

Kennedy Space Center
2004
ANNUAL REPORT

Table of Content

Center Director's Message	2
NASA Vision and Mission	3
U.S. Vision for Space Exploration	4
President's Management Agenda	6
Significant Events	8
Our Transformation	12
The NASA Values	13
Space Shuttle Program	16
International Space Station and Payload Processing	21
Launch Services Program	23
Hurricane Damage and Recovery	25
Environmental Leadership	26
Spaceport and Range Technologies	28
Partnerships	31
Education Programs	32
Outreach to the World	34
2004 KSC Business Report	
Chief Financial Officer's Letter	38
Economic Impact	40
Work Force Diversity	43
Procurement Report	44

Center Director's Message

On the day our astronauts take their first steps on the "red planet," historians will ask, "When did this journey truly begin?" They will point back to 2004 and this incredible year in our Agency's history. The year 2004 will undoubtedly go down as one of the most pivotal years for NASA as President George W. Bush, on January 14, announced America's new Vision for Space Exploration. The U.S. Congress proved its commitment to our Agency when it endorsed the Vision in November by fully funding the President's proposed space exploration budget.

In 2004, Kennedy Space Center (KSC) made a commitment to "raising the bar" and surpassing the Columbia Accident Investigation Board requirements, and by all accounts, we met this challenge. Our team reassembled Space Shuttle Discovery's major components, preparing it for testing and its eventual roll over to the Vehicle Assembly Building in 2005. Shuttle technicians completed stacking the Solid Rocket Boosters as they awaited mating to the STS-114 External Tank. Preparing for our return to the International Space Station (ISS), our ISS team diligently processed payloads for the Space Station, with the high bay of the Space Station Processing Facility at KSC packed full of flight hardware ready to fly. None of this would have been possible without the hard work of 14,000 dedicated people at KSC.

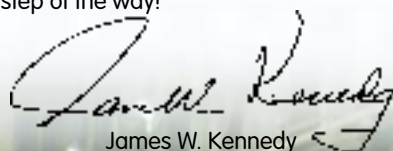
We are very proud of our Launch Services Program for enabling incredible scientific discoveries. They ensured successful launches of Gravity Probe B, Aura, Messenger and Swift spacecrafts, and accomplished the major preparation work for an early January 2005 launch of Deep Impact, starting the year off with a bang. NASA also saw the Mars Exploration Rovers, Spirit and Opportunity, exceed all expectations, lasting four times longer than their life expectancy. They sent dramatic pictures back to Earth and discovered that water, which could have facilitated life, once existed on Mars. They have literally rewritten the scientific textbooks concerning Mars right before our very eyes.

In addition to launch and payload processing, KSC is recognized as having world-class engineers and scientists, with several of our research scientists being awarded Inventor of the Year and top awards in research and development. The total list of accomplishments by the KSC work force in 2004 stretches as high as the Vehicle Assembly Building, too many to begin to list them all here. But as I've said many times, each KSC team member plays a pivotal role in our success. They range from the security guards carefully clearing each worker and visitor through our gates; to mission-support specialists ensuring our "mini-city" keeps functioning on a day-to-day basis; to our professional processing technicians working on space flight hardware.

The year 2004 was unusual in that it dealt KSC some major adversity provided by Mother Nature, with Hurricanes Charley, Frances and Jeanne. But true to their reputation and commitment to the NASA family, KSC people helped each other and their communities, and found ways to perform their work under adverse conditions. This ensured a full Center recovery with minimal impact to our mission.

As the year closed, KSC had its eyes looking toward the future. The first step in the Vision for Space Exploration is returning our Space Shuttles safely to flight. We're on track for a launch window of May to June 2005, and it will be a tremendous day when Discovery flies again.

With America's new Exploration Vision, NASA will return to the Moon, then to Mars and beyond, and historians will record 2004 as "when it all began." I'm excited about where NASA is heading for the future with the vision guiding our way. It will be a tremendous journey for our nation, and I invite you to join us every step of the way!


James W. Kennedy



NASA Vision & Mission

The NASA Vision
To improve life here,
To extend life there,
To find life beyond.

The NASA Mission
To understand and protect our home planet,
To explore the universe and search for life,
To inspire the next generation of explorers
...as only NASA can.

This image of comet NEAT was taken with a Mosaic I camera from the Kitt Peak National Observatory near Tucson, Ariz., on May 7, 2004.

(Left) On a tour of the Orbiter Processing Facility, Center Director Jim Kennedy (center) views the External Tank door corrosion work being performed on Endeavour during its Orbiter Major Modification period which began in December 2003.

U.S. Vision for Space Exploration

In January 2004, President George W. Bush announced the nation's Vision for Space Exploration and NASA started working on several tasks in its support. KSC established an Exploration Office to quickly focus Center efforts and provide a unified approach to contributing to the vision.

The Exploration Office leads and focuses the Center's efforts in aligning with the Vision for Space Exploration, and ensures the Center supports the needs and requirements of the Exploration Initiative. The Exploration Office is responsible for establishing and maintaining good working relationships with external organizations that lead and support key elements of the initiative. The office is also responsible for communicating exploration needs and requirements across the Center.


KSC employees responded well in making important contributions supporting the Exploration Initiative. In the area of requirements definition and analysis, the work force participated with simulation-based acquisition and with ground-support system requirements development and concepts of operations.

In the area of Constellation Systems, KSC employees provided:

- a key member of the Safety and Mission Assurance Working Group
- launch site facility infrastructure studies
- ground operations concepts
- command and control systems concepts
- Integrated Discipline Team members for the integrated systems approach, including the lead for Ground Infrastructure and support for 12 other teams
- Crew Exploration Vehicle request for proposal development and SEB team members
- System Integrator request for proposal development and SEB team members

KSC also served as a key member in the Operations Advisory Group. In the area of Human Systems Research and Technology, KSC workers developed key bio-regenerative life-support technologies. To benefit Exploration Systems Research and Technology, KSC workers served in key roles in technology formulation planning.

Inside KSC's Space Life Sciences Lab, Dr. Kyeon-Hye Kim checks plants in a plant growth chamber for testing under various light conditions. This research will be crucial to long-term habitation of space by humans.



KSC employees are playing a crucial part in planning and developing Exploration Outreach efforts. These efforts include presentations and assisting with planning the first Space Exploration Conference and NASA's Centennial Challenges program, which offers prize contests to stimulate innovation and competition in exploration and ongoing NASA missions.

KSC workers stepped up to support the Vision for Space Exploration and currently serve in key roles to help NASA in the challenging endeavors that will take us to the Moon, Mars and beyond. They consistently demonstrate the key knowledge, skills and capabilities that will help to make the exploration vision a reality.

An artist's rendering of the "Earth, Moon, Mars and Beyond" echoes the U.S. Vision for Space Exploration.

The President's Management Agenda

KSC fully embraces the President's Management Agenda to achieve NASA's mission as safely and efficiently as possible. Within the agenda's framework are five initiatives used to improve government performance. KSC continues to fully support the Agency's implementation of these initiatives.

Strategic Management of Human Capital

NASA strives to attract and retain the best and brightest scientists and engineers. In FY 2004, KSC implemented an Integrated Human Capital Strategy, focusing on work force optimization, recruiting and the student "pipeline." The KSC work force optimization effort facilitated staffing for multiple Agency requirements, including Return to Flight and the Launch Services Program. In addition, KSC implemented a reorganization to implement specific Columbia Accident Investigation Board (CAIB) Report recommendations, including a centralized Safety and Mission Assurance organization. KSC continues to actively participate in the NASA Corporate Recruiting Program, and in July 2004 began utilizing the NASA Flexibility Act Authorities as delineated in NASA's Work force Plan.

KSC "rolled out" a number of human capital tools, including the Travel Manager and Resume Manager systems. In addition, KSC supported a number of Agency-level initiatives,

including the development and pre-production efforts of the Competency Management System. KSC also provided training and system administration support to all Centers transitioning to that system. To facilitate this year's budget-planning activities, KSC used the Workforce Information Management System, a tool developed by Langley Research Center.

Competitive Sourcing

In the framework of the NASA Competitive Sourcing initiative, KSC is working to achieve effective competition between public and private sources, and is meeting competitive sourcing goals defined by the Office of Management and Budget (OMB). The Center completed its Competitive Sourcing Plan and has been provided specific support for the upcoming competition for the NASA Shared Services Center, an approach for consolidating specific NASA business and technical support services.

Financial Management

KSC supported full-cost configuration for FY 2004 operations, implementing Integrated Financial Management (IFM) Core Finance in October 2003. The Center demonstrates continued progress in addressing IFM Core Financial stabilization and data issues, as well as in identifying, standardizing and improving Center reports. KSC was actively involved in the

KSC managers and employees gather in the Center's television studio to watch Pres. George W. Bush announce the goals for NASA's new mission during an address from NASA Headquarters on Jan. 14, 2004.





Astronaut Leland Melvin talks to students at Gainesville Elementary School, a NASA Explorer School in Gainesville, Ga. Melvin discussed the new Vision for Space Exploration with the next generation of explorers on Sept. 21, 2004.

Agency transition to e-Payroll in August 2004, successfully implemented a Travel Manager upgrade, and developed requirements and prepared for the initiation of the next financial management module: Integrated Asset Management. The Center completed planning for the Agency's selection of a vendor for the "e-travel" module, scheduled for implementation in 2006.

e-Government (e-Gov)

KSC continued implementing a common network infrastructure for NASA e-Gov activities and participating in the federal e-Gov initiatives. In FY04, KSC successfully completed the One NASA ePresence pilots based on the Oracle and IBM solutions. The NASA Management Information System (NMIS) progressed smoothly into Phase II. The majority of the KSC NMIS key performance indicators are now online. KSC continues to support the Agency's Identity Management System Project, and is working toward the rollout of SmartCard planned for FY 2005. KSC manages the Agency Security Update System project. In FY 2004, nearly 85 percent of the Agency's computer systems participated in the project. As part of the Agency's solutions on achieving the OMB's Getting-to-Green initiative, this activity received considerable attention from the

OMB and other federal agencies. KSC continues to lead the Space Operations Mission Directorate's ODIN WebEx pilot. In addition, the Center works closely with the Agency's Chief Information Officer office in aggressively addressing the OMB directive on restructuring the Information Technology System Security Plans.

Integrated Budget and Performance

Along with the Agency, KSC implemented full-cost operational procedures in FY 2004 and was successful in using the Integrated Financial Management Budget Formulation system for this year's budget submission process. KSC worked with the Agency to standardize structures and resolve budget execution issues under full-cost operations, and continued to educate the Kennedy work force on the policies and procedures which accompany managing resources under full-cost methods.

Through this framework, KSC realizes its strategic goals: ensuring and advancing access to space for exploration, development and use; providing innovative spacecraft and range technologies for safe space operations and exploration missions; and offering safe, world-class services.

Significant Events

10/01/03 – NASA celebrates 45 years of service.

10/05/03 – KSC Director Jim Kennedy addresses passing of astronaut Gordon Cooper and recognizes his everlasting contributions to the Space Program.

10/12/03 – International Space Station element Cupola arrives at KSC's Space Station Processing Facility. Shipped from Italy, the European Space Agency element will be installed on the Space Station in early 2009. The dome-shaped module has seven windows, giving astronauts a panoramic view.

10/12/03 – NASA's two Crawler Transporter vehicles receive new "shoes." The \$10 million project replaces the 456 tread-belt shoes on each crawler. The shoes, which weigh more than one ton apiece, are critical for safely transporting the Space Shuttle to the launch pad.

10/18/03 – NASA's Deep Impact spacecraft arrives for final launch preparations. The spacecraft was shipped from Ball Aerospace & Technologies in Boulder, Colo., to the Astrotech Space Operations facility located near Kennedy.

