

# **KENNEDY SPACE CENTER'S ANNUAL REPORT FY2008**



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- An aerial photograph of a space shuttle launch complex, showing the mobile launcher platform with a shuttle on it, surrounded by various support structures and buildings. The image is faded and serves as a background for the table of contents.
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Clouds of smoke and steam billow across Launch Pad 39A as space shuttle Endeavour launched on the STS-123 mission March 11, 2008, at 2:28 a.m. EDT. Endeavour's crew made a record-breaking 16-day mission to the International Space Station.

## Center Director's Message

### **Robert D. Cabana**



During 2008, NASA celebrated its 50th anniversary and Kennedy Space Center continued its legacy of being the premier, world-class rocket launching center for humans and payloads. Kennedy remained focused on processing and launching Space Shuttle missions and working toward completing construction of the International Space Station. This was accomplished while also processing and launching vehicles through the Launch Services Program and moving forward with the Constellation Program.

The Kennedy team worked diligently throughout the year to meet our commitment to NASA, launching four Shuttle missions and two expendable launch vehicles. In 2008, the face of Kennedy showed signs of change in preparation for the Constellation Program. In the true spirit of exploration, Kennedy is forging ahead in preparations for humans to once again explore beyond low Earth orbit.

Kennedy was active with “green” initiatives and engineering and applied technology efforts. The Center also worked to strengthen existing partnerships and form new ones.

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

## Significant Events

### 1. Discovery Launch

**Oct. 23, 2007**

Space shuttle Discovery and its seven-member crew launched from Kennedy's Launch Pad 39A at 11:38 a.m. EDT, on mission STS-120. During the 15-day mission, the crew delivered and attached NASA's Harmony node to the International Space Station, and relocated the station's P6 truss.

### 3. Discovery Landing

**Nov. 7, 2007**

Space shuttle Discovery and its STS-120 crew landed at Kennedy's Shuttle Landing Facility at 1:01 p.m. EST, after completing a journey of more than 6.2 million miles in space.



### 2. SpaceX breaks ground at CCAFS

**Nov. 2, 2007**

Space Exploration Technologies Corp., or SpaceX, broke ground at Launch Complex 40 to build new commercial launch facilities at Cape Canaveral Air Force Station in Florida. The launch complex previously was used for Titan IV launches.

### 4. "Green" energy agreement with FPL

**Dec. 13, 2007**

Kennedy Space Center and Florida Power and Light teamed up to explore renewable energy projects. Managers signed a memorandum of understanding that established the framework for determining how technically and financially possible it would be to carry out various "green" power plants.



## Significant Events



### 5. Kennedy hosts international ambassadors Jan. 31, 2008

NASA and the U.S. Department of State welcomed ambassadors from more than 45 countries to Kennedy. Dignitaries were given an overview of the United States' space exploration programs and toured various facilities at the center.

### 8. Endeavour Launch March 11, 2008

Space shuttle Endeavour began its STS-123 mission to the International Space Station by launching at 2:28 a.m. EDT, from Kennedy's Launch Pad 39A. During the 16-day flight, the seven crew members installed the first section of the Japan Aerospace Exploration Agency's Kibo module and the Canadian Space Agency's two-armed robotic system, known as Dextre.

### 6. Atlantis Launch Feb. 7, 2008

Space shuttle Atlantis and its seven-member crew lifted off from Kennedy's Launch Pad 39A at 2:45 p.m. EST, to begin the STS-122 mission to the International Space Station. During the 13-day flight, the crew installed the European Space Agency's Columbus science laboratory to the station.

### 7. Atlantis Landing Feb. 20, 2008

Space shuttle Atlantis and its STS-122 crew landed at 9:07 a.m. EST, at Kennedy's Shuttle Landing Facility, after completing a journey of nearly 5.3 million miles in space.

### 9. Endeavour Landing March 26, 2008

Space shuttle Endeavour and its STS-123 crew landed safely at 8:39 p.m. EDT, at Kennedy's Shuttle Landing Facility, after completing a journey of nearly 6.6 million miles in space. STS-123 was the longest shuttle mission to the International Space Station and included a record five spacewalks.



## Significant Events



### 10. Renewed partnership with EDC May 2, 2008

Kennedy signed a Space Act Agreement and renewed its partnership with the Economic Development Commission of Florida's Space Coast to strengthen, retain and expand Brevard County as the prime location for the aerospace industry.



### 14. GLAST Launch June 11, 2008

NASA's Gamma-ray Large Area Space Telescope, or GLAST, launched aboard a Delta II expendable launch vehicle from Launch Complex 17-B at Cape Canaveral Air Force Station in Florida, at 12:05 p.m. EDT. GLAST is a powerful space observatory exploring the universe's ultimate frontier and studying gamma-ray bursts.

### 12. Work force agreement May 27, 2008

Kennedy signed the center's first Space Act Agreement with the Brevard Workforce Development Board to help support existing and future missions at the space center.

### 11. Ares I contract awarded May 8, 2008

Kennedy Space Center awarded a contract to Hensel Phelps Construction Co. of Orlando, Fla., for the construction of the Ares I mobile launcher for the Constellation Program. The launcher will be used in the assembly, testing and servicing of Ares I at existing Kennedy facilities.



### 13. Discovery Launch May 31, 2008

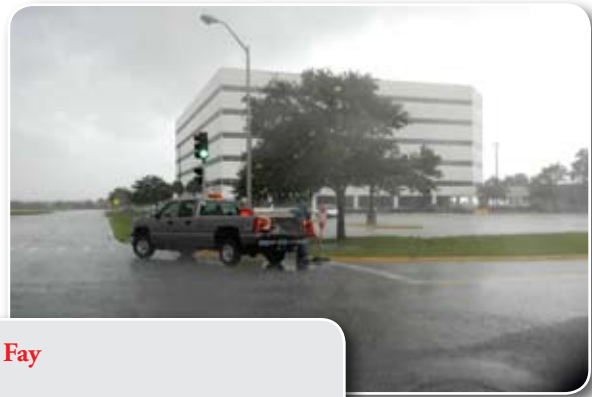
Space shuttle Discovery and its seven-member crew launched on mission STS-124 at 5:02 p.m. EDT, from Kennedy's Launch Pad 39A. During the 13-day mission, the crew delivered and installed the Japan Aerospace Exploration Agency's Kibo Pressurized Module and Japan's Remote Manipulator System to the International Space Station.



## Significant Events

### 16. OSTM/Jason-2 Launch June 20, 2008

NASA's Ocean Surface Topography Mission/Jason-2 launched aboard a Delta II expendable launch vehicle from Launch Complex 2 at Vandenberg Air Force Base in California, at 12:46 a.m. PDT. The satellite is on a globe-circling voyage to continue charting sea levels, a vital indicator of global climate change.



### 17. Tropical Storm Fay Aug. 19, 2008

Kennedy Space Center closed because of the potential threat of heavy rain and high winds from Tropical Storm Fay. The storm made landfall along Florida's southwest coast. Kennedy remained closed through Aug. 21 and resumed normal operations Aug. 22.

### 15. Discovery Landing June 14, 2008

Space shuttle Discovery and its STS-124 crew landed at Kennedy's Shuttle Landing Facility at 11:15 a.m. EDT, after completing a 13-day journey of more than 5.7 million miles in space.



### 18. Kennedy Contract Transition Sept. 30-Oct. 1, 2008

The Space Gateway Support 10-year Joint Base Operations Services Contract ended Sept. 30. New contractors officially began the smooth transition Oct. 1, resuming operations and services to the center.



## Launch Vehicle Processing

Since 1981, space shuttles have soared through the sky above Kennedy Space Center amazing spectators, engineers and scientists alike. But without the accomplishments from the launch vehicle processing team, NASA's three orbiter vehicles -- Atlantis, Discovery and Endeavour -- wouldn't get off the ground.

This fiscal year included processing for four space shuttle launches, teamwork to solve engineering and technical challenges, major milestones and preparing Kennedy's facilities for NASA's transition to the next generation of space vehicles.

### **Mission STS-120/Discovery**

Space shuttle Discovery lifted off from Launch Pad 39A, at 11:38 a.m. EDT on Oct. 23, 2007, on the 120th shuttle mission and the 23rd mission to the International Space Station. In addition to the planned installation of the Harmony node and relocation of the P6 truss, the crew performed a 360-degree inspection of the

Solar Alpha Rotary Joint, or SARJ, on their second spacewalk. They also repaired a torn solar array on the mission's fourth spacewalk. The crew transferred more than a ton of scientific samples and equipment before undocking and landing at Kennedy's Shuttle Landing Facility, at 1:01 p.m. EST, on Nov. 7, 2007.

### **Mission STS-122/Atlantis**

Originally scheduled for launch in December 2007, Atlantis' engine cutoff, or ECO, sensor scrubbed two launch attempts and delayed the mission until February 2008. In the event of an anomaly, the ECO sensor tells the shuttle to safely shut down the main engines. A mid-December tanking test determined the location of the failure. More than 500 engineers and technicians from Kennedy and other NASA centers worked tirelessly through the holidays and into January 2008, to completely redesign, develop, test and implement a new feed-through connector between the

orbiter and the external tank. Atlantis remained at Launch Pad 39A during the ECO sensor repair efforts.

Atlantis launched on its STS-122 mission Feb. 7, 2008, at 2:45 p.m. EST. After a 13-day mission to deliver and install the European Space Agency's Columbus laboratory to the International Space Station, Atlantis landed safely at Kennedy's Shuttle Landing Facility, Feb. 20, 2008, at 9:07 a.m. EST.

### **Mission STS-123/Endeavour**

Space shuttle Endeavour's STS-123 mission launched March 11, 2008, at 2:28 a.m. EDT, illuminating the early-morning sky on its way to the International Space Station. The crew of the 25th flight to the space station delivered the Japan Aerospace Exploration Agency's first half of the Kibo module -- the Japanese Logistics Module -- to the orbiting laboratory. Endeavour's crew also delivered the Canadian Space Agency's Dextre robotic arm, which will be



Release of the drag chute helps slow space shuttle Discovery as it touches down on Runway 15 at Kennedy Space Center's Shuttle Landing Facility at 11:15 a.m. EDT, June 14, 2008, ending the STS-124 mission.



used for station maintenance and service in conjunction with the station's robotic arm.

A truly international mission, STS-123 also included work on U.S., Russian and European Space Agency projects. In what was the longest mission to the International Space Station to date, the flight was the first to take full advantage of the station-to-shuttle power transfer capability, extending the mission to 16 flight days before landing at Kennedy's Shuttle Landing Facility on March 26, 2008, at 8:39 p.m. EDT.

#### **Mission STS-124/Discovery**

Space shuttle Discovery's STS-124 mission launched May 31, 2008, at 5:02 p.m. EDT. The STS-124 mission successfully delivered the Pressurized Module and robotic arm of the Japanese Experiment

Module, known as Kibo, or hope, to the International Space Station. It was the 123rd shuttle mission and the 26th flight to the orbiting laboratory. After a 13-day mission, Discovery touched down at Kennedy's Shuttle Landing Facility on June 14, 2008, at 11:15 a.m. EDT, to begin ground processing toward the upcoming STS-119 mission, targeted to launch in February 2009.

