistics Module Leonardo to the International Space Station, the crew performed three spacewalks during the mission. They removed and replaced a materials processing experiment outside the European Space Agency's Columbus module and retrieved an empty ammonia tank assembly.

Discovery's 14-day mission, the 30th to the station, came to an end Sept. 11, 2009, at 8:53 p.m. EDT with a landing at California's Edwards Air Force Base, due to weather constraints at Kennedy.

Ares I-X Flight Test

The launch of the Ares I-X flight test became a reality for Kennedy's processing team. This fiscal year saw the completion of stacking operations on NASA's first new vehicle in more than a quarter-century in the Vehicle Assembly Building. A dedicated team drawn from across the agency performed in-depth integrated vehicle verification and validation testing in preparation for a scheduled October 2009 rollout from the Vehicle Assembly Building to Launch Pad 39B.

Ares I-X Pad Modifications

Major modifications were made to Launch Pad 39B in anticipation of the arrival of Ares I-X. The space shuttle's orbiter access arm, gaseous oxygen vent arm and lightning mast, as well as the Apollo-era crane assembly, were removed from the fixed service structure.

A new lightning protection system was constructed in preparation for the much taller Ares I-X rocket. More than 200 concrete pilings extending up to 55 feet below the ground were laid to support three new lightning towers. Each steel tower reaches 500 feet tall with a 100-foot fiberglass mast atop. At 600 feet tall, they dwarf the fixed service structure and are taller than the Vehicle Assembly Building. The towers were partially assembled on the ground and then lifted into position by a massive 650-foot-tall crane, then assembled using several smaller cranes. A large cable, called a catenary wire, was strung between two of the three towers, offering lightning protection to the Ares I-X rocket. Additional cables will be added for future Ares launches.

Other pad modifications included a vehicle stabilization system on the fixed service structure to keep the vehicle from swaying while on the launch pad, and a platform on the rotating service structure to allow access to the fifth segment simulator, which housed the first stage avionics module.

Space Shuttle Transition and Retirement

As the Space Shuttle Program draws to a close, the transition and retirement team efforts have picked up significantly. Several key milestones were met this fiscal year. Agency-level funding was approved for all transition and retirement activities. Development of the Shuttle Processing Transition Management Plan was completed and transition property assessments were completed on about 23,000 personal property line items belonging to the center's Ground Operations Project Office. This fiscal year also saw the transfer of Mobile Launcher Platform-1 and Launch Pad 39B to NASA's Constellation Program to support the launch of Ares I-X.

In September 2009, NASA issued a request for proposal and invited eligible educational institutions, museums and other organizations to begin registering to screen potential space shuttle artifacts. To ensure broad access to the artifacts, NASA partnered with the U.S. General Services Administration to provide a first-of-its-kind, Web-based electronic artifacts prescreening capability. ■

Under a full moon on Launch Pad 39A at Kennedy Space Center in Florida, space shuttle Discovery is revealed after the rotating service structure rolled back. The rollback was in preparation for Discovery's liftoff on the STS-119 mission to the International Space Station.

International Space Station and Spacecraft Processing

During the year, Kennedy Space Center's International Space Station and Spacecraft Processing team managed the processing of several important components for transport aboard space shuttle missions to the space station. Even as construction of the station wraps up, work will continue to process science and research experiments for delivery to the orbiting laboratory.

Prior to the STS-125 mission, an on-orbit anomaly with the Hubble Space Telescope's Science Instrument Command and Data Handling Unit required the processing team to remove the mission's current payload from space shuttle Atlantis. The Hubble Space Telescope Servicing Mission 4 processing team completed re-integration of the payload, along with a new unit before the mission successfully launched in May 2009.

For the STS-127 mission, the processing team completed the integration and testing of Japan Aerospace Exploration Agency's, or JAXA's, Exposed Facility, Exposed Section, and NASA's Integrated Cargo Carrier-Vertical Light Deployable. All three elements were delivered and successfully attached to the space station, signaling the completion of JAXA's Kibo laboratory. The mission also carried some much needed spare parts for the station's exterior.

For the STS-128 mission, technicians installed about 30 cargo stowage bags into the Multi-Purpose Logistics Module, or MPLM, Leonardo. The module carried about 7 tons of equipment and supplies, including new sleeping quarters, galley facilities, the COLBERT treadmill and a water recycling system, which helped support the station's six-crew capability.

For the STS-129 mission, prelaunch preparations of the first two Express Logistics Carriers were completed. An assortment of very large orbital replacement units and one research payload were mounted on the carriers for delivery to the space station. During the mission, both carriers were deployed to parking locations on the station's integrated truss assembly.

The European-built Node 3 module, also called Tranquility, arrived at Kennedy on May 20, 2009, and was transferred to the Space Station Processing Facility to prepare it for the STS-130 mission to the space station.

The Tranquility node connecting module was contracted to the European Space Agency and built by prime contractor Thales Alenia Space Agency in Turin, Italy. Kennedy's processing team worked with the Italian Space Agency to process, test and checkout Tranquility and the cupola.

The cupola will allow a nearly 360-degree view of the station and Earth to monitor robotics and observe our home planet.

Technicians also continued integration activities on the MPLM Leonardo for the STS-131 mission currently targeted to launch in March 2010. They also prepared provisions, supplies, science experiments and an ammonia tank that will support cooling activities on the station.

Planning is under way to prepare the payloads slated to fly on the last scheduled space shuttle mission, STS-133. This flight will carry the fourth Express Logistics Carrier, which will be mounted to a very large, spare heat rejection radiator. The mission also is scheduled to carry the modified MPLM Leonardo outfitted with at least 12 cargo-carrying racks. Both elements will remain on the station at the conclusion of this final assembly mission.

The processing team completed a facility assessment of the JAXA launch complex located on Tanegashima. The assessment finalized processing and logistical plans for the shipment of two space station integrated orbital replacement units -- a cargo transportation container and a flex hose rotary coupler. Shipping of the integrated assemblies to Japan currently is planned for August 2010 for subsequent integration and launch aboard JAXA's H-II Transfer Vehicle on Jan. 15, 2011.

In the Payload Hazardous Servicing Facility at Kennedy Space Center in Florida, technicians check the Multi-Use Lightweight Equipment Carrier where the Science Instrument Command and Data Handling Unit was housed for the fifth and final shuttle servicing mission to NASA's Hubble Space Telescope.

Operations and Checkout Building Reactivation for Orion Production

Baseline construction to remodel the Operations and Checkout Building, or O&C, into a world-class Orion spacecraft production factory was completed in January 2009.

Beginning in January, verification, validation and acceptance testing of the modifications were performed and the team generated and reviewed the technical verification documentation, called Acceptance Data Packages, to support the acceptance and turnover requirements for facility systems. The project was completed at the end of September 2009 and the facility infrastructure systems were turned over to Kennedy on Oct. 1, 2009, for operations, maintenance and engineering. Lockheed Martin will have total operational capability, flexibility and independence within the O&C high bay for Orion production activities.

In the Space Station Processing Facility at Kennedy Space Center in Florida, workers secure the overhead crane to the Tranquility module in its shipping container. NASA chose the name "Tranquility" to honor the accomplishments of the Apollo 11 mission to the moon. The module was delivered to the International Space Station on Endeavour's STS-130 mission.

Space Station Utilization

The utilization team performed launch site preflight testing and integration of several science and research experiments for delivery to the space station and assisted with successful on-orbit operations of these experiments. The team also processed an array of returning research payloads. These efforts advanced the strategic accomplishments of NASA's Space Operations Mission and Exploration Systems Mission directorates in key scientific research fields, including biological, human physiology, physical and materials research, and Earth and space science.

The team worked to develop ways to preserve NASA's hands-on engineering skills for future programs. That included collaborations with government and commercial research entities to use the space station as a National Laboratory.

Following is a synopsis of some of the major science and research payloads processed during the fiscal year.

The European Space Agency's Muscle Atrophy Research Exercise System, or MARES, will gather research on musculoskeletal, biomechanical and neuromuscular human physiology to better understand the effects of microgravity on the muscles. MARES is capable of assessing the strength of isolated muscle groups around joints by controlling and measuring relationships between position/velocity and torque/force as a function of time.

NASA's Mice Drawer System, or MDS, is hardware provided by the Italian Space Agency that will use a validated mouse model to investigate the genetic mechanisms underlying bone mass loss in microgravity. MDS is a multifunctional and multiuser system that allows experiments in various areas of biomedicine, from research on organ function to the study of the embryonic development of small mammals under microgravity conditions. Research conducted with the MDS is an analogue to the human research program, which has the objective to extend the human presence safely beyond low Earth orbit.

The Minus Eighty-degree Laboratory Freezer, or MELFI, is a refrigerator/freezer for biological and life science samples collected on the space station. The European Space Agency-built and NASA-operated freezers store samples at temperatures of 4 degrees C to as low as minus 80 degrees C.

NASA's Materials International Space Station Experiment, or MISSE, is a series of external, exchangeable test beds located on the European Space Agency's Columbus module for studying the durability of materials, such as optics, sensors, electronics, communications devices, coatings and structural materials. To date, six different MISSE experiments have been attached to the outside of the station and evaluated for the effects of atomic oxygen, vacuum, solar radiation, micrometeorites, direct sunlight and extreme temperatures. This experiment allows the development and testing of new materials to better withstand the rigors of space environments. Many of the materials may have applications in the design of future spacecraft.

The Device for the study of Critical Liquids and Crystallization, or DECLIC, is a multiuser facility developed by the French Space Agency, and was flown in collaboration with NASA. It was designed to conduct experiments in the fields of fluid physics and materials science.

Kennedy's utilization team successfully developed, verified, tested, flight certified, launched and directed on-orbit operations and associated ground controls for the Advanced Biological Research System, or ABRS. It is a single-locker system with two growth chambers. Each growth chamber is a closed system capable of independently controlling temperature, illumination and atmospheric composition to grow a variety of biological organisms, including plants, microorganisms, and small insects and spiders.

The initial plant experiments hosted in the ABRS were the first willow tree seedlings in space. They were used for a Canadian study of cambium formation. An American study used green fluorescent proteins as environmental stress indicators. ■

Launch Services Program

NASA's Launch Services Program, or LSP, at Kennedy Space Center had a demanding year managing seven launches of nine spacecraft from three different sites, using a variety of expendable launch vehicles. Of these missions, five were launched in about a four-month period.

For the first time, LSP launched missions for the U.S. Missile Defense Agency and performed its first advisory role for the Geostationary Operational Environmental Satellite, called GOES-O on a Delta IV. The program also was involved in planning for up to 25 future NASA missions, including the Mars Atmosphere and Volatile Evolution, or MAVEN, mission, as well as an advisory role to the James Webb Space Telescope, aboard an Ariane launch vehicle. LSP continued to foster relationships with emerging commercial launch service providers.

The Interstellar Boundary Explorer, or IBEX, spacecraft launched from a Pegasus XL rocket, carried by the Orbital Sciences L-1011 carrier aircraft, from the Kwajalein Atoll in the Pacific Ocean, at 1:47 p.m. EDT on Oct. 19, 2008.

The mission presented some logistical challenges in order to manage and launch the rocket. LSP established a presence with 90 government and contractor support personnel, equipment and supplies on the remote island. Early on in launch vehicle processing, a vehicle loads problem was detected and LSP supported the development of a load isolation system with NASA's Goddard Space Flight Center in Maryland and the Orbital Spacecraft Systems Group.