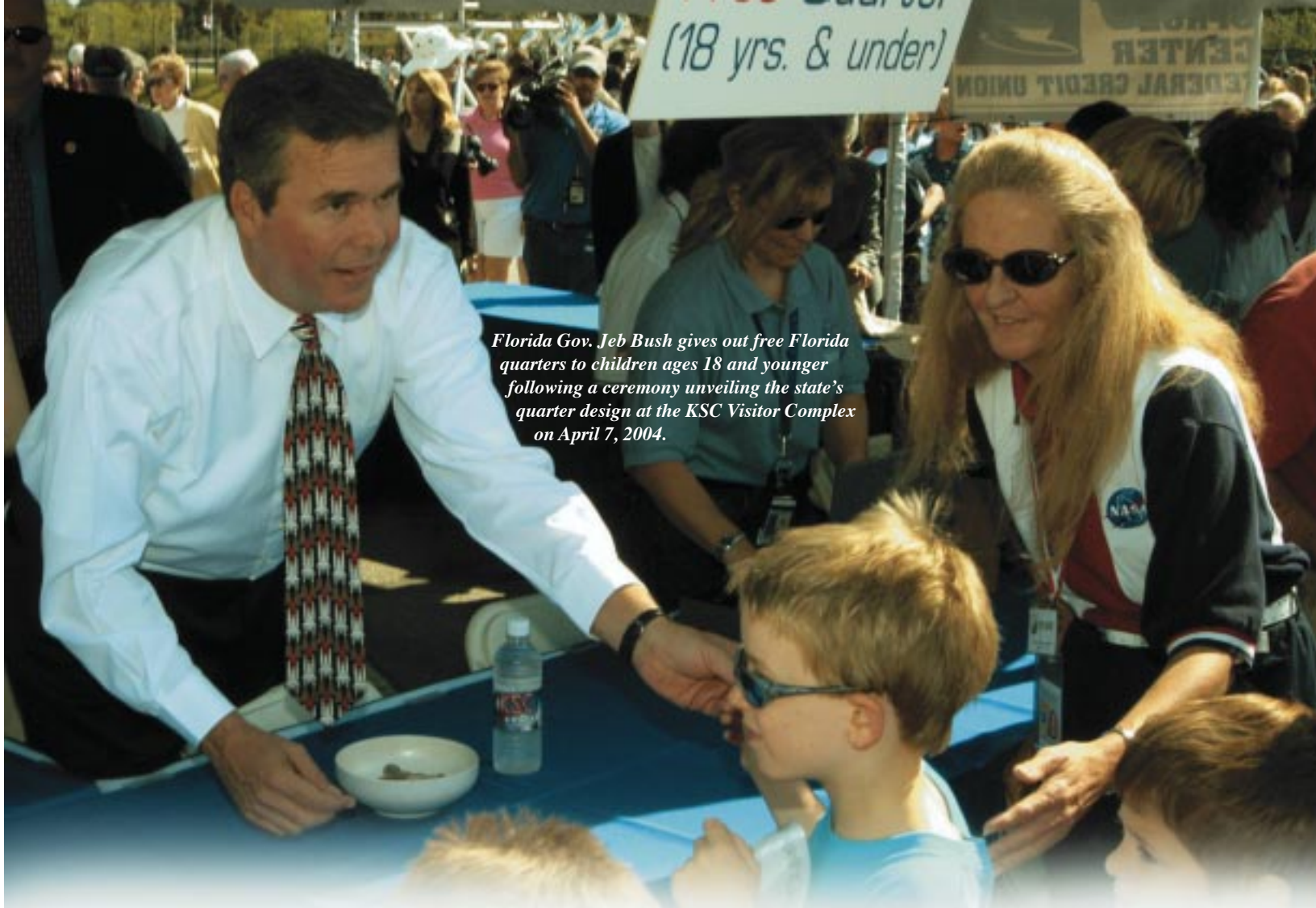
11/07/03 – Three mission specialists are added to the STS-114 crew. The new crew members, Andrew Thomas, Wendy Lawrence and Charles Camarda, join mission commander Eileen Collins, pilot James Kelly and mission specialists Stephen Robinson and Soichi Noguchi (of the Japan Aerospace Exploration Agency), who were named to this flight in 2001.

11/19/03 – KSC dedicates the Space Life Sciences Laboratory. The 100,000-square-foot facility houses labs for NASA's ongoing research efforts, microbiology/microbial ecology studies and analytical chemistry labs. The SLS Laboratory also includes facilities for developing space flight experiments and flight hardware, new plant-growth chambers, and an Orbiter Environment Simulator that will be used for ground-control experiments in simulated flight conditions for space flight experiments.

11/20/03 – The International Space Station, which has orbited Earth more than 29,000 times, celebrates five years in space.

Representatives of NASA KSC and the state of Florida prepare to cut the ribbon officially opening the Space Life Sciences Lab at a ceremony in front of the new lab on Nov. 19, 2003. In the front row, from left, are Dr. Samuel Durrance, executive director of the Florida Space Research Institute; KSC Director Jim Kennedy; Frank T. Brogan, president of the Florida Atlantic University; Florida Lt. Gov. Toni Jennings; and Catherine and Grier Kirkpatrick, children of the late Sen. George Kirkpatrick.





Florida Gov. Jeb Bush gives out free Florida quarters to children ages 18 and younger following a ceremony unveiling the state's quarter design at the KSC Visitor Complex on April 7, 2004.

11/21/03 – Veteran NASA astronaut John Phillips and seasoned Russian cosmonaut Sergei Krikalev are selected as the next Space Station crew, Expedition 11. Their six-month mission is set for launch in April 2005, aboard a Soyuz 10 launch vehicle from the Baikonur Cosmodrome in Kazakhstan, Russia.

01/03/04 – Mars Exploration Rover Spirit successfully sends a radio signal after the spacecraft bounces and rolls for several minutes upon its initial impact at 11:35 p.m. EST.

01/14/04 – President George W. Bush announces the Vision for Space Exploration. This plan offers a building-block strategy of human and robotic missions, beginning with returning the Space Shuttle to flight and completing the International Space Station. The vision also calls for humans to return to the Moon by 2020 and eventually explore Mars and beyond.

01/25/04 – Mars Exploration Rover Opportunity returns the first pictures of its landing site, revealing a surreal, dark landscape on Mars.

01/29/04 – NASA Administrator Sean O'Keefe designates the last Thursday in January as annual NASA Remembrance Day. In the Vehicle Assembly Building, NASA leaders unveil a plaque honoring Columbia, the STS-107 astronauts and their loved ones. The plaque dedication was made on the 16th floor inside the "Columbia room," a permanent repository of the debris collected in the aftermath of the tragic accident.

01/30/04 – Construction is complete on a new air traffic control tower at the Shuttle Landing Facility. The tower rises nearly 100 feet over the midpoint of the runway, giving controllers a 360-degree view of KSC and north Brevard County.

02/02/04 – Administrator O'Keefe announces the Martian hills, located east of the Spirit rover's landing site, will be dedicated to the Space Shuttle Columbia STS-107 crew.

04/07/04 – The new Florida quarter design is unveiled. The "Gateway to Discovery" coin depicts Florida's past with a Spanish Galleon and the state's future with a Space Shuttle. Administrator O'Keefe and Gov. Jeb Bush attended the ceremony at the KSC Visitor Complex.

04/15/04 – A study by the Partnership for Public Service and the American University Institute for the Study of Public Policy Implementation says young people, women and minorities selected NASA as the best place to work in the federal government.

04/20/04 – Gravity Probe B, which will test two of Albert Einstein's theory of relativity predictions, launches from Vandenberg Air Force Base (VAFB), Calif., aboard a Delta II launch vehicle.

05/03/04 – The Occupational Safety and Health Administration recognizes KSC as a Voluntary Protection Program (VPP) Star site, joining an elite group of organizations considered to have the best safety programs in the nation. VPP is a national program designed to recognize and promote effective safety and health management.

05/13/04 – NASA names 50 new Explorer Schools in part of a major NASA education effort to inspire the next generation of explorers that may one day venture to the Moon, Mars and beyond.

05/20/04 – The first pieces of Space Shuttle Columbia debris loaned to a non-governmental agency for testing and research travel from KSC to the Aerospace Corporation in El Segundo, Calif.

06/16/04 – The President's Commission on Implementation of U.S. Space Exploration Policy releases its report unanimously supporting America's Vision for Space Exploration. Titled "A Journey to Inspire, Innovate and Discover," the report contains eight findings and 14 recommendations on how to implement the vision.

07/15/04 – Earth-Observing System Aura launches from VAFB aboard a Delta II on a NASA mission to study the Earth's ozone, air quality and climate.

07/16/04 – NASA celebrates the 35th anniversary of the launch of Apollo 11, a powerful 363-foot Saturn V rocket that zoomed toward the Moon's surface. On July 20, 1969, at approximately 10:56 p.m. EDT, astronaut Neil Armstrong took the historical first step on the Moon's surface.

08/03/04 – The MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft launches from Cape Canaveral Air Force Station aboard a Delta II Heavy launch vehicle for a scientific investigation of the planet Mercury. It will be the first mission to orbit Mercury.

08/13/04 – Hurricane Charley makes landfall at KSC in the evening. The Category 1 hurricane brings sustained winds of 75 knots. *(The Hurricane Damage and Recovery section of this report provides further information regarding the incidents KSC endured during hurricane season.)*

09/05/04 – Hurricane Frances makes landfall at the Center at 1 a.m. The category 2 hurricane brings sustained winds of 91 knots.

09/25/04 – At 11 p.m., Hurricane Jeanne storms through KSC. The category 3 hurricane produced the highest sustained winds (100 knots) of all the storms that enveloped the Center.



During a visit to the Museum of Science and Industry in Tampa, KSC Deputy Director Dr. Woodrow Whitlow Jr. greets students from one of NASA's Explorer Schools, Stewart Middle School.



Apollo 11 lifts off from Launch Complex 39A on Dec. 16, 1969, carrying astronauts Neil Armstrong, Michael Collins and Buzz Aldrin on the first mission to land on the Moon.

Our Transformation

During the past two years, NASA has progressed in the beginning stages of transforming itself. The need for this transformation was born primarily out of the organizational flaws highlighted through the Columbia accident and subsequent investigation report, combined with a new Agency focus on exploration. It became clear that NASA must not only change, but also transform itself to meet future challenges.

To truly transform, the Agency needs to change on many fronts. A complex organization cannot be transformed by changing in only one or two areas. Rather, the organization must be viewed as a system of interdependent sub-systems. Organizational performance is an emergent property of the relationships and interactions between these sub-systems.

Founded on this understanding of organizational performance, NASA undertook a series of initiatives focused on changing different aspects of the Agency. While these initiatives can be categorized into a detailed systems framework, their impact on NASA's technical, organizational and human excellence should be considered. This can be represented graphically below.

KSC is working diligently to support this Transformation. The position of KSC Change Manager was created, and the Star Alignment Team (SAT) formed to focus on guiding KSC's efforts for organizational and cultural change consistent with the Agency Transformation. The SAT analyzed data from surveys and reports dating back to 1984 and developed a comprehensive description of the areas for improvement at KSC. Projects kicked off to improve the areas of communication, performance management, and adherence to the NASA Values, just to name a few.

In addition to these local efforts, KSC also supported Agency-level initiatives. Behavioral Science Technology (BST) began its cultural improvement work at KSC, beginning with a survey of the entire work force and culminating in work with the Safety and Mission Assurance Directorate. KSC also continued its support of the One NASA effort. One NASA is an Agency initiative focusing on centers and individuals making decisions for the common good, standardizing to increase efficiencies and collaborating to leverage existing capabilities. KSC is committed to cultural change and to sustaining continuous system, process and organizational improvement to ensure the highest levels of safety and mission success.



The NASA Values

The NASA Values are at the heart of all that we do, and are profoundly powerful as we strive to improve our Agency and Center. They form the bedrock for our cultural change and, in fact, the whole NASA Transformation. Our values serve as an anchor in this sea of change, and ensure that as we move forward, we do so in a manner that is consistent with what we want to be as an Agency.