#### **Launch Pad 39A Flame Trench Repair**

During Discovery's liftoff on the STS-124 mission, more than 3,500 refractory bricks from the flame trench wall broke loose without warning. Analysis revealed that the bond between the bricks and the underlying concrete wall had deteriorated due to the acidic and high temperature

At Launch Pad 39A, workers fill steel grid structures welded to the wall of the flame trench, with a heat-resistant concrete called Fondue Fyre, developed during NASA's Apollo Program. Damage to the flame trench occurred during the May 31, 2008, launch of space shuttle Discovery on the STS-124 mission.

environment. During a shuttle launch, temperatures in the flame trench can reach 4,000 to 6,000 degrees F. Kennedy engineers and technicians worked through the summer to repair the flame trench in time for the STS-125 mission, which was scheduled for early October.

#### **Ares I-X Flight Test**

The Ares I-X flight test is now within reach for Kennedy employees with the arrival of flight hardware from other NASA centers in 2008. Some extensive modifications took place in the Vehicle Assembly Building, or VAB, to prepare for the processing of this hardware.

#### **Ares I-X VAB Modifications**

The largest facility modification to date took place in the largest facility on Kennedy Space Center. Technicians removed Platform C from VAB High Bay 3 on June 26. Removal of the platform cleared the way for Ares I-X upper stage simulator segments. Originally scheduled to be removed in September 2008, the Constellation Program accelerated the move to take advantage of an earlier window in the shuttle processing schedule. At 70 feet wide by 45 feet deep and 50 feet tall, the platform weighed nearly 200 tons. Using the 325-ton VAB crane, the platform was lowered onto special powered transporters and moved out of the building through the north doors, where it was demolished and sold for scrap.

#### **Continuing Improvements**

Though NASA's Space Shuttle Program is more than 25 years old and nearing retirement, the team continues to refine the pro-

cess for preparing and launching vehicles.

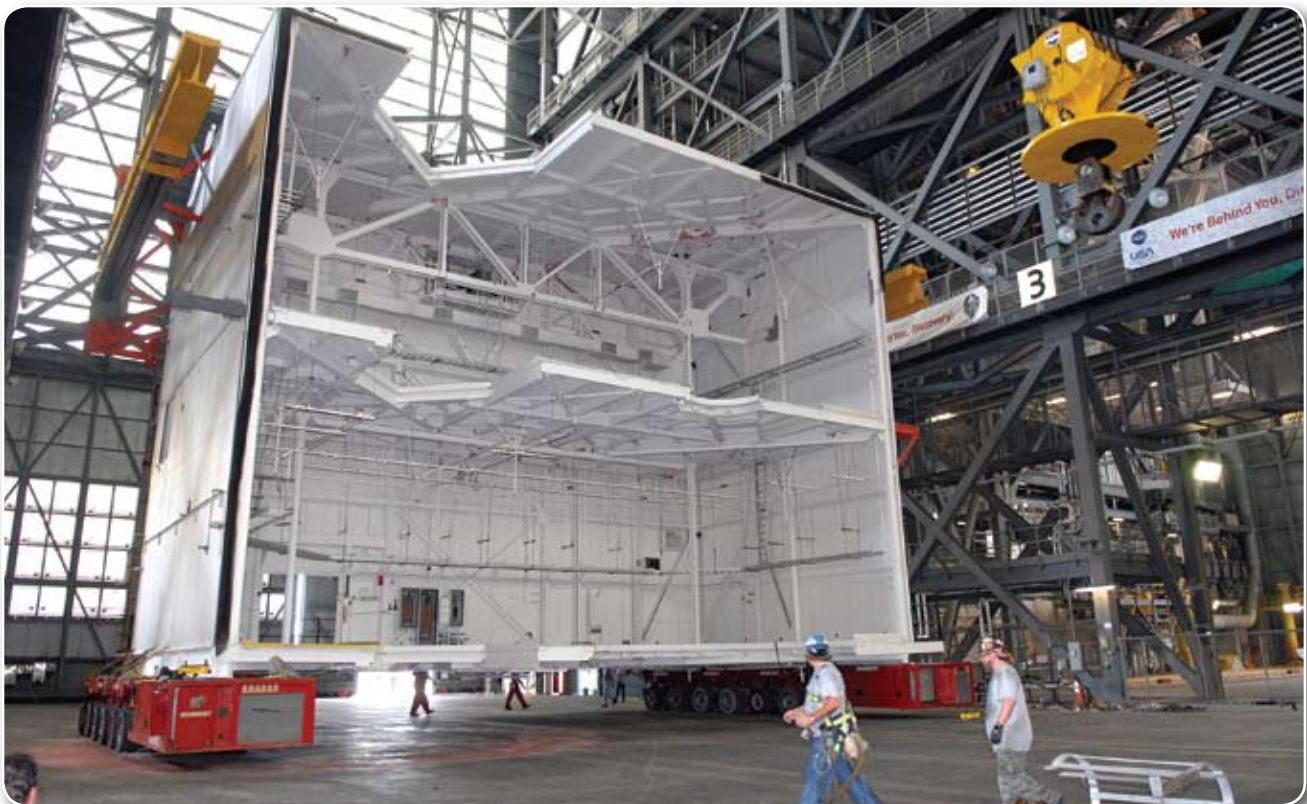
The significant modifications to the external tanks after the Columbia loss, resulted in the tank production rate becoming the limiting factor in meeting the manifest of shuttle launches. To overcome potential delays, certain tasks in the external tank production process were transferred from the Michoud Assembly Facility in New Orleans to Kennedy. This effort freed up enough resources to allow production to continue at a rate that will support the five flights per year required through the end of the program, and enables NASA to meet its presidential mandate.

Another improvement that helps NASA's Space Shuttle Program, helps the environment, too. Using tablet personal computers and wireless internet connections, technicians and engineers in the VAB, the orbiter processing facilities, and numerous other shops are able to eliminate the reams of paper that were used in the maintenance and operations associated with daily processing. This effort will lead the way in becoming more paperless in the processing of NASA's next-generation spacecraft. ■



Above: The Freedom Star, one of NASA's solid rocket booster retrieval ships, tows a solid rocket booster to Hangar AF at Cape Canaveral Air Force Station. The booster is from the STS-123 mission, which launched Endeavour on March 11, 2008.

Below: In the Vehicle Assembly Building at Kennedy Space Center, Platform C was moved from High Bay 3 to allow refurbishment of the facility for the Constellation Program's Ares I-X test vehicle.



Space shuttle Discovery hurtled toward space atop twin columns of fire on its STS-124 mission to the International Space Station, May 31, 2008, at 5:02 p.m. EDT. STS-124 was Discovery's 35th flight.



## International Space Station and Spacecraft Processing

As NASA and the world looks toward the 10th anniversary and construction completion of the International Space Station, Kennedy Space Center continues to play an important role in the orbiting laboratory's future.

This year, Kennedy's International Space Station and Payload Processing Directorate received and processed several high-profile station elements and even hosted processing teams from other NASA centers, the Japan Aerospace Exploration Agency, the European Space Agency and the Canadian Space Agency.

### STS-122 (Columbus Laboratory)

Europe's major contribution to the space station received a guiding hand from Kennedy's payload processing team as the Columbus laboratory was carried out to Launch Pad 39A and bolted inside the payload bay of space shuttle Atlantis. The state-of-the-art laboratory will become a home for space researchers living aboard the station. Atlantis also took an integrated cargo carrier with a nitrogen tank assembly and two external experiments into space during STS-122. Kennedy's team sup-

ported the payload during an extended stay at the launch pad before Atlantis lifted off Feb. 7, 2008.

### STS-123 (Kibo Logistics Module and Dextre)

The Japan Aerospace Exploration Agency, or JAXA, wrapped up ground processing of its Kibo Logistics Module in Kennedy's Space Station Processing Facility, or SSPF. The module successfully launched aboard Endeavour on March 11, 2008, and was temporarily attached to the space station's Harmony Node 2 until delivery of Kibo's large laboratory. Ground processing of Canada's robotic arm called Dextre also was completed at the SSPF and delivered to the space station on STS-123. Dextre works with the station's robotic arm, Canadarm 2, for station maintenance and service.

### STS-124 (Kibo Pressurized Module)

Ground processing crews helped JAXA with the Kibo Pressurized Module, which successfully launched to the space station May 31, 2008. During the STS-124 mission, the large laboratory was attached to

the station's Harmony Node 2 and the Kibo Logistics Module was moved and permanently installed to the Japanese Pressurized Module. Kibo is Japan's first human space facility and enhances the unique research capabilities of the space station.

### STS-126 (Multi-Purpose Logistics Module)

The Multi-Purpose Logistics Module Leonardo carried about seven tons of equipment and supplies to the space station, more than any other mission. Latched inside Endeavour, Leonardo was taken into orbit Nov. 14, 2008. The components, packed by payload technicians at Kennedy, are critical for NASA's future plans to increase the station's resident crew to six. The equipment included new crew quarters, galley facilities, an exercise device and water recycling system. The ground support team also accelerated maintenance on the flex hose rotary coupler so it could be taken into space during the flight. Making room for all the supplies meant installing 12 crew transfer bags to the aft-end cone of Leonardo, something that had not been done before.



Technicians monitored the Special Purpose Dexterous Manipulator, known as Dextre, as a crane moved it into position on a pallet inside the Space Station Processing Facility at Kennedy Space Center. Dextre was delivered to the International Space Station aboard Space Shuttle Endeavour on the STS-123 mission.



The Multi-Purpose Logistics Module Leonardo was lifted from its stand in the Space Station Processing Facility. Leonardo was part of space shuttle Endeavour's payload on the STS-126 mission to the International Space Station.

## FUTURE MISSIONS:

### STS-119 (S6 Truss)

For the space station to house extra crew members who perform science experiments, it needs more power. Discovery and its crew will deliver the fourth and final set of solar arrays and batteries to the station. Kennedy workers modified the S6 truss segment by mounting two battery charge and discharge units to the truss. In order to ensure the life of the batteries, both were removed and replaced with fresh ones. Technicians also successfully performed the S6 truss confidence test, which involved making sure the truss' coolant fluid ammonia didn't leak.

### STS-125 (Hubble Space Telescope)

The Hubble Space Telescope Servicing Mission 4 processing team completed an end-to-end integrated verification test and became the leader for all planning activities supporting hardware delivery dates and integrated launch processing tasks. The team processed the payload and delivered it to Launch Pad 39A before Hubble experienced an anomaly in orbit.

The team had to de-integrate the payload from Atlantis and return it to the SSPE. Because Hubble's equipment is so sensitive, the team also came up with contamination control requirements for Kennedy. In addition, the team coordinated a dry run of the battery removal and replacement contingency operation. Launch was rescheduled for 2009.