IBEX now is orbiting Earth in a highly elliptical orbit every five to eight days collecting energetic neutral atom particles generated in the region between our solar system and the interstellar gas found between stars in the Milky Way galaxy. As the particles are collected, the sensors and spacecraft will keep track of their energy and direction, allowing IBEX to map out this interaction region, even though it is billions of miles away.

On Launch Pad 17-B at Cape Canaveral Air Force Station in Florida, the first half of the fairing moves into place around NASA's Kepler spacecraft, atop the United Launch Alliance Delta II rocket. Kepler is designed to survey more than 100,000 stars in our galaxy to determine the number of sun-like stars that have Earth-size and larger planets.

LSP managed the countdown and launch of the National Oceanic and Atmospheric Administration's NOAA-N Prime satellite, which lifted off aboard a United Launch Alliance Delta II rocket from Space Launch Complex-2 at Vandenberg Air Force Base in California at 5:22 a.m. EST on Feb. 6, 2009.

The NOAA-N Prime mission was the last in the series of Television Infrared Observation Satellites, or TIROS, which dates back to the first TIROS launch in 1960. The satellite will become part of a polar-orbiting observation system consisting of morning and afternoon satellites. The pair of satellites ensures that every part of Earth is observed twice every 12 hours, providing measurements for global atmospheric and surface forecast models.

NASA's Orbiting Carbon Observatory, or OCO, spacecraft was prepared for its launch aboard an Orbital Sciences Taurus XL launch vehicle from Vandenberg. This was NASA's first use of a Taurus XL for a mission. Unfortunately, after launching at 4:55 a.m. EST on Feb. 24, 2009, the vehicle failed to reach orbit.

The LSP team analyzed the launch data and completed work in less than two weeks in order to clear the Delta II rocket for the Kepler launch in early March.

The program also supported the OCO Mishap Investigation Board and fostered technical exchange between the Taurus, Delta, Atlas and Minotaur launch vehicles user community.

The mishap investigation board concluded that the fairing did not separate, leading to the failure. The LSP team established a return-to-flight approach for the Taurus XL and is actively working to enable the Glory launch on the vehicle in the fall of 2010.

NASA's Kepler mission launched aboard a Delta II rocket from Launch Pad 17-B at Cape Canaveral Air Force Station in Florida at 10:49 p.m. EST on March 6, 2009, only 10 days after the OCO launch.

Kepler's fundamental goal is to determine the frequency of terrestrial and larger planets in or near the habitable zone of a variety of spectral stars, including those most like the sun. Its photometer, or brightness measurement, will continuously monitor hundreds of thousands of stars from periodic decreases in brightness caused by planets crossing their stars.

LSP provided mission integration, launch site processing and launch management to the U.S. Missile Defense Agency for its Space Tracking and Surveillance System-Advanced Technology Risk Reduction spacecraft, or STSS-ATRR. It launched successfully aboard a United Launch Alliance Delta II rocket from Space Launch Complex-2 at Vandenberg at 4:24 p.m. EDT on May 5, 2009.

On Launch Complex-41 at Cape Canaveral Air Force Station in Florida, workers check out the Lunar Reconnaissance Orbiter, or LRO, after its lift into the mobile service tower.

NASA's Lunar Reconnaissance Orbiter, or LRO, and Lunar Crater Observation and Sensing Satellite, or LCROSS, spacecraft launched aboard an Atlas V from Launch Complex-41 at Cape Canaveral Air Force Station at 5:32 p.m. EDT on June 18, 2009.

LRO/LCROSS was NASA's first mission back to the moon in 10 years and supports the agency's Exploration Systems Mission Directorate.

Processing for the mission required complex integration of the requirements of two spacecraft with different objectives. Also, LSP completed an enormous amount of trajectory analyses, simulations and design work to ensure the single launch would meet the orbit requirements of both spacecraft.

LRO will use its seven instruments to create a comprehensive atlas of the moon's features and identify resources necessary to design and build a lunar outpost. The spacecraft will spend at least one year in a low-polar orbit, focusing on the selection of safe landing sites, the identification of lunar resources and the study of how lunar radiation will affect humans.

The LCROSS launch vehicle second stage impacted the moon, in a permanently shadowed crater near one of the poles, Oct. 9, 2009, creating a debris plume that rose above the lunar surface. LCROSS flew through the debris plume, collecting and relaying data back to Earth before colliding and creating a second debris plume. Evidence of water ice recently was discovered.

LSP also provided advisory assistance for the Geostationary Operational Environmental Satellite, called GOES-O. The satellite

Smoke pours across Launch Complex-41 at Cape Canaveral Air Force Station in Florida as the Atlas V, carrying NASA's Lunar Reconnaissance Orbiter, or LRO, and Lunar Crater Observation and Sensing Satellite, or LCROSS, roars into the sky at 5:32 p.m. EDT on June 18, 2009.

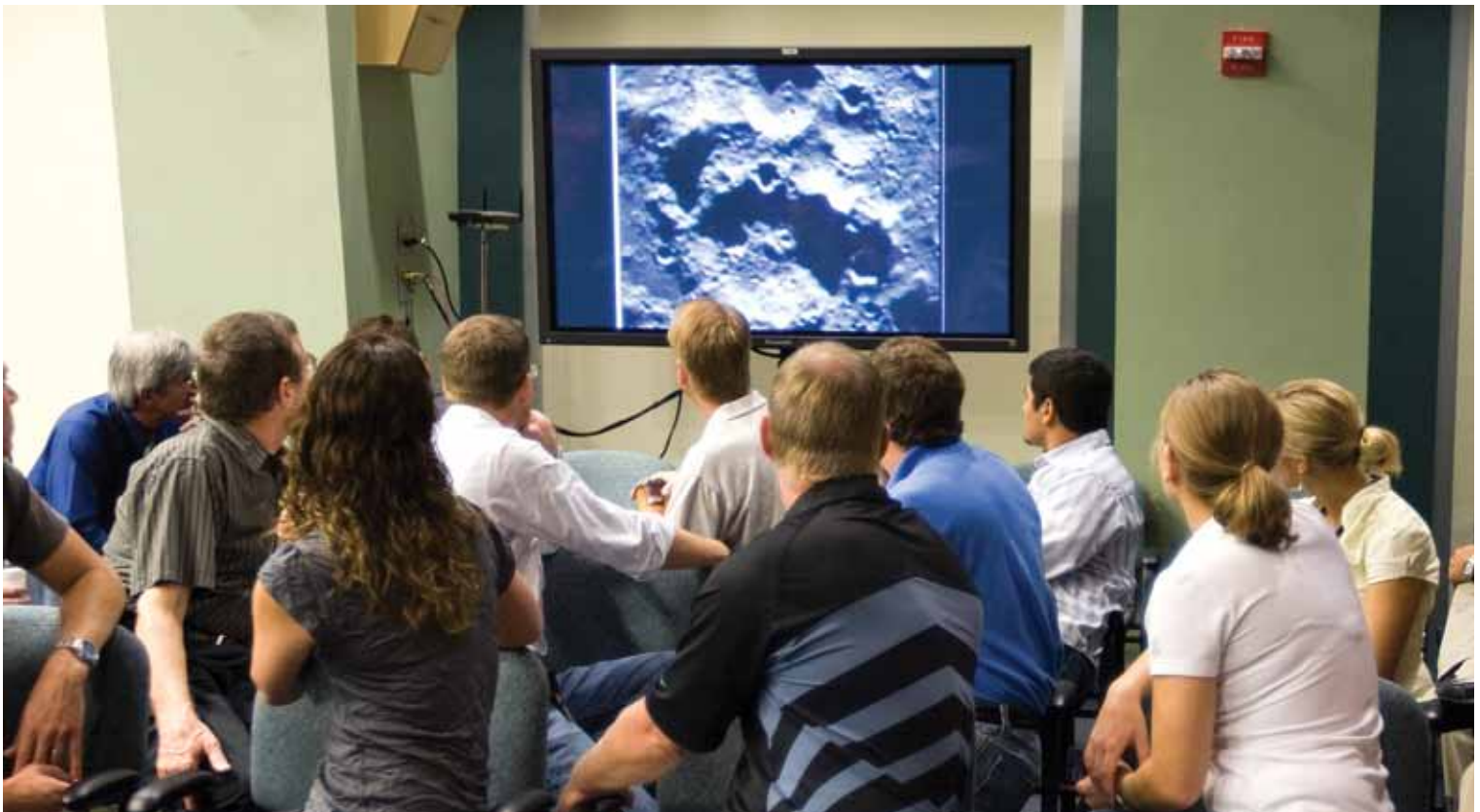
launched aboard a United Launch Alliance Delta IV rocket from Launch Complex-37 at Cape Canaveral Air Force Station, at 6:51 p.m. EDT on June 27, 2009.

A second Missile Defense Agency mission with two satellites, STSS-Demo, launched aboard a United Launch Alliance Delta II rocket from Launch Pad 17-B at Cape Canaveral Air Force Station at 8:20 a.m. EDT on Sept. 25, 2009.

In addition, engineers from LSP and Kennedy's Engineering Directorate continued to provide assistance to NASA's Constellation Program. They performed independent assessments of loads, dynamics and the Ares I-X flight control systems to help NASA prepare for the successful flight test at Kennedy in October 2009.

In order to ensure the availability of launch services for future NASA science missions, LSP continued to work with emerging commercial providers by establishing formal agreements. ■

In the conference room of the Operations Support Building II at Kennedy Space Center in Florida, employees view live on NASA Television the moon impact of the Lunar Crater Observation and Sensing Satellite, or LCROSS, and its spent Centaur upper stage.



The United Launch Alliance Delta II rocket carrying NASA's NOAA-N Prime satellite lifts off Space Launch Complex-2 at Vandenberg Air Force Base in California at 5:22 a.m. EST on Feb. 6, 2009. NOAA-N Prime is the fifth and last in the National Oceanic and Atmospheric Administration's current series of five polar-orbiting satellites with improved imaging and sounding capabilities.

Constellation Ground Operations

A spectacular liftoff by the Ares I-X rocket from Launch Pad 39B at NASA's Kennedy Space Center capped a year of great strides for the center's Ground Operations Project as it moves ahead with the long-term development of the launch site in support of the Constellation Program. The work is critical for NASA's efforts to smoothly transition from the space shuttle to the next generation of rockets and spacecraft.

The test rocket, which topped a space shuttle solid rocket booster with a simulated fifth stage segment, upper stage and spacecraft, was still in several pieces when 2009 began. The individual segments of the upper stage simulator were built at NASA's Glenn Research Center in Ohio and trucked to Kennedy for assembly.

With the parts coming together in the Vehicle Assembly Building, workers and cranes that have spent the past three decades connecting shuttle elements began putting together a new design to provide access to vehicles intended to one day carry astronauts beyond low Earth orbit.

The first four segments of the rocket came by train from ATK's production facility in Utah. Stacked atop the left-hand solid rocket booster exhaust port on Mobile Launcher Platform-1, the Ares I-X quickly grew taller than any shuttle stack. The rocket reached 327 feet high when it was finished, the tallest craft to be stacked in the Vehicle Assembly Building since the Skylab rocket.

Along with the rocket, Kennedy's ground support infrastructure saw extensive changes to support the new design.

Launch Pad 39B saw the most changes, beginning with a trio of 600-foot-tall lightning protection system towers that will guard the next generation of rockets. The towers were completed ahead of schedule and in time to protect shuttle Endeavour as it stood on pad B for possible duty as a rescue shuttle for STS-125, the last servicing mission to NASA's Hubble Space Telescope. The towers also protected the Ares I-X launch vehicle during its short stay on the pad.