KSC demonstrated an unwavering commitment to “living the NASA Values.” This can be seen not only in the projects and initiatives it has undertaken (such as the NASA Values Essay Contest), but also in the actions and behaviors of the work force. The following are some of many examples for each value.

SAFETY

We are committed individually, and as a team, to protecting the safety and health of the public, our partners, our people, and those assets that the nation entrusts to us. Safety is the cornerstone upon which we build mission success.


KSC now provides greater organizational independence to the Safety and Mission Assurance (S&MA) function, in accordance with a key finding in the Columbia Accident

Investigation Board Report by establishing an independent S&MA directorate that reports directly to the Center director. The Center also established an Independent Technical Authority.

All NASA Centers partnered to develop research protocols for the medical concerns of Moon and Mars missions. These include artificial gravity; bone, muscle and cardiovascular de-conditioning; orthostatic intolerance; space motion sickness; and microbiological changes in microgravity. The Occupational Health Office supported Return to Flight simulations and medical training.

During Super Safety and Health Day activities, the importance of good health was promoted by giving employees information on wellness, disease-prevention programs and screening tools, and by offering them opportunities to talk with health care providers. Additionally, the new Adapted Physical Activity Program, a fitness program for disabled employees, increased accessibility to health and wellness activities.

Following damaging hurricanes, the Occupational Health Office helped establish criteria to manage wet building materials, and assess and mitigate mold growth.



In the Launch Control Center, officials monitor the “Mode VII” emergency landing simulation being conducted at KSC on Feb. 18, 2004. The Mode VII is an emergency preparedness exercise for personnel, equipment and facilities used in rescuing astronauts from a downed orbiter and providing immediate medical attention.

THE NASA FAMILY

We are a diverse team of people who are bound together in the most challenging and rewarding of endeavors. We respect each other, trust each other, support each other, mourn together, celebrate together and dream together.

Immediately following Hurricane Charley, KSC moved quickly to set up the Charley Hotline to facilitate employees helping one another. Within hours of the hotline's startup, numerous employees called in offering their time and equipment to those affected by the hurricane. Lackman Culinary Services donated ice to employees in need, and Delaware North Park Services donated bottled water.

EXCELLENCE

We are committed to achieving the highest standards in engineering, science, management and leadership as we pioneer the future. We thrive on new ideas, experiences and continuous learning. We are always rigorous in our operations. We demonstrate and communicate an unquenchable spirit of ingenuity and innovation.

KSC researcher Jan Zysko was awarded both the NASA Invention of the Year Award and the Commercial Invention of the Year Award for his development of the Personal Cabin Pressure Monitor. It was a first for NASA and KSC to win both awards for the same technology.

KSC launched Gravity Probe B, one of the most thoroughly researched programs ever undertaken by the Agency, to test two extraordinary predictions of Albert Einstein's general theory of relativity. Its goal is to assess how the presence of Earth warps space and time, and how Earth's rotation drags space and time.

INTEGRITY


We embrace truthfulness and trust, and have the moral courage and obligation to be open, honest and ethical in all that we do. We treat everyone with dignity and respect. We recognize our responsibility and are accountable for the important work entrusted to us to better our society for future generations.

KSC intensified its focus on the importance of open and honest communication. One example of how KSC encourages upward communication occurred just prior to the hurricanes. An employee was concerned that a 300-foot radio tower with a large antenna did not have the necessary structural strength to handle the load of the antenna. Strengthening of the tower was planned but had not yet occurred.

With hurricane season rapidly approaching, the employee shared his concern to senior management. Management determined the strengthening was necessary and ordered that it be completed immediately. Managers also ensured that all seven towers at KSC be routinely inspected and maintained, and roles and responsibilities for the work was clarified. All seven towers survived the wind loads from Hurricanes Charley, Frances, and Jeanne.



Jan Zysko, chief of the data and electronic systems branch of KSC's Spaceport Engineering and Technology directorate, tests the Personal Cabin Pressure Altitude Monitor in an altitude chamber at Tyndall Air Force Base in Florida. Zysko invented the pager-sized monitor that alerts wearers of a potentially dangerous or deteriorating cabin pressure altitude condition.

A large Delta II rocket is shown in the process of launching the Gravity Probe B spacecraft. The rocket is angled upwards and then pitches over to head downrange. A large plume of white smoke and fire is visible at the base of the rocket.

After a morning launch on April 20, 2004, the Delta II rocket carrying the Gravity Probe B spacecraft pitches over and starts heading downrange from Space Launch Complex 2 at Vandenberg Air Force Base, Calif.

(Inset) In the NASA spacecraft processing facility on North Vandenberg Air Force Base, principal investigator Dr. Francis Everitt and co-principal investigator Brad Parkinson, both from Stanford University, hold one of the small gyroscopes used in the Gravity Probe B spacecraft. The GP-B towers behind them.



Space Shuttle Program

Tremendous efforts occurred during the past fiscal year to prepare NASA's Space Shuttle fleet for Return to Flight (RTF) and ultimately support the Vision for Space Exploration. Orbiter Vehicle Discovery (OV-103) was designated the RTF orbiter, and underwent significant modifications and testing in accordance with the Columbia Accident Investigation Board's recommendations. Orbiter Major Modifications (OMM) and full assembly of a Space Shuttle Main Engine were successfully performed at KSC for the first time. Various Launch Complex 39 facilities were upgraded and modified, and new practices were established to ensure a safer work environment.

Space Shuttle Processing Activities

Discovery (OV-103) Accomplishments


To prepare Orbiter Vehicle Discovery for RTF, it transitioned from its Orbiter Maintenance Down Period (OMDP) and OMM activities to Up Mission Processing. The focus was on implementing the RTF modifications and system testing. The modifications included installation of the Orbiter Boom Subsystem, Wing Leading Edge (WLE) instrumentation, and External Tank (ET) separation camera.

Many of Discovery's major components, which were removed for structural and wire inspections during OMDP, were reinstalled. These components included both Orbital Maneuvering System pods, the Forward Reaction Control System, Rudder Speed Brake, body flap, nose cap and chin panel. Installation of these components allowed for the start of system testing required to validate each of the orbiter subsystems prior to flight. Discovery's final testing and closeouts occurred in March 2005.

Atlantis (OV-104) Accomplishments

Similarly, the Orbiter Vehicle Atlantis (OV-104) underwent a large amount of preparation for the second RTF mission. The orbiter's full structural inspection satisfied more than 270 requirements, enabling Atlantis to support up to six missions.

Atlantis' radiators, airlock and Forward Reaction Control System were removed in order to facilitate a thorough structural inspection. A tremendous amount of wiring modifications were also performed to support the post-Columbia changes including the addition of the Orbiter Boom Sensor System (OBSS), ET well camera, and instrumentation of the WLE with strain and thermal sensors. Additional wiring modifications bolstered the reliability of redundant system capabilities.



Workers in the Orbiter Processing Facility watch closely as Discovery's Forward Reaction Control System is lowered into position in the orbiter's forward fuselage nose area. Discovery is designated as the Return to Flight vehicle for mission STS-114.



Inside the Space Shuttle Main Engine Processing Facility, Boeing-Rocketdyne technicians prepare to move the first main engine fully assembled at KSC. Workers prepare to place a sling around the engine to assist its lift from a vertical work stand into a horizontal position in preparation for shipment to NASA's Stennis Space Center in Mississippi to undergo a hot-fire acceptance test.

All three orbiters' Reinforced Carbon Carbon (RCC) panels were removed and inspected at KSC and Lockheed Martin in Texas. KSC Quality Engineering performed thermo-graphic inspections which utilize a high-intensity flash lamp and infra-red cameras for non-destructive analysis and documentation of each panels' characteristics. Buildup of the RCC panels prior to re-installation required meticulous shimming of the spar fitting hardware to achieve the correct alignment.

Endeavour (OV-105) Accomplishments

Orbiter Vehicle Endeavour (OV-105) entered its OMM phase to begin work on 103 scheduled modifications. This includes upgrades to the avionics and data systems such as the triple-redundant Global Positioning System, Modular Memory Unit and the Multi-Electronic Display System. The orbiter nose cap, which experiences the highest heat during reentry, was successfully replaced and aligned. Orbiter structural and wire inspections of all accessible areas are now complete. The remaining modifications will be completed prior to vehicle power-up and the Up Mission Processing phase. By the end of

this processing flow, Endeavour will have more than 1,600 Thermal Protection System tiles bonded.

Space Shuttle Main Engine (SSME) Status

Assembly of the SSMEs has evolved from the Rocketdyne Manufacturing plant in Canoga Park, Calif., to Stennis Space Center in Mississippi and Kennedy Space Center. The first engine was fully assembled at KSC in August 2004 and will travel to Stennis to undergo a hot fire acceptance test later this year.

Eleven engines are either ready or being processed for their next flight (eight at KSC and three at Stennis). Historically, new SSMEs were assembled in Canoga Park, with KSC responsible for performing post-flight inspections on existing engines in preparation for their next mission. Both functions were consolidated in February 2002, when new engine assembly work transferred to KSC to combine operations and reduce costs.

Facility/Ground Support Equipment (GSE) Accomplishments

Rigorous inspections identified significant corrosion of all three KSC Mobile Launch Platforms (MLPs). Significant repairs required replacement of massive structural members, sandblasting and application of corrosion protection. All repairs are completed.

Inspections of both Crawler Transporter's tread belt "shoes," using instrumented load tests and evaluations of fractures, revealed fatigues and required replacements. Each Crawlers' 456 Apollo-era shoes were replaced beginning in October 2004. The shoes weigh 2,000 pounds each.

Continuous facility modifications included a major overhaul of the Space Shuttle Launch Complex 39B, designated for RTF. Hurricanes Frances and Jeanne briefly interrupted corrosion control efforts. At Launch Complex 39A, a Sound Suppression Water System test released 350,000 gallons of water on MLP 2 in several seconds on May 7, 2004. The test successfully validated the newly installed, 48-inch main system valves. The old valves were in place since the beginning of the Space Shuttle Program and had reached the end of their service life. The system is used to suppress acoustical shock waves and quench the steel deck of the MLP during launch.

The Vehicle Assembly Building's north doors were replaced. The orbiter is towed through these doors prior to mating with the ET and Solid Rocket Boosters. The horizontal High Bay 3 doors underwent extensive repairs due to corrosion.

Foreign Object Debris (FOD)

NASA and United Space Alliance workers developed a more robust FOD control process in response to a CAIB recommendation. Workers in processing, quality, corrective engineering, process analysis and integration, and operations management gathered as a working group to visit various aerospace and related facilities to study each company's FOD prevention process, documentation programs and assurance practices.

Companies visited included Northrup Grumman at Lake Charles, La., Boeing Aerospace at Kelly Air Force Base, Texas, Gulfstream Aerospace in Savannah, Ga., and the Air Force's Air Logistics Center in Oklahoma City, Okla.

The processing team instituted numerous improvements in three fundamental areas of emphasis. First, the program eliminated various FOD categories, and now treats all FOD as preventable and with equal importance. Second, the program re-emphasized the responsibility and authority for FOD prevention at the operations level. And finally, the program elevated the importance of comprehensive independent monitoring by both contractors and the government. The new FOD program has a meaningful set of metrics to measure effectiveness and guide improvements.

Columbia Storage

Space Shuttle Columbia's recovered components are preserved in a secure, climate-controlled facility specifically prepared for them at KSC. NASA currently has approximately 84,200 individual items inventoried and the Columbia Debris

Recovery Office continues to receive one or two additional items weekly.

The components continue to provide useful engineering data. During the year, NASA received 25 requests to examine specific vehicle components for scientific purposes. Most of the requests were a result of CAIB findings or related to key Space Shuttle Program issues.

Also, 17 requests were granted for research on 50 different debris items so far. Many requested pieces of the RCC panels, which protect the wings' leading edges from extreme heat encountered during reentry into the atmosphere.