### STS-127

#### (Exposed Facility & Exposed Section)

The mission processing team coordinated, prepared for and received JAXA's final two elements of Kibo, the Experiment Logistics Module Exposed Facility and the Exposed Section. Workers are preparing for the integration and test of the pump module, space-to-ground antenna and linear drive unit that will fly to the space station on a vertical cargo carrier aboard Endeavour.

### STS-129 (Express Logistics Carrier)

The STS-129 mission will be the first to fly an Express Logistics Carrier. The large carrier will be used to pre-position key space station spares in orbit, allowing operations to continue long after the space shuttle retires. The Kennedy team devel-

oped an integrated flow for assembly and build up of the mission, compliments of orbital replacement units and payloads.

The Kennedy team also supported key integration operations at NASA's Goddard Space Flight Center in Greenbelt, Md., to fine-tune assembly plans and schedules. They worked closely with hardware providers, as well as safety and configuration managers to identify products required for integration and testing. The first carrier arrived at Kennedy in December 2008. Its associated ground support equipment, a rotation stand, was delivered to Kennedy and certified for use in the SSPE.

### Operations and Checkout Building Reactivation for Orion Production

The effort to turn the Operations and Checkout Building, or O&C, high bay into a world-class Orion spacecraft production facility continued to progress on schedule. The demolition phase wrapped up in January 2008 and activation testing began in October 2008 with the majority of the construction complete. The facility was officially activated in January 2009. Lockheed Martin will have total operational capability, flexibility and independence

within the high bay for Orion production activities.

Construction upgrades include new high and low bays and basement refurbishment with:

- Separate facility power feed, and chilled and hot water
- New ceiling, lighting, flooring and wall surfaces
- New heat, ventilation, air conditioning and ducts
- New fire protection, roofing, freight lifts and crane
- New airlock and vehicle refurbishment area
- New proof press and test cell for vehicle testing
- New vehicle servicing utility suites, and test control room and system
- Refurbished vertical doors
- Preliminary work on a visitor viewing gallery
- The first Orion flight hardware to be processed through the O&C will be the Ascent Abort 2 crew module hardware in the summer of 2010

### Commercial Orbital Transportation Services

Kennedy's International Space Station and Spacecraft Processing Directorate provided support to NASA's Commercial Orbital Transportation Services, or COTS, with management oversight and asset transition. The agency also awarded the Commercial Resupply Services, or CRS, contract to supply the space station in December 2008. SpaceX and Orbital Sciences Corp. were awarded the contract to supply

the station through 2015.

SpaceX is developing Launch Complex 40 at Cape Canaveral Air Force Station in Florida for its launches. SpaceX currently is retrofitting the launch pad to support its new Falcon 9 launch vehicle, and the first of three demonstration launches are planned for 2009. Orbital is developing its launch capability at Wallops Flight Facility in Virginia, and will be launching its Taurus II vehicle in late 2010. ■



Above: Kennedy Space Center's Operations and Checkout Building high and low bays were prepared for complete ceiling-to-floor renovation.



Government and industry representatives viewed the completed high bay during a tour in January 2009.

In the Space Station Processing Facility at NASA's Kennedy Space Center, Japanese Aerospace Exploration Agency technicians test the deployment of an antenna and boom for the Inter-orbit Communication System Exposed Facility, or ICS-EF. The system will launch to the International Space Station aboard space shuttle Endeavour on the STS-127 mission.





## Launch Services Program

NASA's Launch Services Program, or LSP, at Kennedy Space Center led planning and implementation for two expendable launch vehicle missions, while performing advanced planning for more than two dozen missions targeted to launch between

2009 and 2018. The program also celebrated its 10-year anniversary at Kennedy and supported several agency missions during the fiscal year.

The LSP team prepared and launched two missions, nine days apart, from oppo-

site coasts of the country. The Gamma-ray Large Area Space Telescope, or GLAST, launched aboard a Delta II rocket June 11, 2008, from Cape Canaveral Air Force Station in Florida; followed by the Ocean Surface Topography Mission, or OSTM/ Jason-2, launched aboard a Delta II on June 20, 2008, from Vandenberg Air Force Base in California.

To achieve the short turnaround time, the LSP team reviewed all Delta II flight anomalies after the GLAST launch in seven days, rather than several weeks, so that the OSTM mission could be cleared for launch from the West Coast.

OSTM is a unique partnership between NASA's Jet Propulsion Laboratory in Pasadena, Calif., and the French Space Agency. The Launch Site Integration branch coordinated 220-volt electrical power requirements for the French Space Agency at the Astrotech facility in California for OSTM testing and processing. The division also performed a dress rehearsal of procedures and techniques for the Mars Science Laboratory spacecraft's multi-mission Radioisotope Thermoelectric Generator. The bus-sized laboratory is targeted to launch aboard an Atlas V rocket in late 2011.

Though NASA's Interstellar Boundary Explorer, or IBEX, spacecraft launched just inside fiscal year 2009, groundwork and preplanning for the mission wrapped up in 2008. IBEX launched aboard a Pegasus XL rocket from the Kwajalein Atoll in the South Pacific Ocean, which presented several challenges. To meet LSP logistical needs, the Ground Systems Integration Branch developed plans and established support services for the remote location a year from the launch date. All necessary computers, communications equipment, data files and satel-



Inside the mobile service tower on Launch Pad 17-B at Cape Canaveral Air Force Station, workers guided one section of the payload fairing into place around NASA's GLAST spacecraft.

NASA's Gamma-ray Large Area Space Telescope, or GLAST, launched on a Delta II rocket from Launch Pad 17-B at Cape Canaveral Air Force Station in Florida, on June 11, 2008, at 12:05 p.m. EDT. GLAST is a powerful space observatory that will explore the universe's ultimate frontier, where nature harnesses forces and energies far beyond anything possible on Earth.





At Vandenberg Air Force Base in California, engineers checked the fit of the Ocean Surface Topography Mission, or OSTM/Jason-2 spacecraft as it was lowered onto the payload attach fitting for installation. The payload attach fitting is the interface with the Delta II launch vehicle. OSTM/Jason-2 launched aboard a Delta II on June 20, 2008, at 12:46 a.m. PDT.

lite link equipment were transferred to the atoll's missile range to create a self-contained portable launch center. A contingency plan was developed, as well.

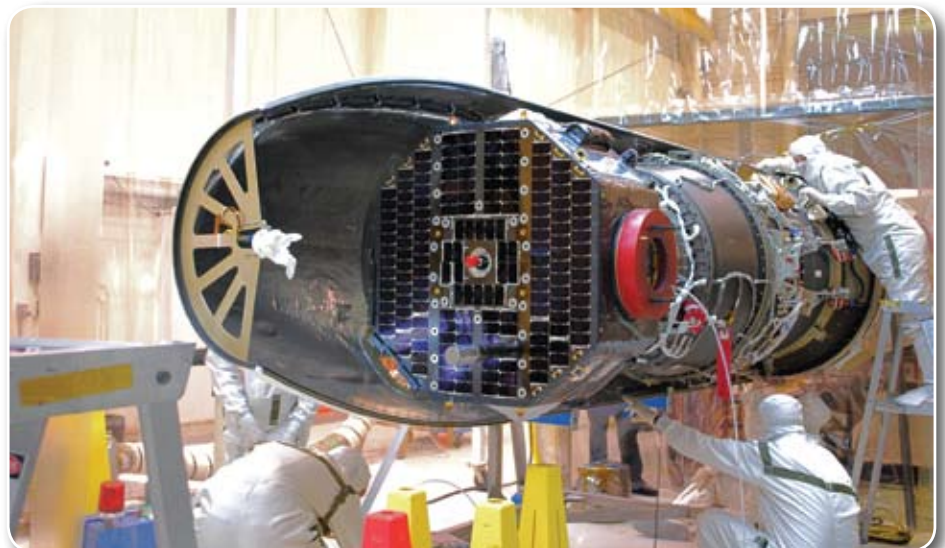
The LSP provided support for the agency's science and exploration systems directorates. Workers are supporting more than 25 science missions in all phases of the development and integration stages. Kennedy provided planning support for NASA-sponsored payloads, including the announcement of opportunity for Small Explorers 12, 13 and 14, and the Mars Scout 2, which selected the Mars Atmosphere and Volatile Evolution, or MAVEN, mission.

Inside a protected clean room tent on Vandenberg Air Force Base in California, workers installed the fairing around NASA's Interstellar Boundary Explorer, or IBEX, spacecraft. IBEX launched atop a Pegasus expendable launch vehicle Oct. 19, 2008.

For NASA's Space Operations Mission Directorate, the LSP provided advanced mission planning for the Tracking and Data Relay Satellite System follow-on missions. For the agency's Explorations Systems Mission Directorate, LSP is providing launch support services for the Lunar Reconnaissance Orbiter's mission integration issues

and unique design requirements.

LSP provided resource protection at Vandenberg's Space Launch Complex-2 during United Launch Alliance's commercial launches, and continued to provide integration and engineering services for the U.S. Missile Defense Agency under the NASA Launch Services Contract. ■



An artist's illustration of NASA's Ares I launch vehicle at Kennedy Space Center's Launch Pad 39B. The illustration shows the emergency egress system and one of three lightning towers in the background.



## Constellation Ground Operations

Excitement for the budding Constellation Program continued to grow throughout 2008, as plans and designs turned into functional facilities to host the Ares I-X flight test in 2009.

Preparations for the Ares I-X mission continued with the successful completion of the critical design review in July. Some of the Ares I-X flight hardware arrived at Kennedy Space Center in November 2008. The upper stage simulator arrived by barge in several sections and was transported to the Vehicle Assembly Building for assembly. Facility readiness reviews were conducted at Kennedy prior to the

arrival of the flight hardware.

For the Ares I-X mission, only the first four segments of the first stage will be active. A fifth booster segment, the upper stage, Orion spacecraft and launch abort system will be simulators matching the dimensions and weight of the operational rocket.

The rocket will launch from Launch Pad 39B, where modifications for the tall rocket have been under way for months. The most conspicuous of these is a set of lightning masts that are being erected around the launch pad. Steel frames are steadily rising and will be topped off in 2009. Another

lightning tower designed for the top of the fixed service structure at Launch Pad 39B also is being built in case the permanent towers are not ready by the time the Ares I-X launches.

Ares I-X will launch from a modified mobile launcher platform used for space shuttle launches. A new platform, called a mobile launcher, is being designed specifically for the operational Ares I rocket. The plans for the structure passed the preliminary design review in May and a contract was awarded for the launcher's construction. Some of the trusses for the mobile launcher were delivered to Kennedy, and assembly work will begin in 2009.

The same firing room that oversaw the first launch of the Space Shuttle Program also will command the launch of the premiere Ares I-X flight test and subsequent Ares/Orion launches. Workers gutted Firing Room 1 -- renamed the Young/Crippen Firing Room for the first shuttle crew -- to make room for computer consoles and systems required for the Ares/Orion launches. The biggest difference is that the Constellation Program requires about half of the consoles needed for a shuttle launch. The Ares I-X firing room is filled with computer cabinets, a single horseshoe-shaped bank of computers and a couple rows of computers where the launch director and test directors will control and monitor tests and launch countdowns.