Once the STS-125 mission concluded in May 2009, workers removed the orbiter access arm from the fixed service structure at pad B since the Ares I-X would not need it. They then pulled the end off of the gaseous oxygen vent arm and built a service platform in its place. Stabilizing arms were added to the gantry to hold the rocket steady during its weeklong stay at the pad before liftoff.

With the finishing touches completed on pad B, the Ares I-X was hauled from the VAB on top of a crawler-transporter.

The testing, rollout and launch of the developmental flight test were watched carefully inside the newly refurbished and renamed Young-Crippen Firing Room inside the Kennedy's Launch Control Center. The control room, which oversaw numerous historical flights, including the first moon landing mission and the first shuttle launch, was revamped with new equipment and an advanced layout for the Ares I-X launch team.

The Ares I-X roared into the sky Oct. 28, 2009, after a weather delay the day before forced a postponement. The flight test was an overwhelming success. The data recorded during the flight from some 700 sensors on the rocket will be used to refine the computer models designers are using to develop next-generation launchers.

As the test rocket made its way into the sky, future ground support equipment took form beside the VAB where cranes and workers have been building a new mobile launcher and accompanying service tower. Eventually, the tower will rival the VAB's height, although it will be able to fit through the VAB's vertical doors. In addition to an access platform reaching to a new spacecraft, the tower will hold umbilical arms to fuel and pressurize liquid-fueled upper stages on a new rocket.

The umbilical arms will be tested with a new simulator called the vehicle motion simulator,

A ribbon cutting on Sept. 25, 2009, officially turns over the Launch Control Center's Young-Crippen Firing Room at Kennedy Space Center from the Space Shuttle Program to the Constellation Program. Participating from left, are Pepper Phillips, director of the Constellation Project Office at Kennedy; Robert D. Cabana, Kennedy's director; Robert Crippen, former astronaut; Jeff Hanley, manager of the Constellation Program at Johnson Space Center; and Nancy Bray, deputy director of Center Operations at Kennedy.

The 327-foot-tall Ares I-X rocket casts shadows on the massive Vehicle Assembly Building at Kennedy Space Center as it heads to Launch Pad 39B aboard a crawler-transporter on Oct. 20, 2009.

which is under construction at the launch equipment test facility. The simulator is meant to evaluate the arms' design for interaction with a rocket while on the pad through liftoff.

The Orion spacecraft and its support requirements also made significant progress in 2009. A mock-up of the spacecraft was lowered into the water at Port Canaveral, Fla., so recovery personnel could test the handling of a craft designed to return to Earth beneath billowing parachutes rather than on the strength of wings. With the tests completed, the mock-up was carried a couple of miles to the Atlantic Ocean for an appraisal in various sea conditions, such as those the spacecraft is expected to see when it returns from space.

Preliminary design reviews, which are major milestones in their own right, were completed for several Constellation systems, including the launch pad, emergency egress, and command control and communications.

The Ground Operations Project as a whole also completed its own preliminary design readiness review.

While much of the year's work focused on the next rocket to carry astronauts, configurations also were evaluated for the large Ares V launch vehicle designed to lift a lunar lander into orbit. The lander program, Altair, also got considerable attention as engineers studied processing concepts for the spacecraft.

This past year could be seen as a pivotal year in the history of the spaceport as Kennedy prepares for the nation's future space exploration challenges. ■

Members of the U.S. Air Force 920th Rescue Wing secure a flotation collar around the mock-up Orion crew exploration vehicle at the Trident Basin at Port Canaveral in Florida. The mock-up vehicle underwent testing in open water to determine what kind of motion astronauts can expect after landing, as well as outside conditions for recovery teams.

Innovative technology experts at Kennedy Space Center support NASA's current programs and future exploration missions by developing new products and processes that benefit the agency and consumers.

Using a highly trained work force, top-notch facilities and technical expertise, Kennedy remains a leader in the world of cutting-edge technology.

Inside Kennedy Space Center's Vehicle Assembly Building, or VAB, David Rowell, left, a NASA Prototype Laboratory technician, and Henry May, with Kennedy's Constellation Transportation Planning Office, perform a fit check on a cover for the tip of the Ares I-X probe.

Corrosion Technology Laboratory

In fiscal year 2009, Kennedy's Corrosion Technology Laboratory developed corrosion-control materials and systems to support launch facilities through their operational life cycles.

With constant deterioration from heat and blast effects, as well as exposure to the elements, bricks along the flame trench walls become susceptible to failure, resulting in large pieces of concrete and mortar breaking away from the steel base structure.

New technologies are aimed at protecting the structure, ground support equipment, launch vehicles and crews from the potentially catastrophic effects of corrosion.

The lab is working to identify or develop an alternate refractory material not susceptible to environmental and launch effects. Testing has been performed on current materials, as well as other commercially available products, based on acidic resistance, compression strength, thermal shock, dimensional stability and abrasion resistance.

The lab also is developing smart coatings that can detect and control corrosion without external intervention. In fact, this multifunctional, environmentally friendly paint system will have the ability to self heal mechanical damage. The coating works by using corrosion-sensitive microcapsules that deliver contents without external intervention, and soon will be incorporated into existing paint systems and tested for performance. Second-generation, corrosion-sensitive microcapsules already have been successfully synthesized and tested.

The lab is taking its innovative ideas to the moon, too. A future base on the lunar surface would require large amounts of dense, strong construction material for thermal and dust control, as well as radiation protection.

The lab previously investigated the use of a solar concentrator to turn simulated lunar soil, called JSC-1A, into a solid, although it has been difficult to solidify large areas due to the insulating properties of the soil and difficulty in aligning the concentrator.

Currently, a system is being built that will integrate a hopper to feed soil with a resistive heater, which provides a more stable heat source than a concentrator. The system will be part of a large area surface sintering system integrated onto a lunar rover for a field demonstration beginning in late January 2010, along with a significant number of other in-situ resource utilization systems at a lunar analog site in Hawaii.

Prototype Development Laboratory

Following two scrubbed STS-127 launch attempts due to a hydrogen leak issue seen from the external fuel tank's gaseous hydrogen venting system, the NASA team determined that crucial measurements were necessary to check the alignment of the system's quick disconnect seal with the Ground Umbilical Carrier Plate.

A tool provided by Kennedy's Prototype Development Laboratory was used by United Space Alliance technicians to take measurements of the umbilical plate while space shuttle Endeavour was at Launch Pad 39A. The tool worked perfectly in providing measurements accurate to one-thousandth of an inch and helped determine corrective actions. Being able to accurately take field measurements without disassembling flight hardware prevented a significant delay to the space shuttle manifest.

The lab was tasked for another launch vehicle, this time to protect two important sensors on the Ares I-X rocket.

The five-hole probe at the top of the 327-foot-tall rocket and total air temperature sensor on the side of the launch abort system were the rocket's most critical payload. Rain,

mosquitoes and even bird droppings could seriously impact the data output of those sensors.

The lab developed covers, consisting of zero porosity nylon fabric with Velcro fasteners, based on customer requirements, size, shape and location of the sensors. All seams were sealed for protection against moisture intrusion, and a lanyard made from 1,000-pound spectra line was sewn into each cover for removal at the pad.

Lab personnel, working with a United Space Alliance lift operator, successfully installed the covers and taped the lanyards on the rocket in August 2009. Lab personnel also routed and configured the lanyards at the pad about 12 hours before launch to be ready for the T-2-hour pull from the 295-foot level of the fixed service structure.

As part of the new Ares I vehicle design process, the lab was tasked by NASA's Constellation Program to provide prototype test articles for water recovery of the Orion crew exploration vehicle. The Post-landing Orion Recovery Test, or PORT, focused on recovery during a variety of weather and sea conditions in order to help drive the vehicle's final design.

The primary purpose was to determine the maximum sea conditions pararescue jumpers could safely recover the vehicle and a crew. The lab completed development of a prototype stabilization collar and inflatable ladder system to support recovery testing. The stabilization collar, an inflatable ring that provides stability as well as a work platform, allowed the rescue crew to access the side and top hatches.

The Orion stabilization collar design was similar to that used during the Gemini and Apollo programs. The new inflatable ladder system can be used as a platform, or porch, when placed in the water to provide additional room for the rescuers and crew.

PORT testing came to Kennedy's Trident turning basin, and then two miles off the coast of Kennedy, first in calm water and then gradually increasing waves, using NASA's recovery ship, Freedom Star. The sea anchor, stabilization collar and inflatable ladder were tested under various sea state conditions and various heat shield flooding conditions.

Applied Physics Laboratory

In 2007, space shuttle personnel approached Kennedy's Applied Physics Laboratory and asked for a sensor that could non-intrusively monitor gaseous nitrogen flow in a steel tube to determine if the desiccant canisters used in the window cavity conditioning system were plugged.

Inside Kennedy Space Center's Vehicle Assembly Building, or VAB, NASA Lead Engineer for the Prototype Development Laboratory Adam Dokos performs a fit check of the External Tank Hydrogen Leak Anomaly Measurement Tool on a mock-up of the fuel tank's umbilical plate for the STS-127 mission.

As a result, the Window Cavity Conditioning System Redundant Flow Path Verification Device was conceived, approved and funded in the spring of 2008. ASRC Aerospace Corp., the Prototype Development Lab, and the Applied Physics Lab developed the GSE version of the hardware and in May 2009, it was used on space shuttle Discovery in support of the STS-128 mission, supplying desiccant canisters flow indications, removing the need to disassemble and bench test the system.

Recently, the labs delivered a handheld tool, in response to a request from the shuttle window inspection group, for locating and inspecting defects in fused silica. The window inspectors are required to quickly determine if any given defect is serious and the existing tool had failed in blind testing. This new tool consists of two bore-sighted cameras, one that looks at a large field-of-view to help locate the defect and the other that looks at a narrow field-of-view providing a microscope-type image of the defect.

Kennedy's Engineering Directorate

Kennedy's Engineering Directorate continues to apply its considerable abilities and one-of-a-kind experience to benefit NASA's space shuttle fleet, the International Space Station and the Launch Services Program. Engineers at Kennedy also are increasingly focusing their attention on new spacecraft and launchers.

Engineers in the directorate work in Kennedy's areas of expertise, such as processing, ground operations and launch. With the merging of applied technology into engineering, the directorate now has the complete life cycle from advanced studies and conceptualization through integration. That means an engineer can conceptualize an element, design the element, and have it evaluated, perfected and incorporated into a mechanism or other environment without leaving the directorate.

During 2009, Kennedy's engineers and scientists played a role in preparing the last shuttle mission to service NASA's Hubble Space Telescope and working with the Launch Services Program on the launch of weather observation spacecraft and the Wide-field Infrared Survey Explorer, or WISE.

Analysis, design and other engineering work conducted in 2009 and in previous years paid off spectacularly with the successful launch of the Ares I-X. Kennedy's expertise was employed for the mission in many ways, including retrofitting Launch Pad 39B to host the much taller Ares I-X rocket instead of a space shuttle.

Looking far into the future, the Engineering Directorate is playing a role in developing technologies astronauts will require for visits to the moon, asteroids or Mars. ■

Space shuttle Endeavour, mounted atop its modified Boeing 747 carrier aircraft, flies over California's Mojave Desert on its way back to NASA's Kennedy Space Center in Florida.

Partnerships

At Kennedy Space Center, Director Robert D. Cabana, left, congratulates Eric Silagy, Florida Power & Light vice president and chief development officer, for his part in the construction of NASA's first large-scale solar power generation facility. The one-megawatt facility is the first element of a major renewable energy project currently under construction at the center.