Some debris studies were beneficial to developing damage-detection equipment such as the Orbiter Boom Sensor System to perform on-orbit integrity assessments of the Thermal Protection System during future Space Shuttle flights. Several of the Orbiter Maneuvering System thrusters are being used in Non-Destructive Evaluation research at the White Sands Test Facility in New Mexico.



A KSC employee uses a clean-air shower before entering a clean room. Streams of pressurized air directed at the occupant from nozzles in the chamber's ceiling and walls are designed to dislodge particulate matter from hair, clothing and shoes. An adhesive mat on the floor captures soil from shoe soles.



Workers prepare to install the giant-sized sprocket (left side) and gear (right side) on the Crawler-Transporter (CT) behind it. The drive sprocket turns the belt on the CT. The sprocket is mated to the gear that attaches to the drive motor.

(Inset photo) Mission STS-114 pilot James Kelly (left) and mission specialist Andrew Thomas (center) look closely at the shoes of a Crawler-Transporter track. Each 10-foot-high track on a crawler contains 278 "shoes," weighing 2,200 pounds each.



Technicians in the Space Station Processing Facility set up a lifting device to help open the 270-pound starboard hatch on the Node 2 module. Node 2 is the second of three International Space Station connecting modules. It will attach to the end of the U.S. lab and provide attach locations for several other elements. Node 2 is scheduled to launch on mission STS-120.

International Space Station and Payload Processing

The International Space Station (ISS)/Payload Processing activities centered around preparing for Return to Flight and supporting the Vision for Space Exploration.

STS-114/LF-1 (Logistics Flight)

Several activities readied designated payloads for the first Return to Flight mission. Work included mission-specific buildup of the Lightweight Multi-Purpose Experiment Support Structure Carrier, removal and replacement of the Multi-Purpose Logistics Module (MPLM) hatch and a complete modification of all Resupply Stowage Platform racks. The racks carry equipment, supplies and other items for transfer to the ISS.

STS-121/ULF-1.1 (Utilization Flight)

To support the research payloads on the future STS-121 mission, Space Station U.S. Lab interfaces for the Minus Eight Degree Laboratory Freezer for ISS (MELFI), European Modular Cultivation System (EMCS) and Space Dynamically Responding Ultrasonic Matrix System (SpaceDRUMS) were tested in the Payload Test and Checkout System. External shields and blankets were removed and a new thermostat modification was implemented on the MPLM. Hatches were removed, force-balanced off site and reinstalled on the MPLM.

STS-115/12A (P3-P4 Truss Assembly)

STS-117/13A (S3/S4 Truss Assembly)

The truss team completed numerous maintenance activities. Discrepant Solar Array Wing structural fasteners were reworked. This effort included developing a special tool at KSC to overcome obstructed access to enable repairs. These repairs eliminated the need to intricately remove the wing from the truss element, avoiding added handling risk to the flight hardware. A preload reduction on the flight wing blanket boxes was completed, relaxing the wings from their flight-configured compressive loads. The team also successfully offloaded the flight-loaded ammonia from the S4 Truss to prepare the cargo element for the installation of an added Photovoltaic Radiator in 2005.

STS-116/12A.1 (P5 Truss Assembly)

STS-118/13A.1 (S5 Truss Assembly)

In work relating to the extended ground stay, the truss assembly continued to remain ready for the Space Shuttle integration mode and workers utilized the extended ground time to make necessary repairs and modifications as needed.

STS-120/10A (Node 2)

Node 2 processing continued with the completion of the On-Orbit Constraints Test, designed to verify all connections between the node and its on-orbit connected elements. The

team also completed the Common Berthing Mechanism acceptance testing and the Traveled Work Systems Test. Both tests check out components not previously verified at the manufacturing site. Several modifications were completed to the audio fiber-optic system and the Quick Disconnect on the fluid systems to correct design deficiencies discovered after delivery of the module to KSC.

STS-119/15A (S6 Truss Assembly)

The truss team completed extensive truss assembly and checkout, along with numerous maintenance activities, and resolved problems. The S6 truss was assembled and verified without the upper deck solar array wing. An integrated, powered checkout with liquid anhydrous ammonia will be performed. To protect the wings for an extended ground stay, flight wing preload reductions relaxed the wings from their flight-configured compressive load.

STS-126/1J (Japanese Experiment Module)

The JEM remains in long-term dwell. KSC continues to provide support services on a periodic basis to JAXA (The Japanese Space Agency).

Active MPLM

The majority of planned Active MPLM (A-MPLM) Minus Eighty Lab Freezer for ISS (MELFI) Risk Mitigation testing was completed successfully. The tests included activation of water servicing ground-support equipment; verification of A-MPLM cooling subsystems, MELFI to A-MPLM interfaces, and new A-MPLM to orbiter interfaces; as well as demonstration of control of the payload from the Mission Control Center at Johnson Space Center in Houston and the Marshall Space Flight Center Payload Operations Integration Center in Huntsville, Ala. The successful completion of testing and resolution of problems will reduce risks to critically-conditioned science samples during launch, on-orbit and landing phases, and launch processing schedules.

Engineering Activities

Avionics engineers headed up a team to develop alternative and safer methods for inspecting fiber-optic contacts on ISS components. They also developed an adapter tool to allow existing inspection tools to more safely interface with the fiber-optic contacts.

Avionics engineers developed and implemented an automated battery health-check capability for Utilization Experiment Pre-launch Batteries. The automated system reduced personnel needs to approximately 20 percent of the level required with the manual process, while improving the accuracy of the data recorded.



The Multi-Purpose Logistics Module (MPLM) Donatello is slowly lowered toward a work stand inside the Space Station Processing Facility highbay on Feb. 13, 2004. This is the first time all three MPLMs (Donatello, Raffaello and Leonardo) are in the SSPF at the same time.

Fluid Systems

To improve ammonia processing, the Checkout Assembly and Payload Processing Services (CAPPS) developed a test conductor training class to enhance the number of qualified Ammonia Task Conductors. In addition, CAPPS dedicated specific people to ammonia activities and implemented a biweekly ammonia team meeting to review the progress of activities leading up to ammonia servicing and support operations.

Payload Transporter/Canister Modifications

When moving a bus-sized payload from one facility to another, the payload is lowered into a payload canister through canister doors that open up like Space Shuttle bay doors. Because a payload can weigh up to 20 tons, if the canister and transporter it sits on are not perfectly level, the

payload might be damaged when mounted inside the canister, and the canister doors might not close properly due to canister flexing under the heavy payload weight. The original analog transporter leveling system proved to be inadequate and was replaced with a laser-based, micro-leveling system. The new system can adjust the canister longeron beams to within 0.063 inches of zero planar condition. This represents an improvement in accuracy of almost twice the capability of the old system and resolves the previous payload insertion challenges.

Payload Rack Checkout Unit

Multiple mission and payload maintenance tests were completed in the Payload Rack Checkout Unit for the MELFI for ISS, MELFI Flight Unit 2 and the Human Research Facility 2.

Launch Services Program

NASA's Launch Services Program at KSC was busy with three successful Expendable Launch Vehicle (ELV) launches and other projects supporting the Vision for Space Exploration. A highly skilled team worked to provide safe, reliable, cost-effective and on-schedule processing, mission analysis, and spacecraft integration and launch services for NASA and NASA-sponsored payloads on ELV missions.

The Gravity Probe B (GP-B) spacecraft launched on a Delta II rocket on April 20, 2004, from Vandenberg Air Force Base (VAFB), Calif. GP-B is designed to observe and measure two extraordinary predictions of Albert Einstein's general theory of relativity: the warping of space-time due to the presence of a nearby massive body, such as the Earth or Sun, and the twisting (dragging) of space-time near a rotating massive body.

The AURA satellite launched on a Delta II on July 15, 2004, from VAFB. The NASA mission studies the Earth's ozone, air quality and climate. This mission is designed exclusively to conduct research on the composition, chemistry and dynamics of the Earth's upper and lower atmosphere. Aura is the third in a series of major Earth-observing satellites to study the environment and climate change and is part of NASA's Earth Science Enterprise.

Gaining knowledge about Mercury and the forces that shaped this enigmatic world is fundamental to understanding the other terrestrial planets (Venus, Earth and Mars) and the evolution of the inner Solar System. The Mercury Surface, Space Environment, Geochemistry, and Ranging (MESSENGER) spacecraft launched on a Delta II Heavy vehicle on Aug. 3, 2004, from Cape Canaveral Air Force Station. MESSENGER will travel to Mercury, flying past the planet three times — twice in 2008 and once in 2009. The spacecraft's cameras and sensors will provide the first images of the entire planet and is the first scientific investigation of the planet from orbit. MESSENGER's data will ultimately help explain how the terrestrial planets were formed.

While overseeing missions such as those of the past fiscal year, the LSP team managed 40 future ELV missions. The team works with other NASA Centers, including the Jet Propulsion Laboratory in Pasadena, Calif., Marshall Space Flight Center in Huntsville, Ala., and Goddard Space Flight Center in Greenbelt, Md., to plan and process NASA's scientific, research and communications spacecraft for launch.

Future scientific missions include CALIPSO/CloudSat, key parts of the Earth Observing System, and NOAA-N, a satellite developed by NASA for the National Oceanic and Atmospheric Administration. The Geostationary Operational Environmental

Satellite (GOES-O) completes the upcoming Earth-observing missions and will launch aboard NASA's first flight on a Boeing Delta IV launch vehicle.

Future planetary missions include the Mars Reconnaissance Orbiter to analyze the surface of Mars, and the Demonstration of Autonomous Rendezvous Technology (DART) mission that will utilize an advanced video-guidance sensor to demonstrate the capability for two spacecraft to autonomously rendezvous in space.

The program also supported planning and processing for NASA's Deep Impact mission, which launched on Jan. 12, 2005, on a Delta II from Cape Canaveral Air Force Station. Deep Impact will rendezvous with Comet Tempel 1 on July 4, 2005.



After rollback of the mobile service tower at Launch Complex 17-B, the Boeing Delta II rocket with the MESSENGER spacecraft aboard is ready for launch on a seven-year journey to the planet Mercury.



(Background) This photo of Hurricane Frances was taken by astronaut Mike Fincke aboard the International Space Station as he flew 230 statute miles above the storm at about 9 a.m. CDT Aug. 27, 2004.

(Top inset) Panels from the exterior walls of the Vehicle Assembly Building are recovered during clean-up activities following Hurricane Francis.

Members of the hurricane assessment team from Johnson Space Center and Marshall Space Flight Center observe the damage to the roof of the Thermal Protection System Facility at KSC after Hurricane Frances hit the east coast of Central Florida and Kennedy Space Center.

The storm surge and high winds of category 3 Hurricane Jeanne replaced the rolling sand dunes on the KSC shoreline east of the launch pads with cliffs of sand. Jeanne barreled through Central Florida Sept. 25-26, 2004, becoming the fourth hurricane in six weeks to batter the state.

The Damage Assessment Recovery Team, including Center Director James Kennedy (left), meets at the NASA KSC News Center following Hurricane Jeanne.

Hurricane Damage and Recovery

Florida's East Coast was plagued with extreme weather challenges during the 2004 hurricane season. KSC suffered significant damage from the collective forces of Hurricanes Charley, Frances and Jeanne, although the most notable damage occurred during Frances. It was also the most active hurricane season in KSC's history.

KSC received \$125.5 million in supplemental funds to repair hurricane damage and enhance emergency preparedness for future hurricanes. All repairs necessary for Return to Flight and the start of the next hurricane season will be completed prior to these events. No flight hardware was damaged during the storms.