Hangar AF at Cape Canaveral Air Force Station also was modified for the Ares I-X launch. The hangar was outfitted to handle the four-segment solid rocket boosters used by shuttles, so it had to be modified to accommodate the five-segment version on top for the Ares I.

On Launch Pad 39B, lightning towers are being constructed to hold catenary wires as part of the new lightning protection system for the Constellation Program and Ares/Orion launches.



Although much of the work focuses on the Ares I-X flight test, the Ground Operations Project is moving steadily toward setting up an infrastructure at NASA's Kennedy Space Center to support the operational Constellation Program. That means the center will handle final assembly of Orion spacecraft, processing of Ares I and Ares V rockets and eventually readying Altair spacecraft to land on the moon.

A System Definition Review of the necessary requirements and processes to meet the Constellation Program needs was successfully completed in May, setting the stage for a more intensive evaluation of the ground systems infrastructure, called a Preliminary Design Review. This evaluation is the next critical milestone for the Ground Operations Project.

The past year saw the first designs for the Multi-Payload Processing Facility take shape. The building will be outfitted to load hazardous commodities into the Orion spacecraft.

One of the high bays inside the Vehicle Assembly Building will be refit to assemble and process the 327-foot-tall combined Ares and Orion stack. The Ares I is almost twice as tall as a space shuttle stack and is designed to launch astronauts into orbit aboard the Orion spacecraft. Designs for the final platform construction will proceed throughout 2009.

Early concept work began on the lunar exploration aspects of the Constellation Program. Engineers are evaluating concepts of processing the Altair lunar lander and preparing it for its journey to the moon.

Also, technology experts at Kennedy are making impressive progress in developing systems as part of the In-Situ Resource Utilization, or ISRU, exploration program. One of these systems is the Regolith and Environment Science and Oxygen and Lunar Volatile Extraction experiment package, or RESOLVE, which includes a chemical plant designed to analyze and extract resources from lunar simulated soil. ■



Above: Inside the Parachute Refurbishment Facility at Kennedy Space Center, Deborah Coombs, senior parachute technician, measures suspension lines for the Ares I main canopy. Ares I is an in-line, two-stage rocket that will transport the Orion crew exploration vehicle to low Earth orbit.

Below: In the Assembly and Refurbishment Facility at Kennedy Space Center, a worker attaches an overhead crane to the aft skirt for the Ares I-X flight test. The segment is being lifted into a machine shop work stand for drilling modifications.



## Applied Technology

Innovative technology experts at Kennedy Space Center support NASA's current programs and future exploration missions by developing new products and processes that benefit both NASA and consumers. Using technical expertise, a highly trained work force and top-notch facilities, Kennedy remains a leader in the world of cutting-edge technology.

During the past year, technologists supported several Space Shuttle Program requests ranging from constructing a system and monitoring gaseous nitrogen flow inside the orbiter window cavities to developing certification processes for an ice-imaging camera. They designed and built a handheld device that can accurately measure defects in orbiter windows, as well as a much larger system that can scan entire windows and locate those flaws while the windows remain installed. Investigations to mitigate launch issues include foam de-bonding, foam moisture uptake and ice liberation.

Kennedy's team is developing a smart, environmentally friendly paint system for early corrosion detection, mitigation and healing. They also supported the engineers who assessed the extensive damage to the flame trench at Launch Pad 39A during Discovery's May 31 launch. Some 5,300 heat-resistant bricks lining the northeast wall of the flame trench under the shuttle's mobile launcher platform blew away. Adhesion testing was performed on the bricks to determine the strength of the epoxy bonding between the bricks and the concrete wall.

A critical issue in the repair of NASA's Hubble Space Telescope is the change out of circuit cards in the environment of space. To address this issue, electrostatics experts proposed a Faraday Cage design that will protect the electronic card from residual electric fields and protect Hubble's electronic

system from static discharge. This method will be incorporated into the repair mission, targeted for May 2009.

The International Space Station currently is testing a light-emitting diode, or LED, lighting fixture designed and built at Kennedy. The LED delivers better performance and uses less energy. The expertise needed to develop the fixture came from plant studies using LEDs.

Kennedy's technology team partnered with NASA's Wallops Flight Facility in Virginia to develop Global Position System metric tracking for flight vehicles during launch and ascent by using space assets, such as satellites. The technologists provided flight algorithm and engineering support, as well as computer systems and sensors for the Autonomous Flight Safety System, which currently is being tested

in flight vehicles. Discussions are taking place with NASA's Constellation Program and the U.S. Air Force to incorporate this technology, which soon could be ready for commercial use.

The team is actively working with NASA's Exploration Systems Mission Directorate to develop soil extraction, excavation and surface preparation technologies for the return to the moon effort. Chemists are leading an agencywide effort to develop techniques to extract oxygen from lunar regolith, as well as developing self healing wire insulation. Meanwhile, physicists are investigating methods to control and remove dust and manage plume effects, and biologists are working on water purification, air revitalization, mitigation of radiation effects and management of microbial communities. ■



Bionetics Corp. Lead Mechanical Engineer Todd Mortenson performs a fit check of the Solid State Lighting Module, or LED light, in a lighting fixture slot of a multi-purpose logistics module in the Space Station Processing Facility at Kennedy Space Center.

# Engineering Achievements

The Kennedy Space Center Engineering Directorate's accomplishments during the year exemplify the organization's dedication to high-stakes problem-solving and technical excellence.

## Solar Alpha Rotary Joint Failure Analysis

During the STS-120 mission in October 2007, spacewalking astronaut Daniel Tani collected debris from the International Space Station's starboard Solar Alpha Rotary Joint, or SARJ. The station has two such joints, which allow the station's power-generating solar arrays to track the sun. Tani's sample was returned to Kennedy Space Center for remote failure analysis. The goal: to determine what was causing current spikes and vibrations that a camera mounted on the joint detected.

Using high-resolution optical, laser, and electron microscopes, as well as advanced metallography techniques, Kennedy's engineering team revealed that the mechanism's

race surface was spalling, or flaking, due to contact stress fatigue. Additional samples collected during Expedition 16 and analyzed at Kennedy confirmed the spalling mechanism.

## Launch Pad 39A Flame Trench Analysis and Repair

During the May 31, 2008, launch of space shuttle Discovery on its STS-124 mission, a 15- by 75-foot section of brick was blown loose from the east wall of the Launch Pad 39A flame trench. While leading the analysis and repair team, Kennedy engineers helped evaluate the flame trench system and the extent of the damage, as well as possible designs for a sound repair.

Additionally, the directorate led the hands-on work to demolish the damaged section, repair and install new hardware and concrete, and add an array of sensors to validate computer models and collect data about the flame trench environment.

After the repair, the directorate provided valuable computational fluid dynamics analysis to NASA's Marshall Space Flight Center in Alabama and United Space Alliance engineers to help evaluate the work. Material characterization testing continues in Kennedy engineering labs, with the goal of incorporating the results into future strength analysis models.

## Constellation Program Support and Development

In support of the Constellation Program, Kennedy's Engineering Directorate completed 30 percent design reviews for 42 new subsystems, including the Launch Equipment Test

Facility, or LETF, mobile launcher element and vehicle integration element. The LETF Preliminary Design Review was the first official design review for the Constellation Program. These successful reviews paved the way for the directorate to begin working toward 60 percent design reviews.

Engineering also developed and built a tilt-up umbilical and liftoff simulator, a prototype for what may be used at the launch pad for the Ares I launch vehicle. Because the Ares rocket will ascend faster than the shuttle, the prototype umbilical relies on gravity to retract the umbilical arm during liftoff.

The directorate supported the non-destructive evaluation plan for the Orion Thermal Protection System Advanced Development Project, as well as the Constellation, Ares I-X and Orion contamination control plans for potential impacts to Kennedy ground operations.

## Kennedy Engineering Academy

The Kennedy Engineering Academy, or KEA, continually strives to share relevant knowledge with the center's technological and engineering community. Almost 1,100 people participated in the academy's 14 on-site courses in fiscal year 2008. These included classroom-style sessions and "KEA on the Move," an in-the-field, hands-on session. The academy offers courses for a variety of topics, from "Software Engineering 101" and "Lunar Launch and Landing Concepts" to a tour of the solid rocket booster retrieval ships. For more information, visit: <http://kea.ksc.nasa.gov/>.

## Support of Space Act Agreements

Kennedy's Engineering Directorate actively supports NASA's Space Act Agreements. The directorate contributes to ongoing design, qualification and failure analysis of several space vehicles, including the Orbital Science Corp's Taurus vehicles and the Space Exploration Technologies Corp's, or SpaceX, Falcon 1 rockets. ■



Clara Wright, a Kennedy Space Center materials engineer, uses a stereomicroscope to analyze small fragments of the International Space Station's damaged starboard Solar Alpha Rotary Joint returned on mission STS-120.



## Partnerships

Throughout the year, NASA's Kennedy Space Center developed and strengthened existing partnerships with local, state and federal officials, as well as economic development entities and space industry leaders.

As NASA transitions from the Space Shuttle Program to the Constellation Program, Kennedy strives to keep all of its partners well-informed. Partners include Florida's governor and lieutenant governor, Space Florida, the Economic Development Commission, or EDC, of Florida's Space Coast, Brevard Workforce Development Board, or BWDB, Enterprise Florida Inc., the Florida High Tech Corridor Council, the Brevard County Commission, the Florida Legislature and Congress, as well as chambers of commerce and various key civic associations local to Kennedy.

In fiscal year 2008, Kennedy hosted members of Congress, state legislators and community leaders for the four space shuttle missions that launched from the center. Throughout the year, elected officials and stakeholders visited the center to learn more about Kennedy's mission and the role Kennedy will play in future space exploration.

Kennedy also hosted international ambassadors from more than 45 countries, who were given an overview of America's space program and toured on-site facilities. More than 100 presidents and CEOs from chambers of commerce throughout the state attended a forum at the Kennedy Space Center Visitor Complex to learn about Kennedy's impact on Florida's economy.

Senior management participated in roundtable discussions, space forums and town hall meetings, as well as addressed legislative delegations, to discuss work force issues and NASA's transition to the Constellation Program. Senior management also attended Florida Space Day in Tallahassee and supported NASA's Office of Legislative and Intergovernmental Affairs at the annual Day on the Hill event in Washington, D.C.

Two major Space Act Agreements were signed in May 2008, with Kennedy partners, the EDC and the BWDB. With the EDC, the center will continue to serve as a liaison to the board of directors, support the quarterly space committee and work to

identify business partnerships to create jobs.

The new partnership with the BWDB was a first of its kind for Kennedy, focusing on transition from the shuttle to the Constellation Program. Of particular note, is the weekly presence of the Brevard Job Link Express Bus at the center, which provides a full range of transition assistance to workers. This service was instrumental in helping 43 Space Gateway Support firefighters gain Department of Defense qualification, which enabled them to find new work at Cape Canaveral Air Force Station. By the end of fiscal year 2008, about 500 people had used these services.