With the retirement of NASA's space shuttle fleet scheduled for 2010, Kennedy Space Center increased its efforts to expand and strengthen partnerships with private and public organizations.

Key among these efforts was the formation of the Center Planning and Development Office, which now serves as Kennedy's "front door" for new partnerships.

To ensure the most efficient utilization of Kennedy's work force, hardware and facilities for NASA's future initiatives, as well as the commercial space industry, the office combined Kennedy's master planning and real property management with management of the agency's programmatic transition and a focused Center Development Program. The office supports NASA programs and helps ensure efficient use of center institutional and technological assets.

A Partnerships Board comprised of Kennedy's senior managers was established to coordinate and focus center activities that enable, develop and sustain non-traditional business and partnerships. The board also facilitates integration of partnership activities across internal and external organizations.

A Business Development Working Group developed by the board supports identification, pursuit and implementation of new opportunities. The new group is strengthening existing stakeholder interactions, and expanding cooperation with local, state and federal government agencies. Among these are collaborations with Space Florida, the Economic Development Commission of Florida's Space Coast, the Brevard Workforce Development Board, and planning and development offices across the nation.

Several key strategic partnerships formed or initiated in fiscal year 2009 will help Kennedy transition into the post-shuttle era.

In December 2008, Kennedy and Space Florida signed a long-term lease for a 60-acre parcel of land to be developed as the first phase of a mixed-use technology and space commerce park adjacent to the state's Space Life Sciences Laboratory.

Exploration Park at Kennedy will be developed and operated by Space Florida and their

industry partner, The Pizzuti Companies, to provide a campus for tenants who will support space-related activities for NASA, other government agencies and the U.S. commercial space industry. Eight facilities spanning about 315,000 square feet will provide space for offices, light manufacturing, assembly, processing and a variety of support functions. The project, expected to break ground in 2010, will help mitigate technical work force disruptions at the center. It also will provide an environment that fosters growth of commercial space capabilities, supporting NASA's mission and benefiting the nation's economy.

Kennedy furthered its partnership with Florida Power and Light, or FPL, to develop use of renewable energy by initiating construction of two solar power generation projects, totaling 11 megawatts. FPL and their contractor, SunPower Corp., completed NASA's first utility-scale solar power generation facility, a one megawatt facility now providing a portion of the electricity used at Kennedy.

A larger, 10-megawatt solar farm being built nearby, will supply power to FPL's customers when it is completed in April 2010. The projects are supporting a national goal aimed at increasing America's energy independence while improving the planet's environment and were recognized by the General Services Administration as the 2009 winner of the Real Property Award for innovative use of federal land.

In September 2009, Kennedy and Starfighters Inc. of Tarpon Springs, Fla., negotiated a new partnership allowing the firm to use the runway at the center's Shuttle Landing Facility, or SLF, for its venture to support the commercial space industry. The agreement will enable Starfighters to operate its private fleet of Lockheed F-104 aircraft at the SLF for approved flight activities. The partnership is an example of how Kennedy is working to diversify use of the shuttle runway to help sustain a unique asset for horizontal space launch and recovery after the shuttle retires.

Throughout the year, the center continued to grow its technology and educational partnerships, and expand support for commercial space transportation firms, such as SpaceX. The company is developing launch facilities at Cape Canaveral Air Force Station to supply NASA with commercial launch services to the International Space Station.

Kennedy's employees continued to demonstrate that the center's work force is a strong partner in the community through the 2009 Combined Federal Campaign. A total of $455,774 was voluntarily contributed to various charities. ■

Space Launch Complex-40 on Cape Canaveral Air Force Station in Florida is being outfitted to support the new Falcon rockets to be launched by Space Exploration Technologies, known as SpaceX.

Environmental Leadership

The keen sense of responsibility among Kennedy Space Center's work force to protect the environment -- both on the center on which they work and in the neighboring communities in which they live -- led to new projects in fiscal year 2009 and greater levels of achievement in green initiatives.

NASA's first large-scale solar power generation facility broke ground in May 2009 and was formally commissioned Nov. 19, 2009. The one-megawatt facility is the first element of a major renewable energy project currently under construction at Kennedy and is supplying part of the electricity needed to run the center.

A 10-megawatt solar farm is under construction on nearby Kennedy property and will supply power to Florida Power & Light customers when it is completed in April 2010.

Construction of a new 10,730-square-foot Propellants North Facility in the Launch Complex 39 area is under way to replace facilities built in the 1960s. The new building will qualify for the U.S. Green Building Council's Leadership in Energy and Environmental Design, or LEED, Platinum designation, a first for the center, as well as NASA. Currently, there are 145 Platinum-rated facilities in the U.S., but only one other in Florida. The new facility is scheduled to be completed in 2010.

Deconstructed Launch Control Center firing room glazing and frames, and reclaimed and processed waste concrete from Kennedy's demolition projects are being used for the facility's foundation and paving sub-base materials. The roof will be constructed of recycled metal covered with a rainwater harvesting system that supplies restroom fixtures. Xeriscape landscaping will use native species and recycled crushed crawlerway rock for mulch.

The facility will feature a high-efficiency roof and walls; air conditioning with energy recovery technology; Smart Lighting controls with step dimming and occupancy sensors; Energy Star appliances; and high-velocity hand dryers. Natural lighting will be provided using high-efficiency windows with correct solar orientation, as well as sustainable flooring using polished concrete and laminated bamboo.

The Florida State Historic Preservation Office and the Advisory Council on Historic Preservation entered into a programmatic agreement with Kennedy for the management of historic facilities on May 18, 2009. The agreement clears the way for the center to perform normal maintenance and minor modifications to existing and future historic, ground-based facilities and structures listed on

A variety of alternative fuel vehicles are driven around Kennedy Space Center in Florida in an effort to reduce gasoline consumption and conserve energy. These include compressed natural gas, bi-fuel, diesel and flex fuel vehicles.

Florida Fish and Wildlife Conservation Commission and Kennedy Space Center workers, along with volunteers, move a green sea turtle into a Merritt Island National Wildlife Refuge shop located a few miles away from Launch Complex 39. The turtle was one of hundreds affected by the sudden drop in temperature during the month of January 2010.

the National Register of Historic Places. It also allows for reuse to support new programs.

Kennedy's strategic focus on cleaning up environmental contamination from past operations continued in 2009, with the removal of 8,018 tons of contaminated soil and the implementation of groundwater interim measures at Launch Complex-34 and the Spaceflight Tracking and Data Network Station. Regulatory approval was obtained on 57 work plans and reports, and final remedies were implemented at 12 sites, six of which were completed. The lessons learned from these remediation and cleanup efforts led to the modification of Kennedy's current processes to prevent future contamination.

The recycling program at Kennedy continued to grow in 2009 with the collection of about 496 tons of office paper and cardboard; 1,364 tons of metal; and 15 tons of plastic, glass and aluminum. About 14,690 tons of concrete and 604 tons of electronic parts, batteries, chemicals and toner cartridges also were recycled. The proceeds from recycling activities are used to fund additional recycling, green purchasing and pollution-prevention efforts.

About 30,000 tons of recycled concrete were utilized in the NASA Causeway seawall repair project, saving about $2.3 million. This coastal revetment project replaces the function of the existing vertical concrete bulkhead and protects the causeway from erosion near the Indian River Bridge. To further support recycling in the region, Kennedy procured recycled content and environmentally preferable materials where possible.

Application of an environmentally preferable paint, Hypalon H-27, as a seal coat over the thermal protection system of the space shuttle's solid rocket boosters and the exterior of the motor cases reduced hazardous air emissions and the generation of hazardous waste.

Through a partnership with the Florida Department of Environmental Protection, Kennedy's hazardous waste permit was modified to allow the treatment and curing of inorganic zinc paint. Once treated, the paint's waste is non-hazardous and can be handled accordingly.

The U.S. Fish and Wildlife Service, or FWS, received stimulus money from the St. Johns River Water Management District for wetland restoration along the Banana Creek. About 500 acres of impoundments are being restored and 12 miles of dike road removed.

NASA continues to partner with FWS and the U.S. Geological Service to develop and implement sustainable mitigation strategies to restore eroded dunes and protect Kennedy's shoreline. This includes wildlife habitats critical to sustaining populations of threatened and endangered species, such as sea turtles.

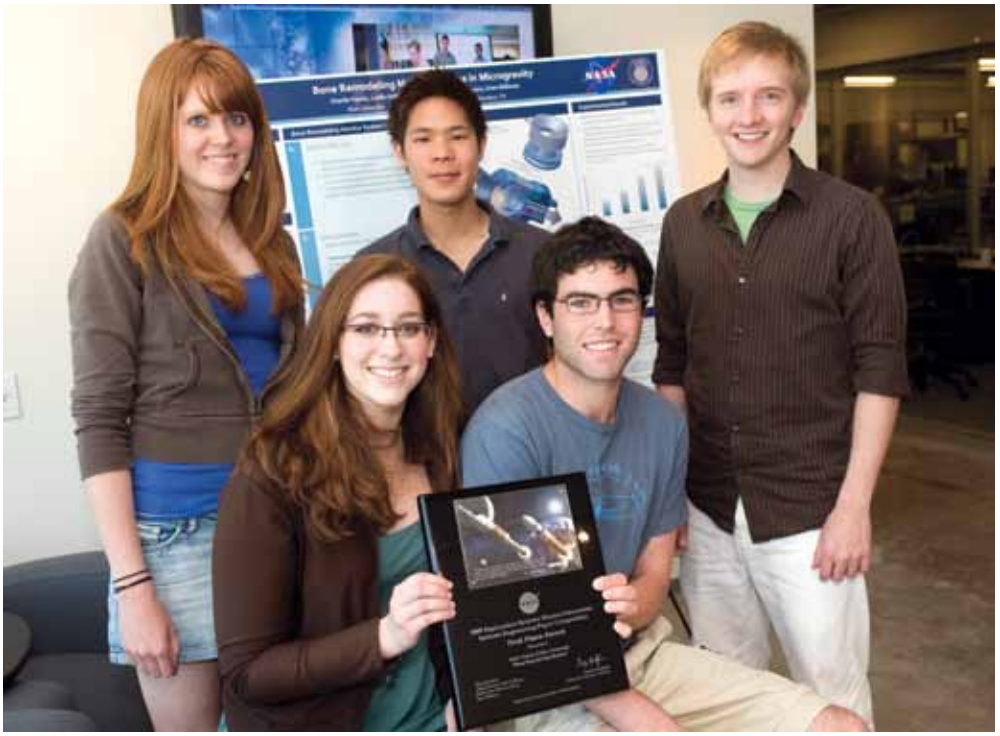
Turtle-friendly light fixtures also were designed for a new mobile launcher under construction at Kennedy. The aluminum fixtures are fully enclosed to reduce the scattering of light, directing it straight down to the work areas. ■

Education

"Today, we must continue to cultivate new astronauts, scientists, robot designers and computer engineers."

Charles Bolden, NASA Administrator

The mission of Kennedy Space Center's education programs is to deliver quality education products and services, and continue to refine its approach by determining the factors of quality education and how it can be quantified, benchmarked and ensured.



"Team Taurus" from Rice University in Houston placed first in the NASA Exploration Systems Mission Directorate's Space Grant Systems Engineering Paper Competition in April 2009.

Agencywide Project Management

Kennedy manages four agencywide education projects for NASA. They are the Interdisciplinary National Science Project Incorporating Research and Education Experience, or INSPIRE; Minority University Research and Education Programs, or MUREP, Small Projects; the Exploration Systems Mission Directorate, or ESMD, Space Grant; and Experimental Program to Stimulate Competitive Research, or EPSCoR.