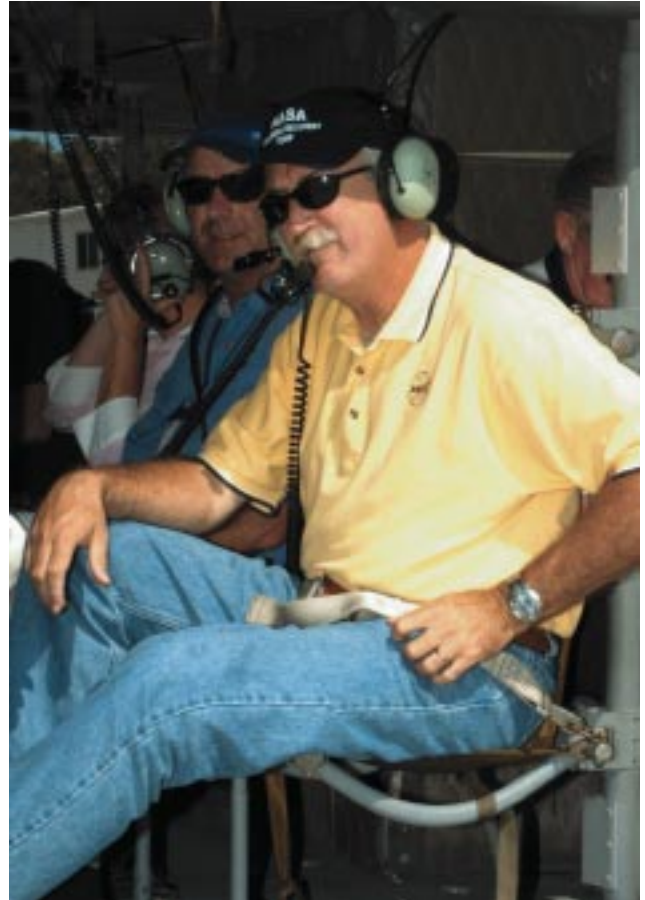
After Frances and Jeanne, the Damage Assessment and Recovery Team (DART) surveyed all KSC areas to report damage. Workers were allowed back to the Center only when it was determined that all areas were safe.

During Hurricane Frances, the Vehicle Assembly Building sustained damage to the roof and lost nearly an acre of exterior panels. Repairs were completed in time to support Solid Rocket Booster stacking operations for STS-114.

During Hurricane Frances, a large portion of the Thermal Protection System Facility roof peeled back, exposing critical tools and other unique equipment required to manufacture orbiter thermal tiles and blankets. The DART quickly secured the items and relocated them to a vacant hangar. The equipment was thoroughly cleaned, inspected and re-certified for use at the new location, greatly minimizing the impact to RTF processing.

The Process Control Center (PCC) also experienced damage compromising the roofs integrity, allowing water to penetrate all three floors. The PCC houses a tremendous amount of computer equipment and consoles used to develop and debug system software. Critical electronic equipment was not damaged due to the precautions personnel took prior to the hurricane. The building was dried out quickly and reoccupied with minimal impact.

Other facilities that sustained damage include the Headquarters Building, Launch Control Center, Operations and Support Building I, fifth floor of the Operations and Checkout Building, Multi-Payload Processing Facility and Landing Aids Control Building at the Shuttle Landing Facility. Repairs included drywall mold remediation, roof work and equipment replacement. The Hangar AF turn basin, where the SRB retrieval ships come in, will be dredged to remove hurricane-driven sand.



NASA Administrator Sean O'Keefe (right) sits next to KSC Director of Spaceport Services Scott Kerr in a helicopter as they observe overall damage at the Center from Hurricane Frances. The Labor Day storm caused significant damage to the Vehicle Assembly Building, Thermal Protection System Facility and Processing Control Center.

The KSC Visitor Complex sustained damage to the Apollo Saturn V facilities, Rocket Garden and roof of the IMAX theaters. Rockets at Pass and ID Gates 2 and 3 were also damaged. KSC was closed for normal business for nine-and-a-half days.

Additionally, much of KSC's pristine shoreline, dunes and sensitive plant life were damaged due to beach erosion from the major storms.

Environmental Leadership

It seems little can slow KSC's environmental progress. NASA Headquarters comprehensively audited the Center's Environmental and Energy Programs and greenlighted all program areas. No other NASA center has achieved positive "green" ratings in all 13 environmental and energy program areas.

Every three years, NASA Headquarters evaluates each center's environmental and energy programs through an intensive Environmental Functional Review, which analyzes regulatory and policy compliance, and environmental, energy and water program management.

The reviews gauge the "health" of the program areas and metaphorically rate quality. Some of KSC's recognized strengths include a solid energy program aligned with Center operations and programs, being the only NASA center with director-approved energy management and water conservation plans in place, and excellent contractor support.

The Environment Program also promptly responded to the unexpected discovery of 23 aging Booster Separation Motors. These motors belonged to a discontinued program, so the Environment Program found and implemented a safe and environmentally acceptable disposal method. After Florida's Department of Environmental Protection approved emergency disposal of these motors, KSC safely disposed of the various ordnance devices through detonation at the Center landfill.

NASA and contractor environmental professionals at KSC developed a pocket guide detailing common environmental requirements and contact information to reduce environmental compliance problems.

The removal of environmental contaminants restores polluted sites for useful industrial purposes or returns them to a natural state. The KSC Environmental Remediation Program continued its aggressive cleanup of contamination that occurred during the spaceport's historical era, when the potential for damage was unrecognized.

During 2004, the Remediation Program used numerous innovative cleanup technologies such as "low-temperature thermal desorption," an on-site, cost-effective process that releases contaminants from soil by thermal means. Other remediation technologies include "soil-vapor extraction," which forces air through the soil, and "air sparging," which injects air through contaminated groundwater. All of these technologies effectively strip the contaminants from the soil. Using these and other remediation methods, the KSC Remediation Program removed contaminants from 22,000 tons of soil at affected KSC sites.

The new desk-side recycling containers are evidence of KSC's new recycling contract. Since 1991, KSC recycled more than 54 million pounds of paper and cardboard, which is roughly equal to preserving more than 450,000 trees. While the Environment Program continuously explores recycling opportunities, the new contract encourages recycling "mixed" paper instead of just white paper. Colored manila file folders, Post-it notes, business cards, construction paper, paper envelopes and other materials are now acceptable. Furthermore, the monetary return to KSC is now 61 percent of the recycling profits, surpassing the previous contract's 24 percent.





Hérons, a roseate spoonbill and other species of water birds gather in a canal near KSC, which shares a boundary with the Merritt Island National Wildlife Refuge. Just beneath the surface of the water below is one of nearly 5,000 alligators that call KSC home.

(Left) KSC employees visit a display table about energy set up in a tent near the Operations and Checkout Building for the annual Environmental and Energy Awareness Week, held April 20-22, 2004.

Spaceport and Range Technologies

KSC's message traveled far across the world, including to the Ukraine when Fundamental Space Biology Outreach Program Manager Thomas Dreschel met with Ukrainian educators, scientists and education leaders this fiscal year.

In addition to gaining international attention for projects, KSC saved NASA \$110,000 by relying on in-house technology and workers to recover a Space Shuttle training aircraft thrust reverser from the Banana River. Also, the Image Analysis facility worked with the Federal Bureau of Investigation to study kidnapping surveillance video for a case in Sarasota, Fla.

Some other highlights include developing a fire-suppression agent which is more powerful and environmentally suitable than other models, award-winning insulation methods for cryogenic systems, tastier crops for long-duration space missions, an aid for those with sight disabilities, and methods to maximize water usage in space.

The Technology Commercialization Office received 120 New Technology Reports for KSC-developed innovations, which may result in patent and copyright licenses and partnerships.

A frequent leader of the Space Act Awards program, KSC received \$108,000 from the program for the fiscal year, which

is divided among award areas. More than 100 awardees were present at the fifth-annual awards ceremony. The Space Act Awards program stimulates and encourages creating and reporting similar contributions in the future.

Approximately 100 three-dimensional External Tank models were built to enhance the safety of Space Shuttle processing operations. This tool simulates situations and scenarios common during orbiter and External Tank mating.

To evaluate the performance of a wireless instrumentation system, the Radio Frequency Health Node launched from White Sands, New Mexico, in September 2004. The system dramatically reduces the amount of wiring needed, eliminates safety concerns associated with aging wires, provides rapid response to vehicle instrumentation needs, and offers building blocks for use in Integrated Systems Health Management technologies.

Hazardous Maintenance Facility personnel required a suitable solution for improving access to service the Orbiter Maneuvering System (OMS) pods. Using a virtual-reality laboratory, the facility's OMS Pod Access Platforms were developed to remedy the problem. The new labor-saving platform elimi-



Kimberly Beck, a Spaceflight and Life Sciences controlled biological systems trainee, helps with growth studies supporting the WONDER (Water Offset Nutrient Delivery Experiment) flight payload. The experiment investigates hydroponic plant crop production in microgravity.

nates the need for scaffolds, reducing risks to flight hardware and personnel.

Previously, heat lamps boiled water out of wet Space Shuttle tiles. KSC developed a new vacuum system that waterproofs tile holes and is capable of drying 25 tiles simultaneously. Four complete systems are ready for use.

To manage the Space Station Processing Facility and Operations and Checkout Building's floor and work space, workers developed the Aurora Scheduling Tool. Once fully incorporated, the artificial-intelligence-based software will allow for more efficient ISS and Space Shuttle payload processing.

The Human Factors Process Failure Modes and Effects Analysis Tool identifies potential human errors, ways to reduce or eliminate the likelihood they occur, and consequences if the errors do happen. A combination of human-error analysis and risk-assessment software technology, the tool also reduces human factors analysis time by up to 50 percent, trains novice analysts and reduces high-risk situations for improved safety.

KSC identified cable-free range communication technologies that decrease life-cycle cost and increase operational flexibility. Ultra Wideband, Wireless Ethernet and Free Space Optics are cable-free technologies investigated during 2004.

The Wallops Flight Facility in Virginia and KSC developed the Autonomous Flight Safety System to increase range capabilities for ELV launch locations that don't have or can't afford extensive ground-based range safety assets. The system decreases range costs and reaction time for special situations. The project is in its third phase of development and requires future ground and flight testing.

The Spaceflight and Life Sciences Training Program (SLSTP) prepares pools of potential Space Program workers to replace retiring personnel. Since its 1984 inception, 703 undergraduates, 50 counselors (graduate students and academics), and more than 50 teachers have conducted hands-on research with NASA. Educators with the Florida Summer Industrial Fellowship for Teachers (SIFT) developed ecology and space-science modules for use at their respective schools, as well.

More than half of the SLSTP participants are women and more than 30 percent are minorities. One indication of the program's excellence is its recent selection as an Exemplary NASA Partnership in NASA's Fiscal Year 2003 Annual Performance Report to the White House Initiative Office on Historically Black Colleges and Universities.

SLSTP alumni, including space industry scientists, engineers and administrators, recently formed a non-profit organization and Web site for former SLSTP members and SIFT teachers to communicate.

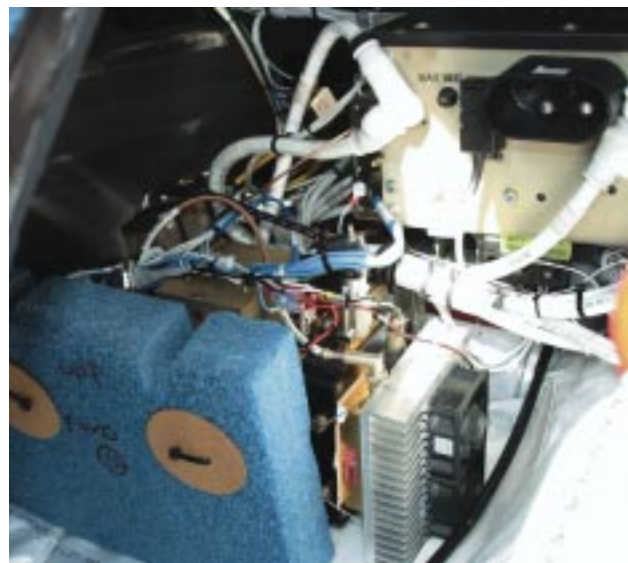
The multi-center Space-based Telemetry And Range Safety (STARS) project demonstrates the capability to use existing space-based platforms, such as the Tracking and Data Relay Satellite System and Global Positioning System, to provide reliable communication, telemetry and tracking.