Kennedy's membership in the Aerospace Career Development Committee, part of the BWDB, allowed the center to educate and inform partners of the transition program, including new work coming to the center and projected work force numbers.

Additionally in 2008, employees participated in the Combined Federal Campaign and voluntarily contributed \$432,409. The 2008 Campaign was themed "One Small Gift – One Giant Impact." ■



Workers received instruction inside the Brevard Workforce Development Board's Job Link Express Bus at Kennedy Space Center. The bus made various stops around the center to assist with resumes and job searches prior to the Oct. 1, 2008, contract transition.

## Institutional Contract Transition

Kennedy Space Center's 10-year Joint Base Operations and Support Contract with Space Gateway Support LLC, ended Sept. 30, 2008. Approximately 18 months prior, the center formed a transition team to help ensure a smooth and efficient changeover from the previous institutional contract to eight separate NASA contracts.

As the new contracts were awarded and announced, the transition team distributed updated information to the NASA and contractor work force through internal

publications and a transition Web site. The new contracts transitioned in during a 30-, 60- or 90-day period, depending on predetermined requirements.

To minimize impacts to the continuity of operations at Kennedy, several town hall meetings introduced the work force to the new contractors. They provided a forum for customers and stakeholders to hear an overview of what would be changing as the new contracts began.

Comprehensive phase-in plans and pro-

cesses were developed for each follow-on contractor. These plans included risk management, business management, space allocation, work control system and desktop services migration. Also, agreements with the U.S. Air Force, badging, launch readiness and mission critical assurance, mail code transition, property inventory and management, mediation and dispute processes and communication plans.

### Contracts Awarded:

- Institutional Services Contract to EG&G Technical Services Inc. of Gaithersburg, Md. A five-year base contract, and five one-year options.
- Information Management and Communications Support Contract to Abacus Technology Corp. of Chevy Chase, Md. A five-year base contract, and four one-year options.
- Medical and Environmental Support Contract to Innovative Health Appli-

cations LLC of Cape Canaveral, Fla. A five-year base contract, and two one-year options.

- Mail Distribution Services Contract to Government Contract Resources Inc. of Viera, Fla. A one-year base contract, and four one-year options.
- Kennedy Institutional Support Services to REDE-Critique Inc. of Metairie, La. A seven-month base contract, and four one-year options.

- Custodial Services Contract to Brevard Achievement Center of Rockledge, Fla. A one-year base contract, and four one-year options.
- Grounds, Landscaping, Maintenance and Pest Control Contract to S.C. Jones Services Inc. of Dillwyn, Va. A three-year base contract, and two one-year options.
- Agencywide NASA Protective Services Contract was protested and is in the process of being recompeted. ■



Kennedy Space Center participated in several town hall meetings to learn about the new contracts that replaced the Joint Base Operations Support Contract, or JBOSC. Coordinated by Kennedy's contract transition team, the meetings provided valuable information to both NASA civil servants and contractor employees to ensure a smooth transition.

## Environmental Leadership

### Kennedy goes green in 2008

This year, Kennedy Space Center took several steps toward reducing its carbon footprint by building an energy efficient facility, recycling, making use of solar power and protecting the center's surrounding environment.

The center recycled 369 tons of office paper and cardboard, 1,250 tons of scrap metal and more than 21,000 tons of construction material in 2008. The center also expanded its recycling program to include aluminum, plastics and glass. The proceeds from Kennedy's recycling activities funded additional recycling, green procurement and pollution prevention efforts. A portion of the 2008 recycling revenues funded actions, such as purchasing renewable energy credits, mulching and reusing green waste, and testing to validate the use of top coat paint and thermal spray coatings containing low levels of volatile organic compounds.

In July, the center completed construction of a new Life Support Facility incorporating the U.S. Green Building Council's green-building principles. It is the first NASA-funded building on Kennedy property that will receive the council's Leader-

ship in Energy and Environmental Design, or LEED, certification. The building includes sustainable design, construction and operational features, such as increased filtration and carbon monoxide monitoring for improved indoor air quality, dual-flush toilets for water conservation and high-efficiency fluorescent lights.

NASA and Florida Power & Light, or FPL, teamed up to provide Florida residents and America's space program new sources of green power, which will cut reliance on fossil fuels and improve the environment by reducing greenhouse gas emissions.

FPL will lease 60 acres at Kennedy, then build and maintain a solar photovoltaic power generation system that produces an estimated 10 megawatts of electrical power -- enough energy to serve about 3,000 homes. As part of the lease agreement, FPL also will provide a nearly one megawatt system on Kennedy property, inside the center's "grid." This will help NASA meet its goals for use of power generated from renewable energy and enable NASA engineers and technicians to gain experience in energy production. It also may serve as a test bed for solar power technology, which

could be used on the surface of the moon and other planetary bodies.

Kennedy continued its strategic focus on cleaning up environmental contamination from past operations. In 2008, it removed more than 67,000 tons of contaminated soil. The center applied lessons learned from remediation and cleanup efforts to prevent recurrence of environmental contamination.

The center also is restoring more than 2,000 feet of coastal sand dunes damaged by storms during the past four years by replenishing the eroded sand dunes with native plants and installing sand fences to stabilize the restored areas. Storm erosion poses a potential threat to the center's infrastructure, as well as threatened and endangered species, like sea turtles.

In September, Kennedy employees received NASA Blue Marble Awards for energy conservation and environmental stewardship from NASA's Environmental Management Division at the 2008 NASA Environmental and Energy Conference at Langley Research Center in Virginia. ■



On Kennedy Space Center's beach, more than 130 volunteers from Kennedy and the U.S. Fish and Wildlife Service contract organizations gave up an afternoon to gather all of the "unnatural" items along a 6.1-mile stretch of central Florida's east coast shoreline. Volunteers gathered enough trash to fill about 45 garbage bags and enough recyclable plastic and glass to fill 150 bags.

Water lilies reach for the sun from their water beds at Kennedy Space Center. The center, which shares a boundary with the Merritt Island National Wildlife Refuge, is surrounded by marshes and creeks.



## Education

Kennedy Space Center's Education Programs and University Research Division play a key role in educating and preparing the minds of the future. In 2008, Kennedy continued to invest in a variety of learning opportunities to attract and retain students in science, technology, engineering and mathematics, or STEM, disciplines to build the work force of tomorrow. Kennedy provided a variety of hands-on experiences designed to encourage students' interest in space exploration and support teachers in these disciplines.

### Agencywide Project Management

Kennedy manages several agencywide education projects, including the Interdisciplinary Science Program Incorporating Research and Education Experience, or INSPIRE. 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, as well as opportunities to participate in hands-on research during the summer

months at a NASA center. This year, Kennedy hosted 20 INSPIRE interns from Florida, Georgia and Puerto Rico for eight weeks during summer. Ten of the interns were rising 12th graders and 10 had graduated high school and were starting their freshman year of college.

The Minority University Research and Education Programs, or MUREP, Small Programs or MSP, is an Office of Education project funding innovative education initiatives that meet a need or gap within the higher education portfolio. MSP continues to fund two existing projects; the Pre-Service Teacher Conference, or PSTC, and Achieving Competence in Computing, Engineering, and Space Science, or ACCESS, serving pre-service teachers and students with disabilities respectively. During the year, MSP provided seed funding to New York City Research Initiative, Virginia State University, and Navajo Technical College and an expansion of NASA Science and Technology Institute for Minority Institute at Ames Research Center in California for pre-service teachers.

NASA's Exploration Systems Mission Directorate, or ESMD, supports a higher-education project called the Space Grant Systems Engineer Paper Competition, which is a highly-competitive, national scholarship designed to engage and retain students in STEM fields and is judged by ESMD systems engineers throughout the agency.

During the 2007-08 academic year, the ESMD Space Grant Student Project continued to provide internship opportunities, senior design project participation and a systems engineering paper competition. A total of 115 NASA and industry ESMD internship opportunities and 74 ESMD senior design projects were supported across the nation.

### K-12

NASA's Space Operations Mission Directorate partners with Kennedy on teacher professional development and student workshops through the NASA Education Exploration Team operated by the University of Central Florida and the Florida Space Grant Consortium. The directorate provided STEM-related workshops for educators, hands-on classroom activities for students, and educational information to the general public.

NASA's Educator Resource Center, Aerospace Education Services Project and Kennedy's Exploration Station collaborated on sustained professional development on-center and off-center for formal and informal educators and students. During the year, 31,110 K-12 students and 650 scouts experienced NASA STEM activities. The team also provided educational STEM workshops to 9,579 K-12 educators. For

Rebecca Wight, a student from Matanzas High School in Palm Coast, Fla., participates in a soil stabilization experiment at Kennedy Space Center during the first Governor's School pilot program for gifted students. More than 50 students participated in the program.





Teachers from the Kennedy Space Center region of the NASA Explorer Schools program participated in workshops at the Center for Space Education at the Kennedy Space Center Visitor Complex.

informal programs, 8,944 people came to experience the Exploration Station activity room in the Center for Space Education building, which utilizes aerospace hardware to compliment the teaching of rocketry, spaceflight, space science and space exploration.

A pilot program called the Florida Governor's School for Science, Mathematics and Space Technology also came to Kennedy during the summer of 2008, providing rising 10th-12th grade gifted students the opportunity to learn in a residential-type setting at Kennedy. Students engaged in exciting laboratory activities, scientific experiments and inquiry-based learning, incorporating a high-level science and math curriculum. Program funding was provided by the state of Florida and given to three universities to plan and test it: Florida Tech, Embry Riddle Aeronautical University and Florida State University. Space Florida, NASA and Delaware North Park Services provided the curriculum.

Kennedy's education specialists hosted a NASA Day at the 16th annual Model

Schools Conference at the Swan and Dolphin Resort in Orlando, Fla. It is the nation's premier conference on K-12 education reform, where about 7,000 teachers and administrators attended hands-on workshops and sessions, emphasizing NASA resources, the agency's 50th anniversary and the Constellation Program. Florida NASA Explorer School students and teachers also attended and showcased how NASA's resources have enhanced their schools.

Approximately 50 educators from six designated General Electric Co., or GE, regions participated in a weeklong workshop at Kennedy taught by the National Science Teachers Association, or NSTA, and NASA representatives. The workshop featured a two-day methods course, a concurrent leadership conference for administrators in the GE regions, and NASA taught two workshops on microgravity and rocketry.

#### **Higher-Education Programs**

Kennedy hosted 169 interns during the year. About 38 percent of the participants

were minorities from the following minority-serving institutions: Florida A&M University, Howard University, Bethune-Cookman University, Morehouse College, Dillard University, New Mexico State University, and Polytechnic University of Puerto Rico, as well as Universidad del Turabo and Manuela Toro Morice in Puerto Rico.