INSPIRE provides students from ninth grade through freshman year of college an online community that links them with other like-minded students with interests in aeronautics and space exploration, along with opportunities to participate in hands-on research during the summer months at a NASA center.

This year, Kennedy hosted 21 INSPIRE interns from Florida, Georgia and Puerto Rico for eight weeks in the summer. Eleven of the interns were rising 12th-graders and 10 were starting their freshman year of college.

MUREP Small Projects' mission is to fund innovative science, technology, engineering and mathematics, or STEM, projects that address outcome portfolio gaps within NASA's MUREP priorities. For implementation in fiscal year 2010, the following five new projects were awarded:

- New Mexico State University: Promoting Access, Retention, and Interest in Astronomy
- North Carolina Agricultural and Technical State University: Integrating NASA Science, Technology and Research in Undergraduate Curriculum and Training
- Florida A & M University: Minority Innovation Challenges Institute
- Sistema Universitario: Engaging Minority Serving Institutions' STEM Students Through Space-based Capstone Design
- Crownpoint Institute of Technology/Navajo Technical College: Laser Scanning for Digital Manufacturing

These grants offer a diverse blend of universities with projects that are crosscutting and enhance the education portfolio by including innovative methods, approaches and concepts. They also include the development or enhancement of at least 19 courses, as well as significant leveraging of NASA content, resources and direct NASA partnerships by including minority-serving institutions in NASA-sponsored challenges. Sustainability is considered and captured within all five proposals.

The ESMD Space Grant project was developed to train a highly skilled scientific, engineering and technical work force of the future needed to implement the U.S. Space Exploration Policy. In 2009, ESMD provided 80 NASA and industry internship opportunities and 45 senior design projects. A new senior design course was developed at Utah State University and two senior design courses were pilot-tested at Auburn University and Michigan Technological University. Professors from those universities presented course materials to 44 faculty members during a workshop at Kennedy.

ESMD also supports a higher-education project called the Space Grant Systems Engineering Paper Competition, which is a highly competitive, national scholarship designed to engage and retain students in STEM fields. The competition is judged by ESMD systems engineers throughout the agency. First place honors went to teams at Rice University and Virginia Tech University.

Dr. Neil deGrasse Tyson, right, director of the Hayden Planetarium in New York, was a guest on NASA's Digital Learning Network from Kennedy Space Center's News Center in May 2009. He talked about NASA's Hubble Space Telescope before space shuttle Atlantis launched on the STS-125 servicing mission.

ESMD Space Grant contracted five faculty fellows to work on specific projects for six weeks at a NASA center and implement that project into a senior design course at their university during the 2009-10 academic year. There are 806 members of the ESMD Space Grant Community of Practice and 111 members in the ESMD Space Grant Project Facebook group.

EPSCoR supports students and faculty at universities and colleges to strengthen their research capabilities and provide opportunities that attract and prepare them for NASA-related careers. NASA-funded research conducted at the institutions of higher education directly contributes to the research needs of NASA's mission directorates. Twenty-seven states and Puerto Rico participated in EPSCoR this fiscal year.

Kennedy is preparing new solicitations for fiscal year 2010 by coordinating and monitoring current research grants, and supporting the integration of the new performance management initiatives to enhance reporting and outcome processes.

K-12

In fiscal year 2009, NASA's Educator Resource Center, or ERC, Aerospace Education Services Project, or AESP, the Digital Learning Network and the Exploration Station conducted educational workshops for 10,554 formal educators, 47,319 students, and 5,290 participants for informal events.

Kennedy manages and implements a national design competition for middle school students called the Waste Limitation Management and Recycling Design Challenge, or WLMR. It is comprised of two components: creating a water recycling prototype system that purifies 5 liters of simulated wastewater, and investigating their school's solid waste stream along with creating a schoolwide program to limit and recycle waste.

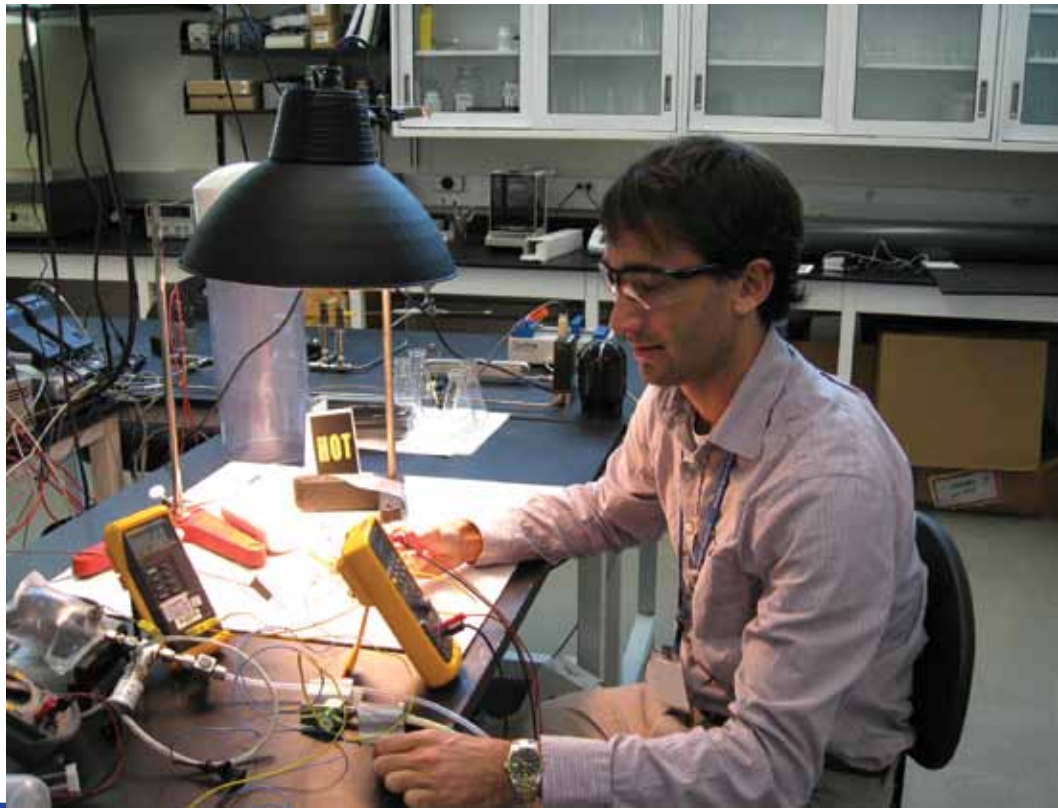
The center signed a Space Act Agreement with Florida Power & Light in a joint effort to create an educational brief with hands-on activities related to solar power.

Kennedy's ERC conducted a professional development workshop, July 20-25, 2009, for 70 educators, representing General Electric's facility regions in Connecticut, Georgia, New York, Kentucky, Ohio and Pennsylvania. The National Science Teachers Association, along with the ERC, taught the workshops.

Kennedy's education division also worked with the Florida Institute of Technology, Embry Riddle Aeronautical University and Florida State University to complete the second Florida Governor's School two-week summer experience. Following that experience, 18 students received four-year scholarships to Florida Tech.

A new local pilot program, called Brevard Space Connections, sought to inspire eighth-grade students to pursue STEM careers before they enter high school. Kennedy education specialists conducted STEM hands-on activity workshops with the students in their classrooms once a month. All participants will be invited to Kennedy for a field trip, with schools providing the transportation.

For NASA's STS-125 and STS-129 mis-



Jason Dunn, a senior aerospace engineering student at the University of Central Florida, performs a test for the Lunar Greenhouse Amplifier project in the Space Life Sciences Laboratory at Kennedy Space Center during a summer 2009 internship.

Karishma Patel, a student from Calhoun High School in Georgia, was a 2009 summer intern with Dynamac Corp. at Kennedy Space Center's Space Life Sciences Laboratory. Patel developed a way to count living and dead bacteria in different environments.

sions, the ERC and AESP staffed "Launch Mission Activity Stations" at the KSC Visitor Complex the day before and on launch day. The stations will continue through the remaining space shuttle launches, and will expand to include a station at the Astronaut Hall of Fame.

Kennedy hosted its fifth Pre-Service Teacher Institute, or PSTI. Eighteen students participated from minority institutions in Florida and Georgia. Students in their junior or senior year, majoring in education, learned how to create effective STEM lesson plans, while incorporating technology and NASA initiatives. NASA partnered with Gardendale Elementary in Brevard County, Fla., which allowed participants to conduct a lesson plan to fourth- and fifth-graders using NASA's unique educational resources.

Kennedy and NASA contractors volunteered their time to judge 54 Brevard County school science fairs. This year, the winner of the Annual State Science and Engineering Fair of Florida was from St. Augustine High School. That winning student received a summer internship at Kennedy.

"Lunacy" was the theme of this year's For Inspiration and Recognition of Science and Technology, or FIRST, Robotics Program, in honor of the 40th anniversary of Apollo 11. Kennedy employees volunteered hundreds of hours to mentor local Brevard County teams, while the Information Technology group provided live coverage for NASA TV and the Web. Kennedy has two home teams: Team 233, called the Pink Team, and Team 1592, called the Bionic Tigers.

Higher-Education Programs

Kennedy hosted 122 interns during this fiscal year. Of these, about 38 percent were female and about 30 percent were minorities from minority-serving institutions. The American Association for the Advancement of Science sponsored three students with disabilities through the Achieving Competence in Computing, Engineering and Space Science, or ACCESS, program for a 10-week summer internship.

Informal Education

The Education Office worked with the ERC and the visitor complex to develop NASA STEM education activities, exhibits

Dustin Lear, a computer science student at Oregon Station University, interned with Lockheed Martin under NASA's Outsourcing Desktop Initiative for NASA, or ODIN, contract for the agency's Motivating Undergraduates in Science and Technology, or MUST, program. Lear is a NASA ambassador and helps communicate educational opportunities to other students.

and events. The goals of the project included increasing participation in high-quality experiences from existing or potential visitors, students, faculty and families; continuing interaction and sharing of project information between centers, visitor complexes and NASA's Museum Alliance; developing interactive exhibits that provide continuing return on investment long after funds have been disbursed; providing professional development opportunities; fostering existing and new educational community relationships; supporting launches via workshops and live webcasts; and improving video conferencing capabilities for Kennedy's regional ERCs in order to increase the number of STEM education opportunities.

On Dec. 3, 2008, a Space Act Agreement was finalized between Kennedy's Education and Guest Services offices and Wannado Entertainment LLC. The goal is to create an innovative, highly interactive and immersive experience at Wannado City in Sunrise, Fla., which will effectively extend NASA's ability to achieve its educational goals for informal STEM education. Negotiations have commenced on the NASA Wannado venue design that will be located at Sawgrass Mills Mall.

The education division continues to support the Central Florida Boy Scout Council. In 2009, the NASA Education Exploration Team hosted STEM workshops for 418 boys, leaders and volunteers. Three members of the education team are members of the Operation Space Scout Committee and are helping to create a new program for the scout's camp, Camp La-No-Che, with a focus on the space aspect of Florida's high-tech industry. While at camp, the boys will learn about the space program, have the opportunity to do many technology-related, hands-on activities, study the stars and astronomy at night, and ultimately become junior space cadets.

Sara Case, a physics student from Virginia Tech, works on a lunar dust mitigation project in the Electrostatics and Surface Physics Laboratory at Kennedy Space Center during a summer 2009 internship.