Reusable launch vehicles, expendable launch vehicles and unmanned aerial vehicles can use STARS, potentially reducing cost and infrastructure of the current ground-based communications system.

Modified STARS Range Safety hardware provided video data, encoded audio, still images and archived footage from the cockpit during a solo, non-stop circumnavigation flight known as GlobalFlyer that took off Feb. 28, 2005.

The team is currently preparing for a 2005 rocket flight at White Sands. A unit including a range safety processor, low-power transceiver and GPS receiver will be onboard.

NASA, the U.S. Air Force, Office of Secretary of Defense, Federal Aviation Administration and other stakeholders are



This STARS' hardware provides a cutting edge system for maintaining tracking and communication with space launch vehicles.

addressing the space launch infrastructure needs of low-cost, routine and safe access to space. The proposed project, the Future Interagency Range and Spaceport Technology Program (FIRST), will develop technologies necessary to achieve interoperable spaceports and ranges around the country and eventually around the globe.

Technology Successes

KSC's Technology Transfer Office thrusts developed technologies to industries for commercial use as spinoffs, and leverages industry partnerships to create "spin-ins." Spinoffs typically are license agreements with companies, while spin-ins are performed primarily through Space Act Agreements. The Technology Transfer Office identifies partners for these projects and facilitates agreement negotiations with industry partners. Occasionally, a company licenses a NASA technology for commercial use and partners with NASA to advance that technology to better meet KSC's needs through a Space Act Agreement. During the fiscal year, KSC made several agreements which are described below.

An agreement with Laura Lee Desrosiers Curts LLC in Virginia and Nivis LLC in Atlanta prompted the use of the **"Wireless Instrumentation System and Power Management Scheme Therefore."** The patent-pending, high-performance system meets stringent requirements for reliability, data integrity and power consumption. KSC now uses the system to acquire and process data remotely.

Zeus Technologies Inc. in Orlando and Intergraph Solutions Group in Alabama partnered with KSC to commercialize two imaging software technologies: **Fuzzy Reasoning Edge Detection ("FRED")** and **Fuzzy Reasoning Adaptive Thresholding ("FRAT")**. Fuzzy reasoning is based on "degrees of truth," instead of typical "true-or-false" methods. FRED is ideal for detecting unfamiliar objects in footage. FRAT can transform a poorly faded signature, weathered document or surveillance tape into a clearer readable image.

NASA used the systems to identify and track foreign object debris in STS-107 launch footage, and during analysis of the Columbia disaster. The companies plan to develop and market medical imaging devices incorporating the software to evaluate and classify body masses in real time.

The KSC Technology Transfer Office successfully negotiated and signed an agreement with GeoSyntec Consultant in Florida and Huff & Huff Inc. in Illinois for the use and sale of NASA's **Emulsified Zero Valent Iron (EZVI)**. EZVI was first tested at Launch Complex-34, where groundwater was polluted during the Space Program's early history. EZVI, an oil-

in-water emulsion, clears up this historical groundwater problem by degrading the site's contaminants of concern.

Demonstrating NASA's environmental commitment, Phoenix Systems International in New Jersey uses its agreement to develop a **Nitrogen Oxides (NOx) emissions reducer** for fossil-fuel-burning power plants. This technology, which is a continuation of previous KSC developments, reduces costs and eliminates hazardous waste streams. With NASA's assistance, Phoenix recently overcame hurdles and is now polishing the final phase of the NOx scrubbing to improve efficiency.

The agreement of Schaffer Test Products Inc. in Florida commercializes the **Current Signature Sensor** technology. The system remotely monitors the health of KSC's widely-used valves. This sensor lowers operational costs and increases reliability by predicting valve failures before they occur.

Additionally, the Center's Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) program enhanced KSC's technology base through industry partnerships. Managed by the KSC Technology Transfer Office, SBIR/STTR funds early-stage research and technology development designed to address future mission needs.

The office managed 61 SBIR/STTR contracts valued at a total of \$19.7 million. Three SBIR/STTR-funded projects were launched.

Based on another of its plant growth concepts, Orbital Technologies Corp. in Wisconsin developed a concept for plant growth in space known as **Biomass Production System for Education**. The system supports Space Shuttle and Station plant-growth research, and is an educational tool for middle-school through college classrooms.

NASA is a primary user of hydrazine-based rocket fuel, and gas scrubbers dissolve this fuel and oxidants into water. To offer an innovative destruction method that is cost effective and environmentally safe, Lynntech Inc. in Texas developed the **GEN II Waste Hydrazine Processing Unit**. This model isn't as labor intensive and is more effective than previous versions.

Following risk assessment, Optimal Engineering Solutions Inc. in Florida developed **PI-eXpert**, software that allows users to visualize and analyze data for process improvement. PI-eXpert visualizes the safety, supportability, mission success, schedule and cost data associated with process and industrial engineering technologies. Ultimately, PI-eXpert can predict risk assessments for future projects when root cause results are available.

Partnerships

Building on its history of partnerships with space-related organizations and other organizations in Florida, KSC continued to combine strengths with its partners to accomplish goals more efficiently and effectively.

The U.S. Air Force's **45th Space Wing** (45SW) is a key KSC partner and plays a vital role in supporting the Center's Space Shuttle launches and numerous Expendable Launch Vehicle missions. Via the Cape Canaveral Spaceport Management Office, the 45SW and the Center managed joint base operations at KSC and the Cape Canaveral Air Force Station. The office improves effectiveness of the two organizations. This partnership resolved key Return to Flight recommendations and embraced the Vision for Space Exploration.

The **state of Florida** continues to be another important KSC partner. Several branches of Florida's government helped KSC achieve its goals and objectives. For example, a partnership with the Florida Space Authority (FSA) helped KSC allow the Columbia Accident Investigation Board to investigate debris in the Shuttle Landing Facility Reusable Launch Vehicle Hanger.

The partnership with the state also launched joint education projects with the Florida Space Research Institute (FSRI) and several financial projects with the Florida Aerospace Finance Corporation. Other state partners included Enterprise Florida Inc., Florida Aviation Aerospace Alliance, Florida universities and institutes, and the Center for Aerospace Technical Education.

Partnerships with **Brevard County** and **civic organizations** greatly benefited KSC's mission and provided a healthy

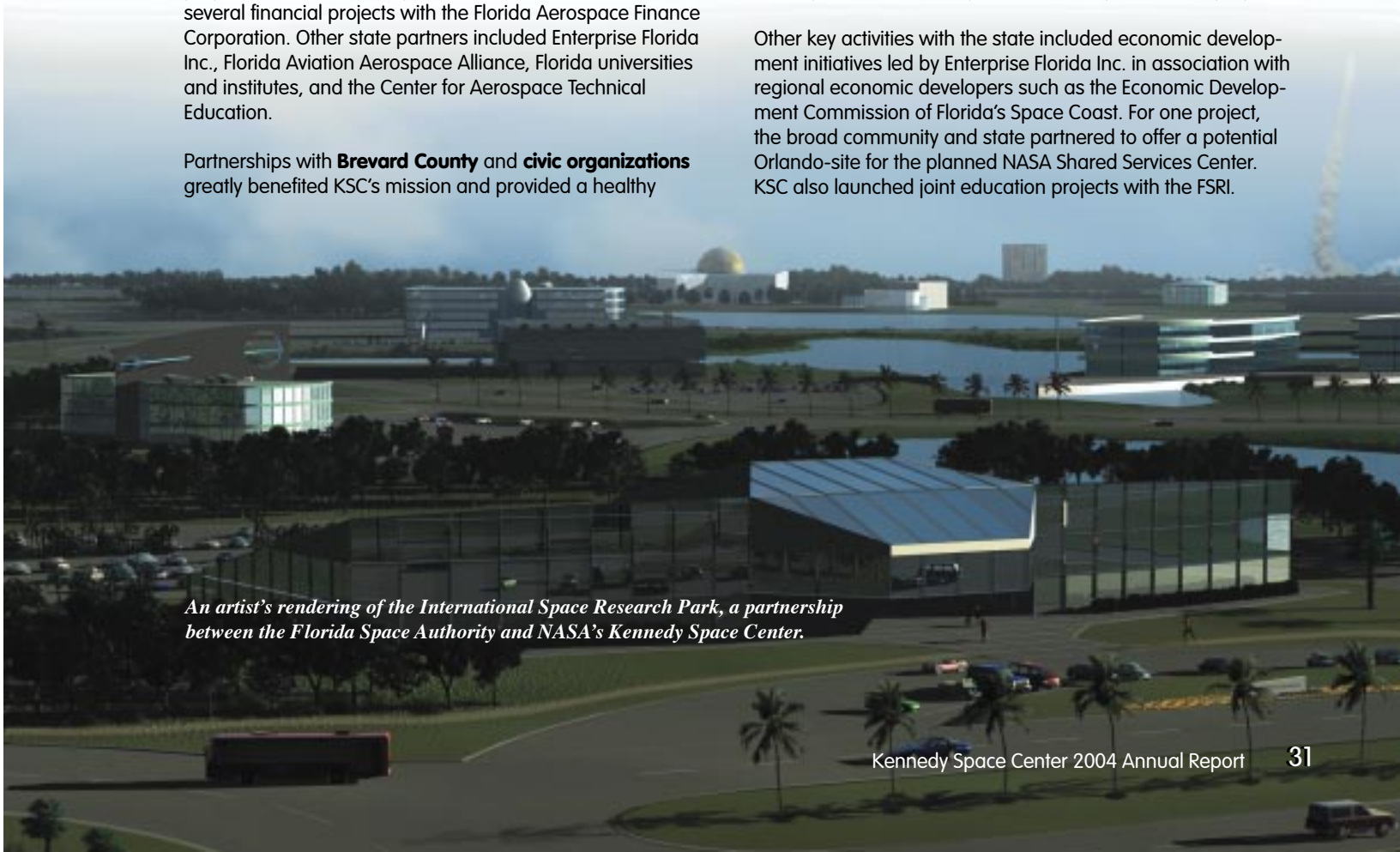
community for employees. In one example, the Brevard Emergency Management Office helped the Center respond to three hurricanes. The local Merritt Island Wildlife Refuge helps KSC manage its 140,000-acre buffer zone.

Other local partners included the Astronauts Memorial Foundation and the Canaveral Council of Technical Societies. The National Space Club local chapter was instrumental in starting the annual Brevard Student Space Week at KSC's Visitor Complex.

Our partnerships with the local Brevard County charitable organizations, principally United Way of Brevard, served as a vehicle for employees to contribute to our healthy and growing community. KSC employees contributed a record-breaking \$389,000 in donations through the 2004 Combined Federal Campaign.

Continuing its long-established and valued partnership with the state of Florida, KSC collaborated with the FSA to complete an environmental impact analysis of the International Space Research Park. Completing the environmental review enables KSC and FSA to finalize the long-term lease agreement and develop the first 90-acre phase of this important new project.

Other key activities with the state included economic development initiatives led by Enterprise Florida Inc. in association with regional economic developers such as the Economic Development Commission of Florida's Space Coast. For one project, the broad community and state partnered to offer a potential Orlando-site for the planned NASA Shared Services Center. KSC also launched joint education projects with the FSRI.



An artist's rendering of the International Space Research Park, a partnership between the Florida Space Authority and NASA's Kennedy Space Center.

Education Programs

Kennedy's Education Programs and University Research Division determinedly supports NASA's mission to "inspire the next generation of explorers...as only NASA can." The Center's unique facilities and specialized work force encourages students to pursue science, technology, engineering and mathematics careers, and engages the public in NASA's pursuit of exploration and discovery.