#### **Minority-Focused Programs**

Kennedy hosted the fourth Pre-Service Teacher Institute, or PSTI, in 2008. Thirty-one students participated from minority institutions in Alabama, Arkansas, California, Florida, Kansas, Mississippi, New Mexico, North Carolina, Texas and Virginia. Students in junior and senior colleges, majoring in education, learned how to create effective lesson plans for mathematics and science, while incorporating technology and NASA initiatives. NASA partnered with a Brevard County school, which allowed participants to conduct a lesson plan to fourth- and fifth-graders using NASA's unique educational resources, tour Kennedy's operational areas and speak



The Historically Black Colleges and Universities program provided opportunities for inner-city youth in grades K-12 to attend education workshops at Kennedy Space Center.

to NASA engineers and technicians during a career panel session.

Grants were awarded to four Historically Black Colleges and Universities: Morgan State University, North Carolina A&T State University, Prairie View A&M University, and Tennessee State University to bring inner-city youth participating in a university K-12 program to Kennedy for an education workshop, conversations with engineers, scientists and astronauts, tour, and possible launch viewing. This program focused on students understanding the need to be successful in STEM studies and enabling a successful background in any STEM-based career.

#### **Electronic Education Projects**

NASA's Digital Learning Network, or DLN, really hit the ground running this year. DLN connected with 10,867 students and 1,826 educators during the 2007-08 school year. The network celebrated NASA's 50th anniversary with middle-

school students and a special guest, former NASA Launch Director Bob Sieck, who worked with Kennedy's Apollo, Gemini and shuttle spacecraft. The network also piloted its first live webcast near Kennedy's Launch Pad 39A, in the 60 minutes leading up to the launch of STS-124. The interactive webcast featured special guests from the higher education community, as well as mission and launch content.

#### **Informal Education**

Thirty local librarians participated in an on-site workshop held Sept. 20-Oct.1, 2008. This train-the-trainer workshop equipped librarians with the knowledge and skills needed to conduct NASA-related after-school workshops at their local library, such as NASA's Space Exploration Program, the Lunar Reconnaissance Orbiter mission and NASA's plans for exploring the moon. The librarians also learned about NASA static display exhibits that are available for short-term loans. Funding

was provided by the Kennedy Space Center Visitor Complex project initiative that Congress directed in 2008.

Kennedy and McNeill Designs for Brighter Minds Inc. entered into a Space Act Agreement for the creation of the "You've Been Sentenced" card game – NASA 50th Anniversary Special Edition Add-On Deck. The main goal of the game is to make sentences with the words on the cards. The add-on deck includes NASA terminology in a unique and fun way for players to understand NASA's language.

Sixty percent of NASA astronauts were Boy or Girl Scouts when they were kids, and NASA and Kennedy carried on that tradition by hosting exciting workshops provided by the NASA Education Exploration Team for 128 Boy Scout and 1,554 Girl Scout leaders and volunteers from central Florida in 2008. ■

Perched high on the branch of a tall pine tree at Kennedy Space Center, a bald eagle surveys its surroundings. There are several active nests of bald eagles throughout the Merritt Island National Wildlife Refuge, which shares a boundary with the center.





## Outreach to the World

### KSC Visitor Complex

The Kennedy Space Center Visitor Complex shared NASA's message with more than 1.6 million guests, reaching both a national and international audience with memorable experiences. Attendance for 2008 surpassed the previous year by 6 percent due to successful marketing initiatives, including continued focus on the new Shuttle Launch Experience, increased annual pass sales and national promotions with high-visibility partners, such as Kraft Macaroni & Cheese, Space Coast Tourism Development Council, Expedia.com, Travelocity and Chick-fil-A.

Large crowds of enthusiastic tourists

and central Floridians flocked to the Space Coast to experience Kennedy launches. The Visitor Complex hosted thousands of guests during four space shuttle missions and one expendable launch vehicle mission, which began with spectacular liftoffs from the Space Coast.

Two new exhibits debuted, including a space shuttle wing at the U.S. Astronaut Hall of Fame, showcasing the personal artifacts of NASA's hero astronauts, and Eye on the Universe: Hubble Space Telescope, featuring amazing images captured by the world's most powerful telescope. Concept designs also were initiated for the permanent display of a space shuttle orbiter at

Kennedy, relocating the hall of fame's museum to the main complex and a new Constellation Program-themed exhibit.

Construction projects included refreshing the Kurt H. Debus Conference Facility, refurbishing restrooms at the complex's entrance and exit points, and major renovations to the Orbit Cafe.

Particularly noteworthy is the design completion of a 13,000-square-foot artifact storage warehouse, which will be the Visitor Complex's second Leadership in Energy & Environmental Design, or LEED, certified facility. This new facility will enable the complex to perform its curatorial responsibilities for unique artifacts and exhibits at a



NASA Public Affairs Specialist and Informal Outreach Coordinator Andres Adorno, left, talks with a participant at NASA's Future Forum event in Miami, Fla. Kennedy Space Center's exhibit featured a display of NASA's next-generation spacecraft, the Ares I and Ares V. The Future Forum was one in a series of presentations in various U.S. cities to celebrate NASA's 50th anniversary.



Sen. Bill Nelson, D-Fla., talks to workers inside the Vehicle Assembly Building at Kennedy Space Center. Nelson toured the center with Kennedy Director Robert Cabana, background at right.

higher degree of quality than ever before. It also will position the complex as a key candidate for custodian of historical property from NASA's Space Shuttle Program.

Additionally, the complex's education programs successfully educated and inspired the next generation of explorers. Overall, 80,000 students participated in Camp KSC, Overnight Adventures, the Astronaut Training Experience and field trips.

In addition to the highly successful partnership with Brevard County Schools, hosting more than 11,300 sixth- and seventh-grade students through formal curriculums, such as Brevard Space Week and Brevard Learns About Science and Technology. A new pilot program with Orange County Schools reached 2,500 eighth-grade students from surrounding communities.

Special events reached non-traditional audiences too, including the induction of the sixth class of space shuttle astronauts to the U.S. Astronaut Hall of Fame, the second Fall Concert Series in the Rocket Garden, and the highly attended KSC Space and Air Show featuring the U.S. Navy's Blue Angels' spectacular performance over the Banana River.

In its 41st year of existence, Kennedy's Visitor Complex operated as a self-supporting entity funded solely through admission, retail and food sales. The complex remains one of Florida's top five most visited tourist destinations.

#### **Exhibits**

From spectacular air shows to inspiring technical conferences, Kennedy's Display Management Team and Integrated Display

Staff supported 22 events across the southeastern United States. Most events were open to the public, with several focused on minority groups, such as African-Americans, Puerto Ricans and Hispanics, as well as student groups, scientific and technical groups, and other government agencies.

During the year, NASA celebrated its 50th anniversary and Kennedy supported several major events in conjunction with other NASA centers and NASA Headquarters.

NASA's outreach team reached about 200,000 people with displays and handout materials featuring the benefits of space, NASA spin-offs and the agency's mission. The program also supported national events, such as the Smithsonian Folklife Festival in Washington, D.C., which alone attracted more than one million visitors.

### Guest Operations

Kennedy's Guest Operations staff enabled more than 15,700 guests to participate in behind-the-scenes Kennedy tours, including educational briefings provided by center engineers and operational experts. Additionally, the center hosted thousands of NASA's invited guests to participate in launch briefings and an up-close view of four space shuttle and two expendable launch vehicle liftoffs. Guests included members of Congress, business and agency leaders, astronaut families, medical and legal professionals, veterans, teachers, students and the public.

### Speakers Bureau

NASA's Speakers Bureau reached more than 20,000 people at 100 events during 2008. Kennedy engineers, scientists, senior management and NASA astronauts spoke at events in Florida, Georgia and across the Midwest.

Utilizing resources, such as new presentations on NASA's transition from the Space Shuttle Program to the Constellation Program, as well as a new agencywide Speakers Bureau database, the Kennedy team reached educators, scientists, government representatives, special interest groups and industry officials. Other groups included, minorities, women leadership programs, churches and scouting groups, universities, civic and professional organizations, and retirement communities.

### Media Services

The Media Services Division at Kennedy's NASA News Center increased international awareness by supporting media coverage of four shuttle launch and landing events, which included delivering the European Space Agency's Columbus module and Japanese Aerospace Exploration Agency's Kibo module to the International



Space Station. Support also was provided for two expendable vehicle launches from a variety of locations and other NASA milestones.

The division interfaced with the world's media and public audience through a variety of 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 400,000 page views this year, and a full-service Public Affairs Office catering to professional journalists. In addition, the division provided more than 185,000 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 at [www.nasa.gov/kennedy](http://www.nasa.gov/kennedy) continues to draw a worldwide audience. The center's home page attracted more than 4.7 million views and consistently ranked in the top ten most-popular pages out of more than one million pages within the NASA Web portal at [www.nasa.gov](http://www.nasa.gov).

The "L-1" series of prelaunch web casts featured astronaut guests, 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

Rock singer Rick Springfield entertained crowds of people at the Kennedy Space Center Visitor Complex to help celebrate NASA's 50th anniversary.

Learning Network in order to bring a dynamic new perspective and academic audience to Kennedy's prelaunch webcast series.

The Web team provided launch processing and countdown coverage for four space shuttle missions and two expendable vehicle missions during the year. An international Internet audience was kept up-to-date during countdowns and landings via 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 a half-million page views.

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

During December 2007 and January 2008, the Kennedy Web site, along with the entire NASA Web portal, received a fresh look and feel. The Kennedy Web team supported the agency's redesign effort by transitioning several sections and pages to the new design, helping ensure a seamless browsing experience for NASA Web visitors. ■



Colorful fireworks light up the night sky over the Kennedy Space Center Visitor Complex's Rocket Garden during a NASA 50th Anniversary celebration.

# KSC Business Report

## Chief Financial Officer (CFO)

FY 2008 was a successful year for the financial and business operations of Kennedy Space Center. The center maintained and continued its trend of sustained budget growth. The Office of the Chief Financial Officer made positive contributions toward NASA's quest in obtaining an unqualified financial opinion from independent auditors. Business development agreements this past year will yield long-term benefits for the center. These and other initiatives contributed to the efficient operation of Kennedy.

## Kennedy Budget

The Kennedy budget in FY 2008 totaled about \$1.4 billion, and more than \$2.3 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 \$117 million in reimbursable work with other government and commercial entities.