In 2009, 327 girl scouts, leaders and volunteers, 110 library attendees, 4,100 local community participants and 110 home schoolers attended STEM workshops both on and off site, hosted by the Education Office.

In September 2009, Kennedy's Informal Education Team coordinated two rocket workshops in Montana for 28 librarians attending the Bozeman Public Library workshop and 23 educators attending the Blackfeet Community College workshop in Browning. Both workshops reached underserved and underrepresented audiences.

Electronic Education Projects

NASA's Digital Learning Network, or DLN, connected with 14,279 students and 1,534 educators. The DLN continued its live launch webcasts or "launchcasts" with exciting guests, such as Dr. Neil deGrasse Tyson, director of the Hayden Planetarium in New York. The launchcasts also expanded to cover spacecraft managed by the Launch Services Program, including the Lunar Reconnaissance Orbiter launch in June 2009. Kennedy's DLN won the coveted Pinnacle Award for outstanding videoconferencing programs from the Center for Interactive Learning and Collaboration. ■

Citrus Council Girl Scout Brownies from Orlando participate in a robotics activity during a Space Adventure Day at the Exploration Station in Kennedy Space Center's Educator Resource Center.

Outreach to the World

KSC Visitor Complex

The Kennedy Space Center Visitor Complex once again shared the NASA story with more than 1.5 million guests, reaching both a national and international audience through a combination of exhibits, space artifacts, IMAX films and tours of Kennedy's hallowed grounds. Even though the U.S. economic decline continued to impact tourism, the visitor complex attendance for 2009 was only 5 percent shy of its 2008 attendance. Though most Central Florida attractions reported similar, or in some cases an even higher decline in attendance, the complex held its market share effectively.

To emphasize the agency's renewed focus on education, the complex reached out to the next generation of explorers with commercials promising "a day of fun, a lifetime of inspiration." The complex even offered free admission for children for a limited time.

Strategic alliances with high-visibility partners provided effective marketing opportunities. National promotional partners included the Walt Disney Co. for the release of the "Wall-e" DVD and the return of Buzz Lightyear after the space toy's 15-month stay aboard the International Space Station; Sega of America and HandMade Films for the release of the film "Planet 51"; Sonic for space-themed toys in kids' meals; and PepsiCo, Waldenbooks, Astronomy Magazine and MasterCard. Regional partnerships included NASCAR's Ford Championship Weekend at the Homestead-Miami Speedway, Borders Books, Hungry Howie's Pizza and SUBWAY.

Launches continued to draw large crowds of space enthusiasts to the Space Coast this fiscal year. The demand for launch viewing opportunities through the complex also grew as the public became more aware of the scheduled retirement of the space shuttle.

The induction of the eighth group of space shuttle astronauts into the U.S. Astronaut Hall of Fame kicked off the spring season for the complex. George "Pinky" Nelson, William Shepherd and James Wetherbee joined an elite group of American space heroes during a weekend of events. Legendary space pioneers and previous inductees also attended the festivities.

The summer season offered exciting features, including special viewings of a new "Star Trek" film in the IMAX theater and a statue dedication of the "Peanuts" pooch Snoopy, which was donated to NASA by the family of the late Charles Schulz.

Kennedy celebrated the 40th anniversary of the first lunar landing by hosting a series of activities highlighting the historic event. As part of its community outreach program, the complex joined Ron Jon's Surf Shop as major sponsors of the Cocoa Beach and Cape Canaveral fireworks show on Independence Day. Local channel WFTV featured highlights of the 40th anniversary in its day-long broadcast. To

Crowds fill Kennedy Space Center's Banana River viewing site to see and record space shuttle Endeavour as it roars into space on the STS-127 mission July 15, 2009, at 6:03 p.m. EST. Endeavour delivered the final elements of the Japan Aerospace Exploration Agency's Kibo laboratory to the International Space Station.

The Apollo/Saturn V Center at Kennedy Space Center in Florida is filled with guests gathered to hear about the Apollo 11 launch and landing in July 1969 from eight Apollo astronauts: Buzz Aldrin, Walt Cunningham, Edgar Mitchell, Al Worden, Charlie Duke, Vance Brand, Gerald Carr and Bruce McCandless. The event was part of NASA's 40th anniversary of Apollo celebration.

commemorate the historic Apollo 11 launch from Launch Pad 39A, eight veteran astronauts participated in media interviews and a panel session at the Apollo/Saturn V Center on July 16, 2009. The event participants were Walt Cunningham, Buzz Aldrin, Edgar Mitchell, Al Worden, Charlie Duke, Vance Brand, Gerald Carr and Bruce McCandless.

Other activities included the grand opening of the new Treasures Gallery exhibit with artifacts from the Apollo moon missions, an unveiling ceremony of a 4-foot-wide Apollo-themed Moon Pie, which was consumed by complex guests and summer camp students, individual Moon Pies distributed to employees in Kennedy's cafeterias, and a special lunar landing Google Doodle. Also, Worden, Apollo 15 command module pilot, selected the Apollo/Saturn V Center for permanent display of a moon rock awarded to him by NASA as an Ambassador of Exploration award. NASA's new Administrator Charles Bolden presented the award to Worden during a dedication ceremony held in the complex's Lunar Theater.

Other noteworthy accomplishments included special guest briefings by NASA program managers and project team members during the Hubble Space Telescope and LRO/LCROSS missions and significant progress made on the design and construction of a new 10,000-square-foot exhibit titled "Exploration

Kennedy Space Center Deputy Director Janet Petro, left, presents a special coin to Barbara Stephenson, the U.S. ambassador to Panama, during her tour of the center in August 2009.

Skylab astronaut Gerald Carr, left, joins the space person at Kennedy Space Center's Visitor Complex to celebrate NASA's 40th anniversary of the Apollo 11 moon landing with a specially designed moon pie.

Space" scheduled to open this year. NASA hosted an industry day and subsequent release of a request for proposals for the recompetition of the current complex concession agreement. Award of the new concession agreement is planned for the spring of 2010.

The visitor complex successfully operated two retail stores in the Orlando International Airport, and offered a variety of robust educational programs geared toward educating and inspiring the next generation of explorers. More than 83,000 students participated in programs, such as Camp KSC, Overnight Adventures, the Astronaut Training Experience, student field trips, Brevard Space Week and Brevard Learns About Science and Technology.

For more than 42 years, the complex has operated as a self-supporting entity funded solely through revenues earned through admission, retail and food sales. The carefully structured business model outlined in the concession agreement serves as a role model for other government-owned visitor centers by enabling successful development, operation and maintenance without taxpayer funding.

Guest Operations

Kennedy's Guest Operations staff enabled more than 18,000 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. Additionally, the center hosted thousands of the agency's invited guests to participate in launch briefings and up-close viewing opportunities for five space shuttle and five expendable launch vehicle lift-offs. Guests included members of Congress, business and agency leaders, astronaut families, medical and legal professionals, veterans, teachers, students and the public.

Government Relations

During fiscal year 2009, Kennedy was host to members of Congress, state legislators and community leaders for the five space shuttle missions and the Ares I-X flight test. Elected officials and stakeholders visited the center to learn more about Kennedy's mission and the role it will play in future space exploration.

The center's senior management continued to participate in roundtable discussions, space forums and All Hands briefings to discuss work force issues.

The center welcomed the newly formed Space Caucus to Kennedy for a tour and discussion with Center Director Robert D. Cabana. Comprised of members of the state legislature, the caucus is dedicated to encouraging and advancing the space industry in the state of Florida.

In early March, Cabana met with Florida Governor Charlie Crist, Lt. Governor Jeff Kottkamp and other elected officials during Florida Space Day in Tallahassee. In July, 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.

Sen. Bill Nelson and Rep. Suzanne Kosmas attended the NASA-Florida Power & Light groundbreaking ceremony for the start of construction of the Space Coast Next Generation Solar Energy Center in May 2009.

Kennedy hosted Space Forum members

The tools that were used to service NASA's Hubble Space Telescope on the STS-125 mission are displayed in the News Center at Kennedy Space Center in Florida.

for a tour of the center's facilities. The forum is composed of state legislators from the Space Coast and Central Florida regions who are dedicated to advancing space in Florida.

Speakers Bureau

The Speakers Bureau's primary function is to educate the community about NASA and Kennedy Space Center missions. Guest speakers from Kennedy visited schools, community and business groups and shared presentations on space exploration and the important role Kennedy plays in America's exploration of space.

This year, Kennedy employees participated in the Great American Teach-In, a program that brings working professional scientists into classrooms to share their experiences. In conjunction with Kennedy's Education Office, employees visited classrooms throughout Florida to inspire students to do great things.

In 2009, the bureau reached more than 22,000 people during 115 events. NASA employees working in management and in the science and engineering fields participated in events throughout the southeast United States.

Exhibits

The Kennedy Display Management Team traveled to a variety of public events throughout Florida and the south. Notably, the team appeared at various sporting events, including NASCAR races and baseball games, looking to inspire a whole new audience. Kennedy exhibits also were found at home shows and various educational events.

The team reached 200,000 people as it communicated the NASA message through the use of displays, videos, handout information and face-to-face presentations. Materials focused on the benefits of space exploration, NASA spinoffs and NASA's mission to explore the universe.

Media Services

The Media Services Division at Kennedy's NASA News Center increased international awareness by supporting hundreds of media who covered five shuttle launch and landing events, which included the last servicing mission to NASA's Hubble Space Telescope, and the delivery of the last segment of the Japan Aerospace Exploration Agency's Kibo laboratory. Support also was provided for eight expendable vehicle launches from a variety of locations and other NASA milestones. The division interfaced with the world's media and public audience through several communication conduits, including Kennedy's new upgrade to high definition for NASA TV broadcasting; streaming video of Kennedy events; digital imagery on the multimedia gallery, which received more than 15 million page views this year; and a full-service public affairs office catering to professional journalists. Also, the division provided more than 750,000 multimedia products, including fact sheets, news releases, video news releases, live and radio phone-in interviews, still photographs, video footage, tapes, CDs and DVDs.

Kennedy Web site

The Kennedy Space Center Web site continued to draw a worldwide audience. The center's home page at www.nasa.gov/kennedy attracted more than 5 million views and consistently ranked in the top 10 most-popular pages out of more than 1 million pages within the NASA Web portal at www.nasa.gov.

The "L-1" series of prelaunch webcasts featured guests, including scientists, launch personnel and other experts who provided behind-the-scenes details about each high-profile liftoff. Kennedy's Web team established a partnership with NASA's Digital Learning Network in order to bring a dynamic new perspective and hundreds of academic audience viewers to Kennedy's prelaunch webcast series.

During the year, the Web team provided launch processing and countdown coverage for five space shuttle missions and eight expendable launch vehicle missions. An international Internet audience was kept up-to-date during countdowns and landings with frequent updates to the mission's main page, and 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. Combined, this fiscal year's launch and landing blogs racked up more than 13 million page views.

Kennedy's Web video products included feature videos and podcasts, as well as highlights of launches and landings. Videos earned nearly 4 million views during the year.

Kennedy's Web operations branched out into the social media arena with the username NASAKennedy, including accounts on Facebook, Twitter, YouTube and Twitpic, which broadened its outreach to the younger generations and increased fans by more than 12,000 between Twitter and Facebook and more than 350,000 video views on YouTube. ■

The Kennedy Space Center FY 2009 budget totaled nearly $1.3 billion, and more than $2.2 billion when the Johnson Space Center-managed Space Program Operations Contract, or SPOC, and related work performed at Kennedy is included. In addition, the center performed $84 million in reimbursable work with other government and commercial entities.