The Aerospace Education Services Program supported the KSC region of Florida, Georgia, Puerto Rico and the Virgin Islands. Programs were provided for 27,000 educators, students and family groups, along with support for KSC's 10 NASA Explorer Schools.

The Educator Resource Center (ERC) and Exploration Station (ES) reached nearly 32,000 teachers and students this year. In addition, nearly 13,000 family groups participated in the ES program for a combined total of 45,000 groups.

The NASA Explorer Schools (NES) program, which focuses on fourth- through ninth-grade educators and students, added five new NES teams from Florida and Georgia to KSC's pre-existing five teams. Educator workshops included ways to integrate NASA's science roots into curriculum, how to use

real-world issues to better understand topics, and an interactive session with International Space Station residents. Oscar Patterson Elementary School in Panama City, Fla., a KSC NES team, applied and was accepted to fly student experiments via NASA's Reduced Gravity Program.

Nineteen teachers still pursuing their degrees attended the Center's first Pre-Service Teacher Institute for two weeks. Langley Research Center in Virginia developed the program so pre-service educators can enhance their ability to teach elementary and middle school mathematics and science using technology. Bethune-Cookman College in Daytona Beach, Fla., and KSC recruited pre-service teachers from schools in the Virgin Islands, Puerto Rico and Florida. Participants learned how to use a problem-based learning method for their students and then developed and taught a lesson to local children.

Three candidates were selected in 2004 for NASA's Educator Astronaut Program. One of them was Joe Acaba, a seventh- and eighth-grade teacher from Dunnellon Middle School in Florida who will serve as a mission specialist. Among the 160 Educator Astronaut finalists, 23 were from KSC's educational region.

Students at Carol City Elementary School, a NASA Explorer School in Miami, prepare to greet Center Director Jim Kennedy on his visit to the school to share America's new Vision for Space Exploration with the next generation of explorers.





Center Director Jim Kennedy (center) poses for a photo amid members of the KSC-sponsored "Pink" team and the FIRST LEGO League at the 2004 Florida Regional FIRST competition, held at the University of Central Florida in March 2004.

NASA Education, ERC, Delaware North Park Services and Brevard County schools completed the second-annual Brevard Space Week by hosting 6,000 sixth-grade students at KSC's Visitor Complex. The partnership also implemented a new pilot program called "Brevard Blast" for seventh-grade students.

KSC's University Programs Team joins education program investments with the Center's high-priority technology development and research initiatives. Two students and 24 faculty members participated in the NASA Faculty Fellow Program. KSC's Spaceport Engineering and Technology, Space Shuttle and Equal Opportunity directorates and Puerto Rico's and Mississippi's Space Grant Consortia contributed funding. The Center's Education Office worked closely with KSC researchers to add two funded slots for National Research Council Research Associates. Now there are six KSC post-doctoral research associates.

The Center's Education, Human Resources and Equal Opportunity directorates identified the best candidates for competency gaps. Education coordinated with Human Resources to provide a complete picture of KSC at four NASA corporate recruiting events. The teamwork ensures students understand NASA's pipelining programs, from academic support and internships to hiring programs.

In February, KSC hosted 20 university research centers, which are minority universities that perform scientific and/or engineering research with NASA funding. The meeting enabled groups to identify mutually beneficial and collaborative opportunities.

For the second year, KSC and the University of Central Florida hosted Florida's For the Inspiration and Recognition of Science and Technology (FIRST) Robotics Competition. FIRST inspires

high school students, their schools and communities to appreciate science and technology. Forty-two teams competed in the three-day event, with more than 2,000 enthusiastic attendees filled with "gracious professionalism," a key word for the students and their mentors. KSC's team Rocco-bots competed in the finals.

KSC and the other human space flight centers submitted to NASA Headquarters a NASA Explorer Institute (NEI) proposal based on Return to Flight and Vision for Space Exploration activities. NEIs are informal education entities, such as museums, that NASA utilizes to communicate its story and educate the public. KSC received more than \$177,000 for the proposal. An extensive four-day workshop for informal educators occurred in November 2004.

During the 2004 school year, 197 KSC employees judged 29 elementary, four regional and two state science fairs (in Florida and Georgia) reaching more than 14,000 students. KSC awarded 10 recognition awards in Florida and five in Georgia. Florida's award winners were offered a summer internship.

KSC's Educational Technology group continues to develop the Learning Technologies Project (LTP) Virtual Lab. KSC manages the grant to enhance the instrumentation.

A local researcher selected KSC's LTP Virtual Lab to use in several classrooms to gauge student interest. This independent assessment will provide valuable information on its effectiveness and on methods for producing learning tools and resources that significantly impact student learning.

KSC created an engaging Enter the Firing Room Web site (<http://enterfiringroom.ksc.nasa.gov>), which receives hits from around the world.

Outreach to the World

Kennedy Space Center Visitor Complex

The KSC Visitor Complex again helped in spreading NASA's message to more than 1.4 million guests from all over the world. The number is expected to grow steadily over the next 10 years through the continuous addition of new attractions, exhibits and improved guest conveniences.

The NASA and concessionaire team worked diligently in 2004 to develop a thematic master plan that will greatly enhance the visitor experience, bringing this premier visitor center to a new level. Extensive progress was made in designing a new exhibit called the "Shuttle Launch Experience" that is planned to open in 2006. The opening of a second retail store in the Orlando International Airport occurred after the first store, which opened in 2003, proved to be a successful venture. The Astronaut Hall of Fame continues complimenting the existing exhibits and attractions, enhancing the educational value to the visitors and expanding student programs.

A new immersive program called the "Astronaut Training Experience" was piloted during 2004 and proved to be a

success. The one-day program is offered to small groups of people ages 14 and older and includes a special tour of KSC, a meeting with an astronaut, participation in astronaut training via a simulated Shuttle mission and classroom exercises. The program was expanded to include a student version.

The Visitor Complex hosted 6,000 sixth-grade students from Brevard County in a partnership with the School Board to promote math and science. Several high-visibility special events were hosted there, including a ceremony to commemorate the first anniversary of the Columbia tragedy and the induction of the second class of Shuttle astronauts into the Astronaut Hall of Fame. The Visitor Complex also hosted the unveiling of the official Florida quarter, with attendance by the NASA administrator, deputy secretary of the U.S. Treasury, U.S. Mint director, and governor of Florida.

NASA Portal and NASA Direct!

The KSC Web Operations team's primary focus shifted this year to providing mission-related coverage through the NASA Portal. KSC took on new responsibilities in developing all of the

At the KSC Visitor Complex, five Space Program heroes are inducted into the U.S. Astronaut Hall of Fame on May 1, 2004. Accepting inductions, from left, are Norman E. Thagard, the first American to occupy Russia's Mir space station; June Scobee, on behalf of her late husband Francis R. "Dick" Scobee, commander of the ill-fated 1986 Challenger mission; Kathryn D. Sullivan, the first American woman to walk in space; Frederick D. Gregory, the first African-American to command a space mission and the current NASA deputy administrator; and Richard O. Covey, commander of the Hubble Space Telescope repair mission.



Congressman Tom Feeney (left) and Deputy Director Woodrow Whitlow Jr. enjoy an air boat tour around KSC on March 1, 2004. During January and February, Feeney traveled the entire coastline of Florida's 24th District, concluding his journeys March 1 in Brevard County at the KSC Visitor Complex main entrance.



official NASA Portal mission sites featuring the launch, spacecraft and science of every new NASA mission. The team co-manages all site content through launch.

The Web team produced eight live Web broadcasts in support of five Expendable Launch Vehicle missions that included informative presentations and public question-and-answer segments relating to spacecraft technology, mission science and launch processing. Included in this programming were the first live Web broadcasts from Vandenberg Air Force Base, Calif. An average of three to five feature stories and a similar number of video features were produced for each mission on a wide variety of technology and science topics.

KSC's launch-day Web coverage mirrored NASA TV coverage and commentary and featured up-to-the-minute coverage of prelaunch, launch and post-launch events. This coverage, along with an average of 10 to 12 NASA TV video downloads, not only kept viewers informed as events occurred, but also provided them with an online highlights archive. Another accomplishment this year was the conceptualization, development and publication of an interactive flash animation

called "Drive the Mars Rovers." This feature allowed visitors to steer the Opportunity and Spirit rovers around the Gusev Crater and Meridiani Planum to view photos and learn about the mission. "Drive the Mars Rovers" was published in March 2004 and highlighted on NASA's M2K4 site. During its first month, the animation attracted more than one million page views, and in December 2004 was still being highlighted by the print and Web media.

Government Relations

The KSC Government Relations office supported the Vision for Space Exploration through extensive legislative outreach efforts with local, state and federal elected officials. The office arranged and conducted briefings given by the Center Director to the Brevard County Commission, the Florida Legislature, the Florida Governors Office and the Florida Congressional Delegation focusing on the Vision for Space Exploration and other NASA KSC Initiatives.

KSC also participated in the annual Florida Space Day in Tallahassee, hosted a visit to the Center by more than 600 members of the NATO Parliamentary Assembly and their

families, hosted a two-day retreat for the NASA Office of Legislative Affairs and NASA Center Government Relations Office Personnel and participated in planning and implementing the governor's rollout of the Florida quarter at KSC. Center officials also visited NASA Explorer Schools in support of the Vision for Space Exploration.

Many local, state and federal elected officials and groups visited KSC, including Sens. Bill Nelson, Wayne Allard, John Kerry, and Bob Graham, and Reps. Dave Weldon, Tom Feeney, Mark Souder, Nancy Johnson and Todd Platts. Center visitors also included Florida Sec. of State Glenda Hood; State Sen. Mike Haridopolos, State Rep. Bob Allen, and several Brevard County Commissioners, among many others.

Exhibits

The KSC Display Management Team and Kennedy Integrated Display Staff delivered the NASA message to more than 312,000 people participating in 35 events throughout the nation and even in other countries. The exhibits team provided informational materials containing Web sites and up-to-date activities to people in a variety of venues. Events included the Sally Ride Science Festival, air shows, educational venues and Hispanic, African-American and Asian-Pacific festivals.

Exhibits included graphic displays of NASA's programs and showcased the Vision for Space Exploration, NASA's mission and vision statements and the benefits of space. They also highlighted the Space Shuttle and Launch Services programs, and the International Space Station.

The KSC exhibits team partnered with Florida's state and local entities, as well as academic groups, to ensure proper distribution of the NASA message.

Speakers Bureau

As the Agency seeks to increase public understanding of NASA's missions and the contributions of the U.S. Space Program, communication with external audiences plays a vital role. Throughout the year, KSC's Speakers Bureau reached more than 200,000 people with messages about the U.S. Vision for Space Exploration, the International Space Station, science and research, and the Mars missions, to name a few. KSC provided speakers to more than 300 educational, industry and government groups, civic and professional associations and clubs, and 50 national events and 16 international events.

A group of 21 astronauts and others in the space industry brought the NASA message to a broad base of diverse events and organizations. These included the Women in Law

Enforcement Conference, the American College of Dentists, Ninety-Nines International Organization of Women Pilots, University of Miami Space Forum and Indian River County Medical Society.

KSC's speakers also presented the NASA message to the 21st Century Space Exploration Conference, the University of Central Florida's Student Union Lecture Series, Astronomy Clubs, Rotary Clubs, university-sponsored Girls in Science programs and the Florida Department of Transportation Conference.

Speakers delivered their programs to aviation associations, aerospace clubs, Boy Scout and Girl Scout groups, Florida Library programs, the Hispanic Heritage Celebration in Tampa, Hispanic Conference in Jacksonville, Fla., American Society of Engineers meetings, Youth Leadership Program for Hispanic Students at Volusia College, Society of Women Engineers, American Society for Mechanical Engineers Tallahassee town hall meeting and the Florida Governor's Council on Indian Affairs.

Media Services

The Media Services division at the KSC News Center helped to increase public awareness and support of Space Programs and KSC activities by producing and distributing various multimedia products to the world's media organizations. Among these products were fact sheets, press releases, video news releases, live and radio phone-in interviews, still photographs, video footage of activities, tapes and CDs.