Specifically:

- The Space Shuttle Program executed its \$1.1 billion budget, including SPOC, in accomplishing four successful missions during FY 2008, all of which in-

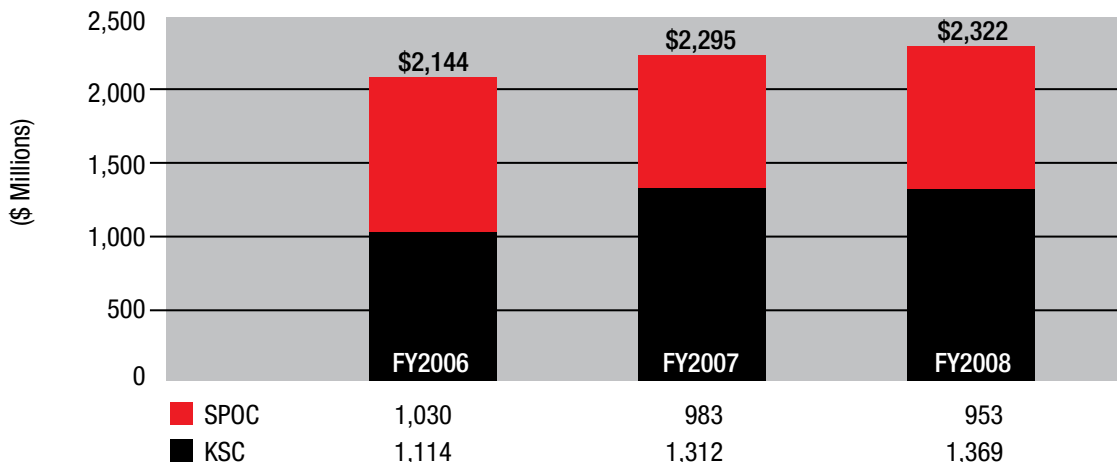
stalled major components or logistics to the International Space Station. Activities also included preparing for five flights in FY 2009, among them the Hubble Space Telescope repair mission.

- The Launch Services Program's \$362 million budget included funding from NASA's Science Mission Directorate, or SMD, and Space Operations Mission Directorate, or SOMD. The program supported the successful launch of two missions: Gamma-ray Large Area Telescope, or GLAST, from Cape Canaveral Air Force Station in Florida and Ocean Surface Topography Mission, or OSTM/Jason-2, at Vandenberg Air Force Base in California, while procuring launch vehicle services for several manifested missions scheduled to launch in FY 2009 and beyond.
- The International Space Station's \$98 million budget allowed for fulfillment of commitments to international partners in completing the orbiting laboratory's assembly, including several major component deliveries -- the Node 2 module called Harmony, the European Space Agency's Columbus laboratory and the

Japan Aerospace Exploration Agency's Kibo laboratory, and funded the ongoing processing and flow of remaining station components at Kennedy.

- The Constellation Program's budget of \$270 million supported continued preparations for the ground operations, launch, landing and recovery of the Ares launch and the Orion crew exploration vehicles for exploration, and planning of ground operations and launch of the lunar lander and components of the lunar outpost.
- The Kennedy Center Management & Operations' budget provided \$323 million to maintain the center's mission-essential facility systems, core technical capabilities and supporting infrastructure; sustain the center's safety and engineering technical authorities; implement NASA's Chief Information Officer initiatives; and provide business systems support with improved internal controls. Kennedy successfully competed, awarded and transitioned to several new institutional services contracts with the completion of the Joint Base Operations Support Contract, or JBOSC.

## NASA/KSC Budget Authority Summary FY 2006 through 2008 (\$ in Millions)



United Space Alliance, or USA, is the contractor for the Space Program Operations Contract at Kennedy Space Center. The space shuttle processing work is managed by Johnson Space Center and performed at Kennedy.

## Kennedy Space Center FY 2008 Budget Authority (\$ in Millions)

Space Shuttle	\$211
Space Station	\$98
Launch Services/Science	\$362
Constellation	\$270
Center Management & Operations	\$323
Other	\$105
<b>Total KSC*</b>	<b>\$1,369</b>

*\* Excludes Space Program Operations Contract*

## FY 2008 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 is excluded here. Its inclusion would increase the percentage of procured services to 88 percent.

### Financial Systems & Processes

Kennedy's financial processes and regulations are continually being improved in an effort to bridge the gaps identified in NASA's audited financial statements toward achieving an unqualified audit opinion. Toward that end, the CFO office established and staffed a Financial Quality Assurance Office to provide oversight and monitoring of Kennedy's internal control processes. Further, Kennedy and other cen-

ters formalized a Continuous Monitoring Program and associated metrics to assure the transactions reflected in the agency's financial system are accurate.

The last two modules of the Integrated Enterprise Management Program, or IEMP, were implemented in FY 2008 – eTravel and Integrated Asset Management.

**eTravel** - Continuing to centralize and improve NASA's financial management. Kennedy, as the agency's pilot center,

implemented the new eTravel solution in June 2008. eTravel is one of five e-Gov initiatives launched in response to the President's Management Agenda. FedTraveler.com, under the EDS Corp., managed the implementation. The new system provides NASA with a standardized, comprehensive and integrated tool to support online booking, travel planning, travel expense reimbursement, payment processing, credit card reconciliation, and manage-

ment reporting for NASA. FedTraveler.com will rollout to the remaining NASA centers in 2009, benefiting from Kennedy's knowledge sharing events, as well as lessons learned and training.

**Integrated Asset Management** – Integrated Asset Management, or IEM, for NASA Property, Plant, and Equipment, or PP&E, was implemented agencywide in May 2008. This system was developed to provide a more reliable financial management of NASA's assets through the integration of asset accounting and equipment management data in one system. Kennedy uses this system to manage, track, value and account for NASA-owned personal property.

### **Business and Partnership Development**

Several major projects to improve efficient use of Kennedy assets and develop new business opportunities from non-traditional partnerships were initiated in FY 2008. Kennedy had 97 active reimbursable agreements, which generated \$117 million in commercial work for other federal and non-federal entities.

Using its authority to enter enhanced-use leases, Kennedy leased a 60-acre site to Florida Power and Light, or FPL, Florida's

largest power utility, to enable the construction and operation of a 10 megawatt solar power generation facility. FPL will construct a separate one megawatt solar power facility for Kennedy in return. The construction for this significant renewable energy project will begin in 2009, and will contribute to both the national goals of reduced carbon emissions and dependence on foreign oil, and help to reduce utility costs at the center.

In December 2008, Kennedy also developed and signed a lease of a 60-acre site to Space Florida to enable the development and operation of Exploration Park, a planned mixed-use technology and commerce park adjacent to the existing Space Life Sciences Laboratory. The project is expected to provide an environment that fosters opportunities for growing U.S. commercial space capabilities to support NASA's mission, to nurture the development and deployment of technology, and enables and supports the nation's exploration and use of space to open up other aspects of space commerce.

In 2008, Kennedy continued to develop new non-traditional partnerships that can bring compatible uses and users to the center. Examples include research conduct-

ed by the U.S. Coast Guard Research and Development Center, and the continued use of the Shuttle Landing Facility by Zero Gravity Corp.'s commercial microgravity flights and aerodynamic testing by several race car teams.

Kennedy established the new Center Planning and Development Office to focus and integrate these and similar activities to plan and implement the center's transition from the shuttle era and its development of a broadened user base supporting NASA's mission and the commercial space industry. The Center Development Office, working closely with the Kennedy Applied Technology Directorate, will lead the development of non-traditional business and partnerships, and serve as a new "front door" for such business activities with the center. These commercial and reimbursable activities are beginning to bring in needed revenue to the center, offsetting center operating costs, employing a skilled work force, and allowing limited investments to create additional future commercial opportunities. The center continues to seek out and secure commercial and business partnerships as a permanent part of the future.

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## Economic Impact

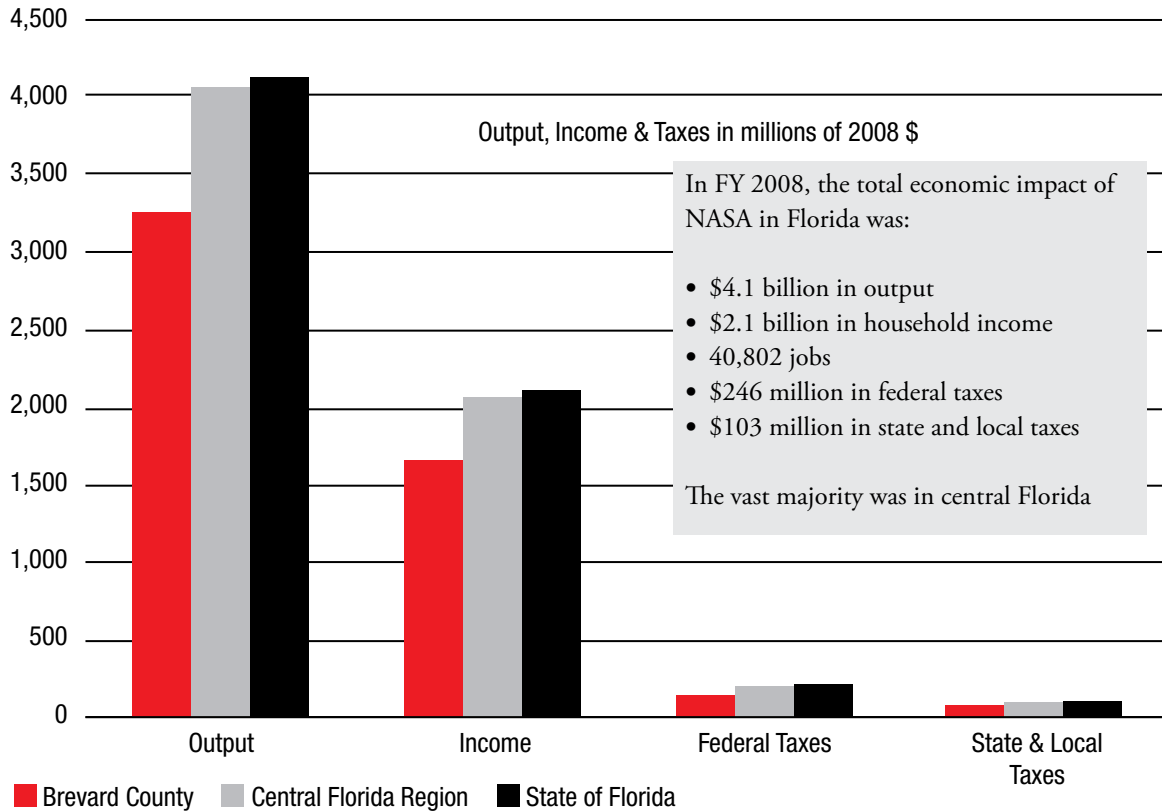
To fulfill its mission, NASA and its contractors require a range of goods and services, both technical and non-technical, ranging from expendable launch vehicles, propellants and computer systems, to motor vehicles, facilities and office supplies. In meeting NASA's demand, local contractors employ workers, 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. In addition, 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.