- The Space Shuttle Program, including total SPOC impacts, executed a $1.2 billion budget by accomplishing five successful shuttle missions, four of which took major components or logistics to the International Space Station and one to repair NASA's Hubble Space Telescope. The FY 2009 activity also included preparations to launch the six remaining shuttle flights, as well as requirements associated with retirement of the program following manifest completion.

- The International Space Station's $97 million budget allowed for fulfillment of commitments to international partners in completing station assembly, including several major component deliveries -- the S6 truss and final set of large power-generating solar arrays, Japan Aerospace Exploration Agency's Kibo Exposed Facility and Exposed Section. Funding also helped the processing and flow of remaining space station components at Kennedy.

- The Launch Services Program, or LSP, executed a $346 million budget -- direct and reimbursable. LSP supported six successful launches of seven missions -- Kepler, the Lunar Reconnaissance Orbiter and Lunar Crater Observation and Sensing Satellite, and STSS-Demo from Cape Canaveral Air Force Station in Florida; STSS-ATRR and NOAA-N Prime from Vandenberg Air Force Base in California; and the Interstellar Boundary Explorer from the Kwajalein Atoll in the South Pacific. The program also procured launch vehicle services for several manifested missions scheduled to launch in FY 2010 and beyond.

- The Constellation Program budget of $276 million supported continued preparations for the ground operations, launch, landing and recovery of the Ares launch and Orion crew exploration vehicles.

- Kennedy's Center Management and Operations' budget provided $330 million to maintain the center's critical and mission essential facility systems and life safety systems, as well as core technical capabilities and supporting infrastructure. It also sustained the center's safety and engineering technical authorities, implemented NASA's Chief Information Officer initiatives and provided business systems support with improved internal controls.

Recovery Act Funding

On Feb. 17, 2009, President Barack Obama signed into law the American Recovery and Reinvestment Act of 2009. NASA received $1 billion in Recovery Act funds to be invested in science, exploration, aeronautics

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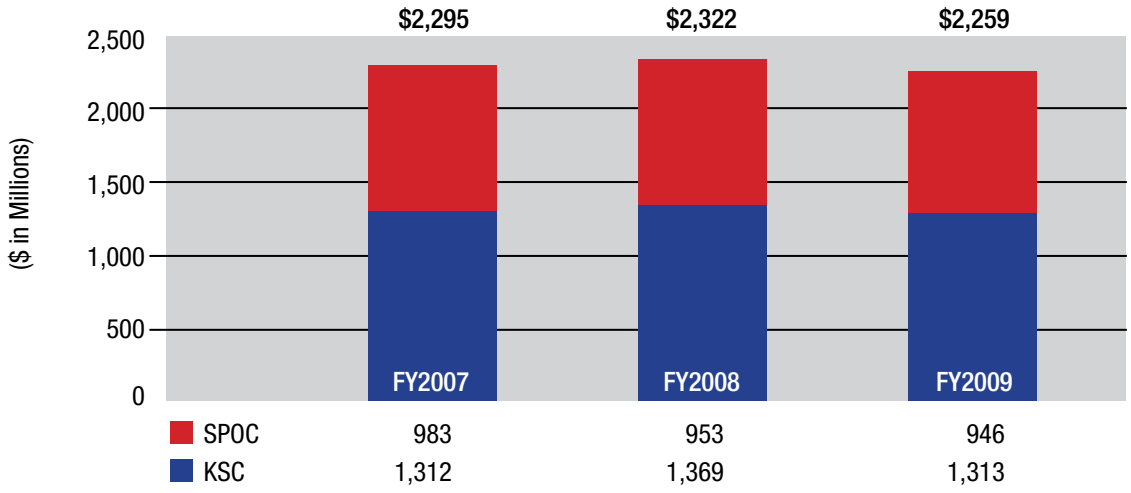
NASA/KSC Budget Authority Summary FY 2007 through FY 2009 ($ in Millions)

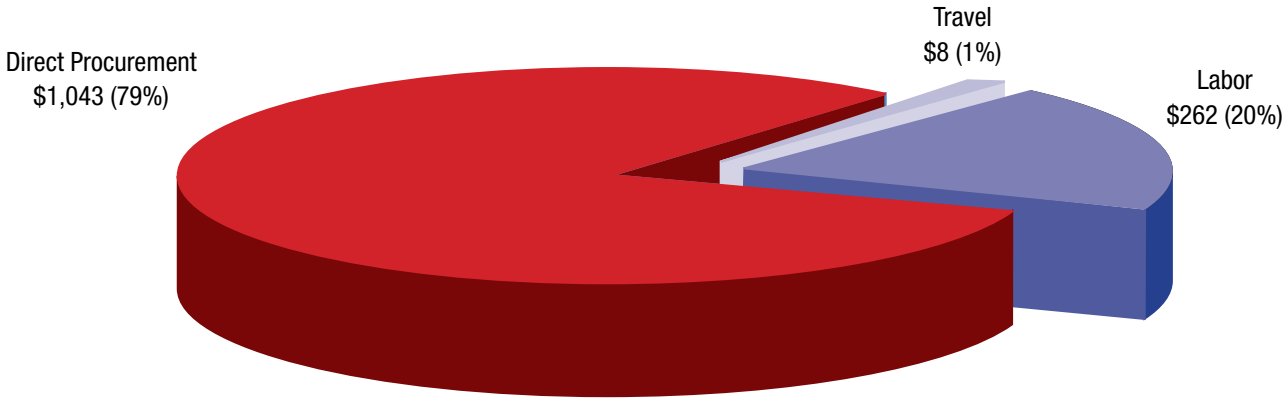


Kennedy Space Center
FY 2009 Budget Authority ($ in Millions)

Space Shuttle	$204
Space Station	$97
Launch Services/Science	$313
Constellation	$276
Center Management & Operations	$330
Other	$93
Total KSC*	$1,313

** Excludes Space Program Operations Contract*

FY 2009 KSC Budget by Element ($ in Millions)



Seventy-nine percent of the Kennedy budget is spent through the purchase of goods and services from commercial providers. The SPOC, or space shuttle contract, managed by Johnson Space Center in Houston, Texas, is excluded here. Its inclusion would increase the percentage of procured services to 88 percent.

and cross-agency support. Kennedy received $26.2 million for Constellation Ground Operations and the Commercial Orbital Transportation Services, or COTS, Dual-use Initiative.

- Constellation Ground Operations: $25 million of recovery funding was put on contract in August for the design of specialized fluids, mechanical, and electrical mobile launcher systems and equipment, which are a critical part of the overall launcher structure. These systems and equipment will fuel and service the launch vehicle and spacecraft systems. This activity retained 130 Kennedy jobs.

- COTS Dual-use Initiative: $1.2 million in recovery funds will be used to perform Launch Complex 40 modifications in support of commercial payload and space station flight hardware storage and processing for the upcoming COTS demonstration mission and subsequent missions. Phase 1 activities include infrastructure maintenance and upgrades to the launch pad's electrical, lightning and air handling systems, as well as other facility structures. This activity was awarded in December 2009.

Kennedy's Chief Financial Office is the centerwide point of contact for all external and internal recovery act matters. Office personnel worked closely with representatives from NASA Headquarters and Johnson, as well as other center representatives and contractors, to ensure compliance with Recovery Act requirements and its associated reporting.

Business Development

With the retirement of NASA's space shuttle fleet scheduled for 2010, Kennedy increased efforts to expand and strengthen partnerships with private and public organizations during the year to help meet the challenges of the pending transition.

- The center had 95 active reimbursable agreements, which generated $84.2 million in commercial work for other federal and commercial entities. These agreements resulted in budget-offsetting revenues to the center of $1.5 million in institutional funding and $2 million in civil service salaries.

- Under its Enhanced-Use Leasing Authority, Kennedy generated $171,000 in FY 2009, largely from its long-standing provision of leased space to media and press organizations for launch coverage.

- Kennedy also will realize benefits from its agreements this year with Florida Power & Light for solar-power generation, Space Florida for the upcoming development of Exploration Park, and agreements with new commercial users of the Shuttle Landing Facility and related facilities. ■

Economic Impact

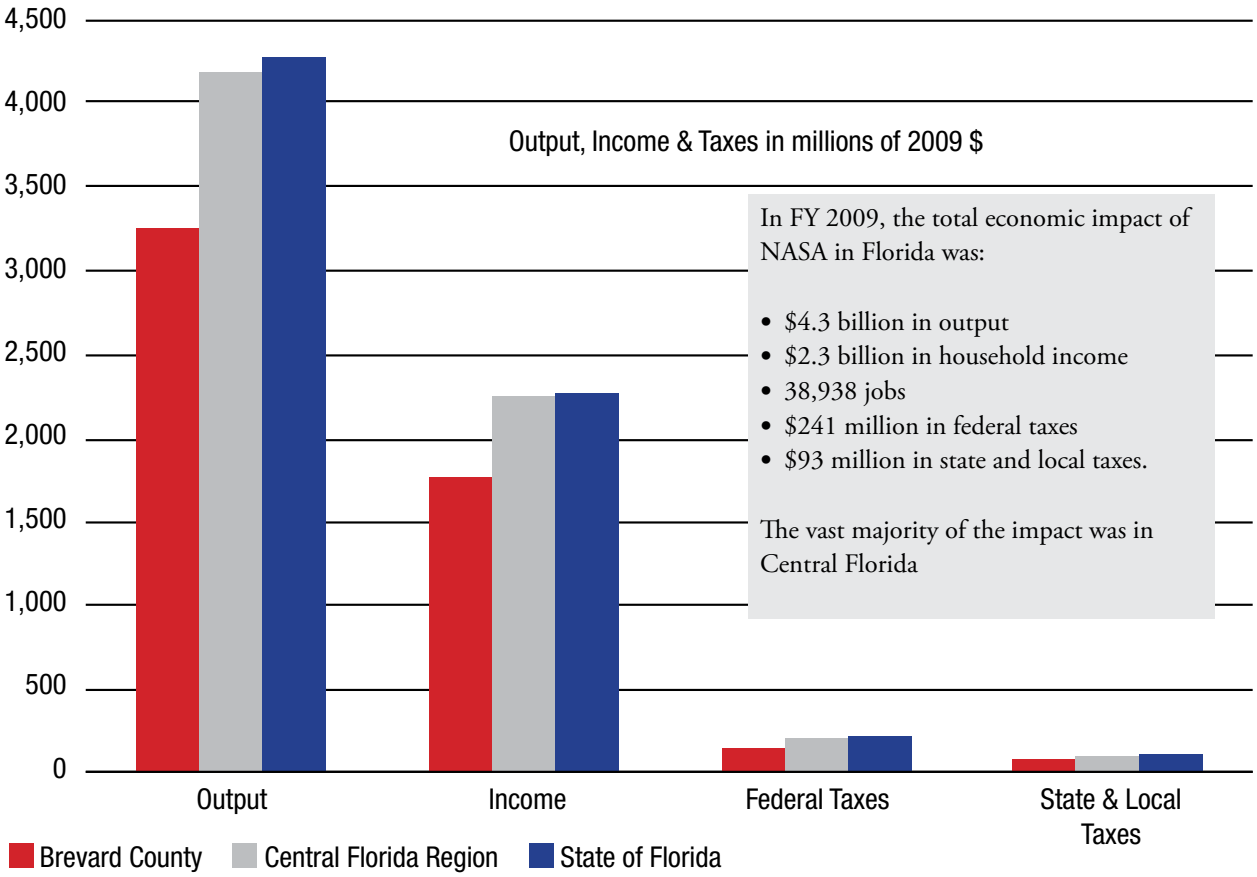
To fulfill its mission, NASA and its contractors require goods and services, both technical and non-technical, ranging from expendable launch vehicles, propellants and computer systems, to motor vehicles, facilities and office supplies. In meeting NASA's demand, local contractors employ workers, produce products, fund payrolls and generate output. These workers and contractors generate additional impacts as they spend their incomes and place orders with other local or regional firms for materials and services. Salaries paid to employees create and generate business for the communities where they live. Supermarkets, gas stations, restaurants, department stores, automobile dealers, dry cleaners, real estate offices and other businesses support the community of workers, and in turn, hire employees, pay salaries and generate further community business needs.