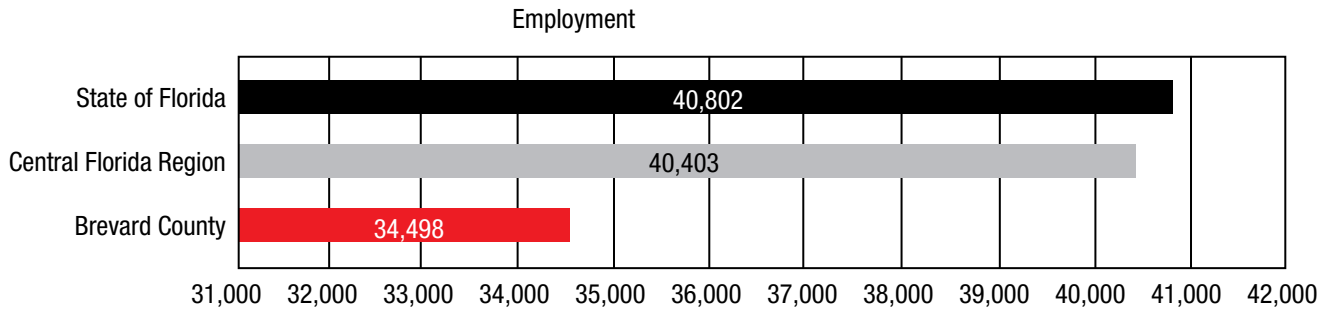
Kennedy annually conducts an economic impact analysis to measure NASA's effect on the economy at the local, regional and state levels. The assessment found that in FY 2008, of NASA's \$17.3 billion budget,

Kennedy and other NASA centers injected \$1.1 billion in wages and \$833 million in purchases into the local and state economies of Florida, which induced a total economic impact of \$4.1 billion in total output and 40,802 jobs within the state of Florida. The report concludes that every space-related dollar spent in Florida produces more than double the economic impact; and every space-related job creates an additional 1.8 jobs within 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 2008 Total Economic Impact of All NASA Activities in Florida by Geographic Area



Area of Economic Impact	Millions of 2008 \$			
	Output	Income	Federal Taxes	State & Local Taxes
Brevard County	3,238	1,676	153	71
Central Florida Region	4,069	2,085	234	98
State of Florida	4,150	2,104	246	103



For every job at Kennedy, an additional 1.82 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 \$2.12 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 individ-

uals fulfill a multitude of tasks.

At the end of each year, 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 September 30, 2008, the total

Kennedy population was 14,864. This includes 2,154 full-time, other-than-full-time NASA civil servants and students, as well as 10,888 on-site and near-site contractor employees. The civil servant skill mix includes scientific and engineering, administrative, technical, and clerical workers. There are 390 construction employees, and 1,432 tenants on the center.

### KENNEDY SPACE CENTER WORK FORCE PROFILE (through 9/30/08)

<b>Total Civil Servants</b>	<b>2,154</b>
<b>Civil Servant Skill Mix</b>	
Scientific & Engineering	63%
Administration	27%
Technical	6%
Clerical	3%
On-Site Contractor Employees	10,757
Off/Near-Site Contractor Employees	131
<b>Total Contractor Employees</b>	<b>10,888</b>
<b>Total Construction Employees</b>	<b>390</b>
<b>Total Tenants</b>	<b>1,432</b>
<b>TOTAL KSC POPULATION</b>	<b>14,864</b>

# Procurement Report

## Industry Partners at a Glance

The companies listed below were Kennedy's top support contractors or launch services contractors in terms of dollars obligated in FY 2008. Following is a brief description of their work for the agency:

### Space Gateway Support Co.

Space Gateway Support, or SGS, a joint venture of Northrop Grumman Corp. and Wackenhut Services Inc., provided base operations support for Kennedy and Cape Canaveral Air Force Station, or CCAFS. SGS was responsible for activities, such as roads and grounds maintenance, facilities maintenance, custodial, fire, security, calibrations and propellants handling.

### Boeing Space Operations Co.

Boeing Space Operations, a wholly-owned subsidiary of The Boeing Co., was the prime contractor for the Checkout, Assembly and Payload Processing Services, or CAPPSS, 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.

### InDyne Inc.

InDyne provided communication services under the Kennedy Integrated Communications Services, or KICS, contract by supporting the space shuttle, payload carriers, launch services and the International Space Station. InDyne provided hardware and software integration and development for voice, video and data communications. InDyne also provided motion picture, photographs, digital and video products and services for NASA, commercial expendable launch vehicle and Department of Defense customers, as well as the operation, administration and maintenance of the telephone system supporting all Kennedy employees.

### Analex Corp.

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 CCAFS 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 Corp.

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.

### Dynamac Corp.

Dynamac, under the Life Sciences Services Contract, provided a broad range of life science services to NASA. These include medical operations for shuttle and station programs, environmental compliance and stewardship, life sciences payload operations, support to NASA's Occupational Health Program, biological sciences, life sciences payload develop-

ment, work force protection, fitness and education outreach.

### United Launch Services LLC

United Launch Services, or ULS, brought The Boeing Co., Delta Launch Services Inc. and Lockheed Martin Commercial Launch Services together. ULS provides launch services to NASA using the Delta II and Atlas vehicles under two of three existing NASA launch services multiple-award Indefinite Delivery 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 the Delta II and the Atlas vehicles launch from CCAFS and Vandenberg.

### Lockheed Martin Information Technology Services Co.

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

### Orbital Sciences Corp.

Orbital Sciences Corp., or OSC, provided the agency's Launch Services Program, or LSP, with the Pegasus and Taurus small expendable launch vehicles at CCAFS, Vandenberg, Wallops Flight Facility in Virginia and equatorial launch ranges. OSC was the contractor for one of three existing NASA LSP multiple-award Indefinite Delivery Quantity task order contracts. Additionally, OSC provided Pegasus and Taurus vehicles to the agency under a second contract, the Small Expendable Launch Vehicle contract.

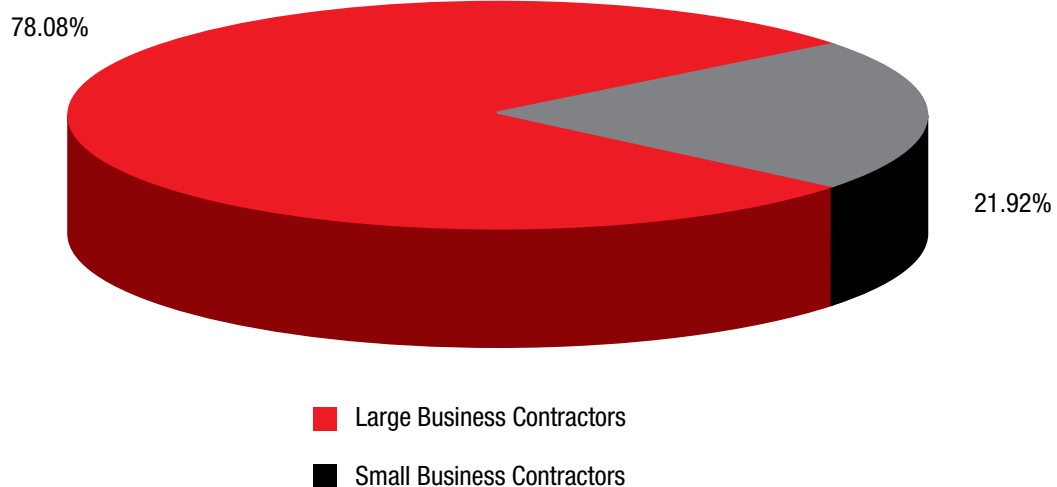
### United Space Alliance LLC

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.



Kennedy Space Center Deputy Director Janet Petro cut the ribbon at a ceremony July 14, 2008, marking the official opening of the Life Support Facility. The facility is recognized as the first NASA-funded building that received the U.S. Green Building Council's LEED Certification, also known as Leadership in Energy and Environmental Design.

### FY 2008 KSC Dollars Obligated to Large and Small Business



## Your Procurement Dollars at Work

### Geographical Distribution by State (Fiscal Year 2008 Obligations)

STATE	TOTAL DOLLARS	STATE	TOTAL DOLLARS
ALABAMA	4,475,012.17	MISSISSIPPI	11,818.00
ARIZONA	213,295.82	MISSOURI	285,605.81
ARKANSAS	51,400.00	NEW HAMPSHIRE	1,106,777.92
CALIFORNIA	119,305,951.95	NEW JERSEY	1,599,476.21
COLORADO	184,096,225.81	NEW MEXICO	731,555.54
CONNECTICUT	11,351,662.17	NEW YORK	1,702,373.57
DELAWARE	32,404.56	NORTH CAROLINA	111,846.75
DISTRICT OF COLUMBIA	873,321.02	NORTH DAKOTA	11,744.79
FLORIDA	291,445,206.88	OHIO	3,572,755.76
GEORGIA	446,470.15	OKLAHOMA	496,513.21
IDAHO	33,555.84	OREGON	64,715.00
ILLINOIS	574,707.57	PENNSYLVANIA	8,800,884.99
INDIANA	202,983.80	RHODE ISLAND	69,687.47
IOWA	174,516.22	SOUTH CAROLINA	7,880.24
KANSAS	30,888.00	TENNESSEE	3,609,015.24
KENTUCKY	256,400.86	TEXAS	13,755,749.28
LOUISIANA	4,620,647.42	UTAH	206,954.54
MARYLAND	126,818,132.49	VIRGINIA	413,789,411.71
MASSACHUSETTS	1,060,185.16	WASHINGTON	88,750.85
MICHIGAN	2,354,803.86	WEST VIRGINIA	22,065.00
MINNESOTA	829,801.00	WISCONSIN	820,684.59
		<b>TOTAL</b>	<b>\$1,200,133,839.22</b>

## Top 25 KSC Business Contractors for FY 2008

Contractor	Number of Contracts/Orders	Dollars
UNITED LAUNCH SERVICES, LLC	2	296,084,458
SPACE GATEWAY SUPPORT CO.	1	266,761,143
HENSEL PHELPS CONSTRUCTION CO.	1	108,464,473
THE BOEING CO.	1	104,163,803
ASRC AEROSPACE CORP.	1	75,627,423
INDYNE INC.	1	56,242,813
ORBITAL SCIENCES CORP.	1	37,158,946
ANALEX CORP.	2	32,506,424
DYNAMAC CORP.	1	14,561,154
OAD CORP.	3	12,526,414
PRAXAIR INC.	10	10,571,137
REYNOLDS SMITH AND HILLS INC.	13	10,011,642
ASTROTECH SPACE OPERATIONS INC.	14	9,568,594
SCIENCE APPLICATIONS INTERNATIONAL CORP.	3	7,979,583
SAUER INC.	9	7,920,767
CANAVERAL CONSTRUCTION COMPANY INC.	9	7,313,429
MILLENNIUM ENGINEERING AND INTEGRATION CO.	2	5,902,133
AIR PRODUCTS AND CHEMICALS INC.	3	5,574,369
SPEEGLE CONSTRUCTION INC.	6	5,385,003
MILITARY CONSTRUCTION CORP.	5	5,255,432
JONES EDMUNDS AND ASSOCIATES INC.	54	4,695,883
REDE-CRITIQUE INC.	21	4,619,451
RUSH CONSTRUCTION INC.	9	3,876,116
AIR LIQUIDE LARGE INDUSTRIES US LLP	1	3,850,711
SHORELINE FOUNDATION INC.	1	3,280,000
<b>TOTAL</b>	<b>174</b>	<b>\$1,099,901,301</b>



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**John F. Kennedy Space Center**  
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