Also, further economic activity is generated through visitors to the Kennedy Space Center Visitor Complex, its launch events and 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 annually 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 2009, Kennedy and other NASA centers spent $2 billion in wages and commodity purchases within the state of Florida. This monetary injection into the local, regional and state economy induced a total economic impact in 2009 of $4.3 billion in total output and nearly 39,000 jobs.

The report concludes that every space-related dollar spent in Florida produces more than double the economic output; and every space-related job creates an additional 1.58 jobs within the Florida economy. Kennedy remains by far the major economic driver in Brevard County and a major contributor to the economic health of the state of Florida.

FY 2009 Total Economic Impact of All NASA Activities in Florida by Geographic Area

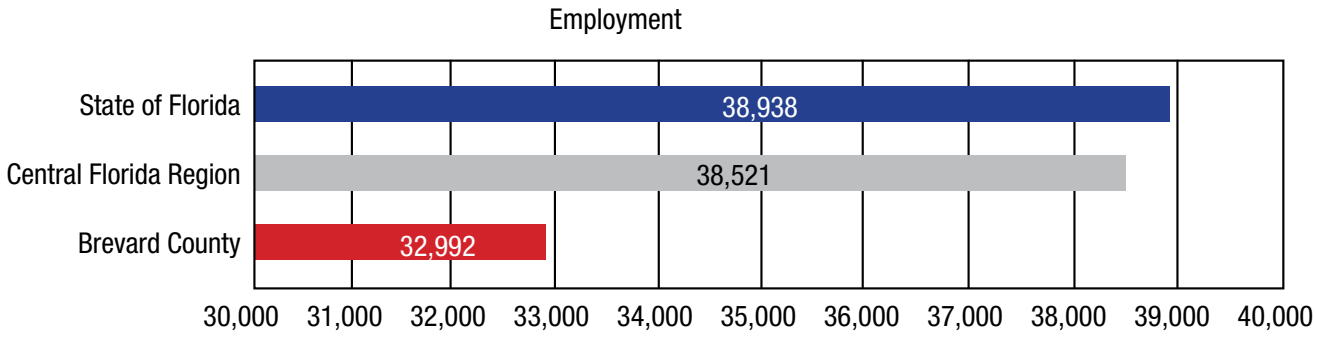


In FY 2009, the total economic impact of NASA in Florida was:

- $4.3 billion in output
- $2.3 billion in household income
- 38,938 jobs
- $241 million in federal taxes
- $93 million in state and local taxes.

The vast majority of the impact was in Central Florida

	Millions of 2009 $			
Area of Economic Impact	**Output**	**Income**	**Federal Taxes**	**State & Local Taxes**
Brevard County	3,332	1,769	138	63
Central Florida Region	4,226	2,240	221	88
State of Florida	4,318	2,261	241	93



For every job at Kennedy, an additional 1.58 jobs are created elsewhere within the state of Florida, each dollar of wages was multiplied into $1.87 in total income and each dollar of total direct spending for commodity purchases and wage payments was multiplied into $2.19 of output production.

Work Force Diversity

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 work force is a diverse group of people dedicated to supporting the nation's space program and NASA's future explorations. To accomplish the various missions expected of the space center, these individuals fulfill a multitude of tasks.

Periodically, the center takes a "snapshot" of its work force. 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, 2009, the total Kennedy population was 15,248, which represents a small increase in the civil servant and contractor work force compared to last year. This includes 2,123 NASA civil servants, 83 NASA co-ops and students, and 11,109 on-site and near-site contractor employees. The civil servant skill mix includes scientific and engineering, administrative, technical, and clerical workers. There are 545 construction employees, and 1,388 tenants on the center.

KENNEDY SPACE CENTER WORK FORCE PROFILE (through 9/30/09)

Civil Servants	2,123
Co-ops and Students	83
Total Civil Servants	**2,206**
Civil Servant Skill Mix	
Scientific & Engineering	62%
Administration	28%
Technical	7%
Clerical	3%
On-site Contractor Employees	11,055
Off/Near-site Contractor Employees	54
Total Contractor Employees	**11,109**
Total Construction Employees	**545**
Total Tenants	**1,388**
TOTAL KSC POPULATION	15,248

The companies listed below were some of Kennedy Space Center's top support contractors or launch services contractors in terms of dollars obligated in FY 2009. Following is a brief description of their work for the agency:

Boeing Space Operations

Boeing Space Operations was the prime contractor for the Checkout, Assembly and Payload Processing Services, or 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, or ELVs.

EG&G Technical Services

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

Abacus Technology Corporation

Abacus provided communication and information technology services under the Information Management and Communications Support, or IMCS, contract. Abacus supported the majority of these requirements at Kennedy, which included support to agency programs, such as space shuttle, Constellation, 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.

Analex Corporation

Analex was the prime contractor on the Expendable Launch Vehicle Integrated Services, or ELVIS, contract. Analex was responsible for performing and integrating the overall programmatic 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 Cape Canaveral Air Force Station, or CCAFS, in Florida, and Vandenberg Air Force Base in California. Analex also provided engineering services and studies, and technical services for various ground and flight ELV systems, missions and payloads.

Arctic Slope Research Corporation

Arctic Slope Research, or ASRC, Aerospace, provided research and engineering services and technical support to Kennedy's Spaceport Engineering and Technology Division and other center operational customers. Support ranged in scope from engineering development and management of complex research, to engineering and technical support of various Kennedy laboratories and test beds. ASRC Aerospace utilized a consortium of affiliated universities in performing applied research and technology development efforts. ASRC Aerospace also provided technology outreach to foster awareness and utilization of Kennedy's unique capabilities.

Innovative Health Applications

Innovative Health Applications, or IHA, under the Medical and Environmental Support Contract, or MESC, provided a broad range of medical and environmental services to NASA. IHA operated the on-site Kennedy medical clinic, which conducts health exams, certifications and emergency medical treatment. IHA also performed occupational health services, aerospace medicine, industrial hygiene, environmental permitting, compliance and stewardship, ecological monitoring, and hazardous waste disposal. IHA operated Kennedy's Fitness Centers and provided education outreach to the center's employees.

United Launch Services, LLC

United Launch Services, or 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 vehicles under two of three existing multiple-award, indefinite delivery, indefinite quantity task order contracts. Principal location for the Delta II vehicle assembly is Decatur, Ala. Principal location for the Atlas vehicle assembly is Denver, Colo. Both vehicles launch from CCAFS and Vandenberg.

OAO Corporation

OAO led the Outsourcing Desktop Initiative, or ODIN, for NASA after acquiring the OAO Corp. The ODIN contract is an agency-wide, long-term outsourcing arrangement that transfers the responsibility and risk for providing and managing the vast majority of NASA's desktop, server and intracenter communications assets and services. Such assets include desktops, servers, mobile BlackBerry devices, WebEx Web conferencing, Kennedy Unified Dialup Access, or KUDA, and e-mail.

United Space Alliance LLC

Under a Johnson Space Center contract, United Space Alliance, or USA, was the prime contractor for the Space Flight Operations Contract. USA's primary purpose was to ensure mission success for the Space Shuttle Program. Kennedy is the primary point of responsibility for launch and landing of the space shuttle. USA supports ground operations and orbiter logistics elements of the shuttle at Kennedy.

Your Procurement Dollars at Work

Geographical Distribution by State
(Fiscal Year 2009 Obligations)

STATE	TOTAL DOLLARS
ALABAMA	1,707,592.14
ARIZONA	69,583.80
CALIFORNIA	19,611,882.82
COLORADO	269,086,402.33
CONNECTICUT	10,016,972.24
DELAWARE	30,238.50
DISTRICT OF COLUMBIA	700,665.00
FLORIDA	270,228,268.60
GEORGIA	70,554.79
ILLINOIS	648,660.22
INDIANA	160,104.72
IOWA	44,979.12
LOUISIANA	9,696,976.44
MARYLAND	345,254,730.48
MASSACHUSETTS	738,203.40
MICHIGAN	588,205.01
MINNESOTA	622,868.33
MISSOURI	31,839.35
MONTANA	14,943.00

STATE	TOTAL DOLLARS
NEVADA	225,078.00
NEW HAMPSHIRE	13,595.35
NEW JERSEY	5,410,290.33
NEW MEXICO	269,710.00
NEW YORK	932,903.93
NORTH CAROLINA	375,215.27
OHIO	5,415,479.26
OREGON	96,759.00
PENNSYLVANIA	13,869,624.91
RHODE ISLAND	27,859.00
SOUTH CAROLINA	440,879.00
SOUTH DAKOTA	65,399.88
TENNESSEE	4,668,358.51
TEXAS	12,536,833.12
UTAH	92,182.01
VIRGINIA	92,976,001.95
WASHINGTON	30,893.75
WISCONSIN	336,970.00
TOTAL	**$1,067,107,703.56**

Top 25 KSC Business Contractors for FY 2009

Contractor	Dollars
UNITED LAUNCH SERVICES, LLC (a subsidiary of United Launch Alliance)	268,913,520
EG&G TECHNICAL SERVICES INC	115,575,095
BOEING SPACE OPERATIONS COMPANY	102,715,658
ASRC AEROSPACE CORPORATION	98,422,469
ABACUS TECHNOLOGY CORPORATION	92,350,333
SPACE GATEWAY SUPPORT, LLC	48,258,722
ANALEX CORPORATION	38,654,777
HENSEL PHELPS CONSTRUCTION CO	37,002,412
OAO CORPORATION	19,292,790
INNOVATIVE HEALTH APPLICATIONS, LLC	16,281,318
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION	16,205,457
DYNAMAC CORPORATION	15,968,486
REYNOLDS SMITH AND HILLS INCORPORATED	13,308,371
SPEEGLE CONSTRUCTION II INCORPORATED	12,543,885
AIR LIQUIDE LARGE INDUSTRIES U.S. LP	11,162,968
PRAXAIR INCORPORATED	9,791,730
REDE-CRITIQUE	9,662,065
MILLENNIUM ENGINEERING AND INTEGRATION CO	8,885,873
AIR PRODUCTS AND CHEMICALS INCORPORATED	7,960,417
ASTROTECH SPACE OPERATIONS INCORPORATED	7,809,056
BREVARD ACHIEVEMENT CENTER, INC	7,639,636
DAVIS H W CONSTRUCTION INCORPORATED	7,630,598
TETRA TECH NUS, INC.	5,691,683
ORBITAL SCIENCES CORPORATION	5,443,080
JONES EDMUNDS AND ASSOCIATES INCORPORATED	5,085,970
TOTAL	**$982,256,369**

Smoke from a shuttle launch, caught in upper air currents, swirls above the Vehicle Assembly Building at Kennedy Space Center.

National Aeronautics and Space Administration

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Kennedy Space Center, FL 32899

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NP-2009-09-094-KSC