The News Center coordinated events and programs spotlighting KSC-related milestones and activities, including the 35th anniversary of Apollo 11, a "Discovery Day" media workshop, STS-114 Orbiter Boom Sensor System modifications, the Astronaut Hall of Fame Induction ceremony, MESSENGER spacecraft processing and launch events, and hurricane preparations and damage assessments.

Other special media events planned and implemented by Media Services included media witnessing a sound-suppression test at Launch Complex 39A, a tour of the Orbiter Processing Facility with Discovery in processing, the Space Life Sciences Lab ribbon cutting and tour, and the media events surrounding launches from both Cape Canaveral Air Force Station and Vandenberg Air Force Base in California. Many other news conferences were hosted by KSC.

It is estimated that nearly 530 million people throughout the world were reached through the efforts of KSC's media projects.

During the year, Media Services provided more than 15,000 products to the media in the U.S. and various countries including Germany, Argentina, England, Zimbabwe, Cameroon, Israel, Finland, India, Denmark, Turkey and Romania. Other requestors included media from Switzerland, Norway, Japan, Canada, Sweden, Australia, South Korea, France and Belgium.

KSC's News Center also received requests from local, national and international media for assistance in nearly 160 media projects. These included requests for tours, on-site filming for documentaries and films, photography and other events at KSC. Requests were received from television, radio, print, Internet and wire service representatives.

Also, the News Center assisted with Agencywide outreach efforts to inform the world of NASA's vision to return a human

presence to the Moon and ultimately the planet Mars. Messages supporting the Vision for Exploration are ever present in the products produced and disseminated to the world's media.

Special media projects supported by the KSC News Center included a 10-part series on "Massive Engines" produced by Oxford Scientific Films; media coverage of Columbia debris preservation in the Vehicle Assembly Building; a Return to Flight documentary for The Discovery Channel; filming for an episode of "Court TV" about extreme evidence; and a History Channel crew filming an Apollo 11 documentary for its "Modern Marvels" program. Also, a WKMG Channel 6 news piece (serving Central Florida) on the Crawler Transporter vehicles and an orientation tour for the U.S. production crew of the Indian movie "Swades" were coordinated by the Media Services team.



Participants visit the One-NASA exhibit featuring NASA's initiatives to strengthen space exploration, information technology and an interactive "space man," at the Interservice/Industry Training, Simulation and Education Conference at the Orange County Convention Center in Orlando, Fla.

2004 KSC Business Report

Chief Financial Office's Letter

Much like the previous year, FY 2004 marked a time of significant change for the financial operation of the KSC. NASA became the first federal agency to operate under full-cost principles, as the Office of the Chief Financial Office successfully directed the implementation of full cost accounting, budgeting and management at the Kennedy Space Center. In simplest terms, full cost ties direct and indirect costs to major programs, projects and institutional activities. In contrast to past business practices, institutional and infrastructure costs, such as civil service salaries and the use of facilities and support services, are linked to programs and projects. Thus, the work performed at KSC, whether it be an Agency program or external work on a cost reimbursement basis, will include the full range of expenses required to perform the activity. This accomplishment significantly contributed to the agency going "Green" on The President's Management Agenda criteria for "Integrating Budget and Performance."

KSC also successfully transitioned the KSC Payroll system to the new Department of Interior (DOI) system, meeting the "go live" date of Aug. 8, 2004. KSC and the other Centers have transitioned their entire payroll function to the DOI. This accomplishment was a significant contribution to the Agency's E-Payroll Initiative in The President's Management Agenda item, "Improving Financial Performance."

The budget brought good news to KSC in FY 2004. The Center increased its spending allowance over FY 2003 by nearly \$300 million to a total of \$2 billion, with the inclusion of Shuttle Program funding managed by the Johnson Space Center, but spent locally. Although not finalized at this point, the Center's expectations for FY 2005 project an increase of an additional \$200-300 million. Increases spell good news for the local and state economies, as well as confidence in the work performed by the employees of KSC.

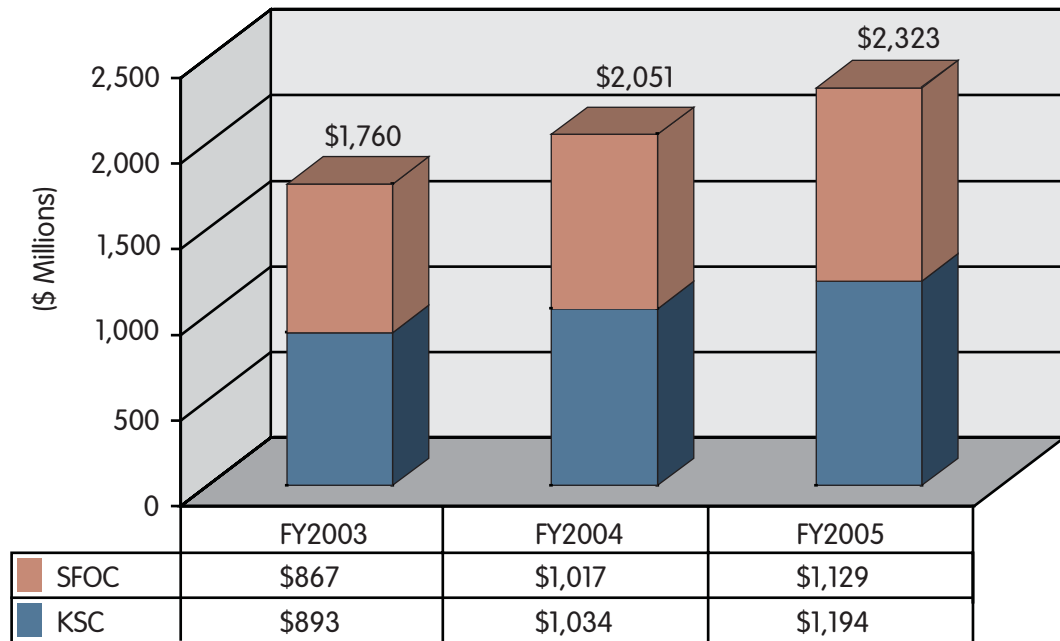
FY 2004 also brought significant hurricane damage around the Center. Quick action by Center management, NASA Headquarters and the U.S. Congress produced hurricane recovery funding for KSC in the amount of \$126 million, which the CFO Office coordinated, distributed and managed the funds to expedite facility repairs, enabling the critical "Return to Flight" operations to resume. The hurricanes occurred during critical end-of-fiscal-year activities when the Center (and the federal government) closes out its books. In response, the CFO office deployed a group of employees to the Marshall Space Flight Center in Huntsville, Ala., to maintain the Agency closing schedule during Hurricane Jeanne-mandated evacuations. The CFO successfully setup and maintained a communications link to the KSC accounting personnel that allowed all Agency-mandated month-end and year-end activities to be completed accurately and on time.

Internally, the Chief Financial Office reorganized to provide a business services group with specific emphasis on process improvements, training and center metrics, as well as created an institutional resources office to improve focus on the growing needs of the KSC infrastructure and alignment with the strategies and changing ways of doing business associated with full cost implementation. In addition, the office has successfully directed major business process improvements using the Six Sigma methodology, initially focusing on contractor cost reporting and analysis, labor utilization, and improvements to the procurement process.

Finally, Chief Financial Officer Napoleon Carroll served as Brevard County Chairperson of the Combined Federal Campaign this year. Under his direction, both donations and employee participation rose to record highs, totaling nearly \$400,000 in charitable giving by 82 percent of KSC employees.



NASA/KSC BUDGET AUTHORITY SUMMARY
FY 2003 THRU FY 2005
(DOLLARS IN MILLIONS)



United Space Alliance (USA) is the contractor for the Space Flight Operations Contract at Kennedy Space Center. The Space Shuttle processing work is managed by Johnson Space Center and performed at KSC. The FY 2003 and FY 2004 numbers are actuals and FY 2005 is the projected budget.

Economic Impact

Just as the sights and sounds of a rocket launch brings excitement to the lives of many Central Florida people, the enormous operation that is required to make the launches possible releases a powerful blast of economic activity that flows through the businesses and households of Brevard County, the Central Florida region and other areas of the state. While the excitement of the launch is relatively short-lived, the economic effects of NASA operations in Florida are continuous and sustained. In FY 2004, of the \$15 billion NASA budget, it is estimated that KSC and other NASA Centers injected nearly \$1.5 billion into the local and state economies of Florida. This spending set off a cycle of economic transactions that flowed throughout many sectors of these economies and created a multiplied level of total economic activity that far exceeded NASA's initial injection. Preliminary estimates of this multiplied "NASA effect" is a total economic impact of \$3.2 billion in the state of Florida.

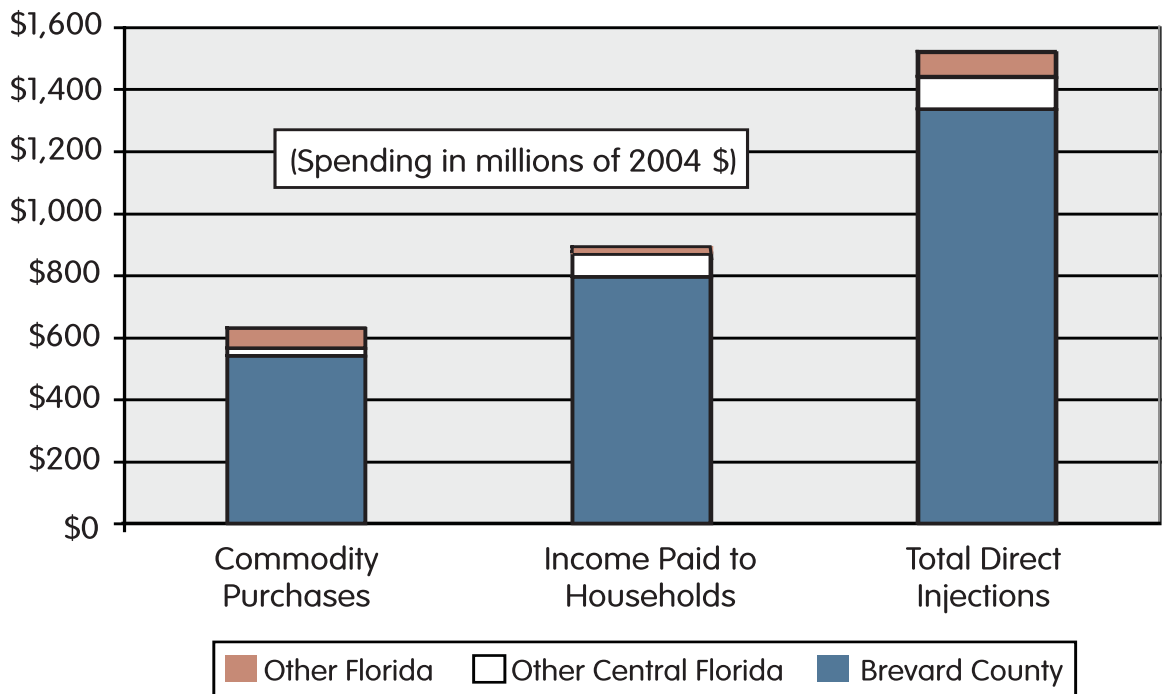
To explore space, NASA requires an extraordinary range of commodities, including liquid and gaseous propellants, rocket engines, computers and photographic equipment. The range of services purchased is just as wide, including communications, laboratory testing, Space Shuttle processing, payload integration and testing, expendable launch services, university research, etc. In meeting NASA's demand for these goods and services, 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 regional firms for materials and services. Each round of such spending recirculates NASA's initial demand among Florida's businesses and households, multiplying the direct impact on the economy.

In addition to the economic activity brought about by NASA's spending on launch and space flight operations, there are a number of other activities directly associated with NASA that also add to the total economic impact in Florida. These include the local travel expenditures of out-of-state business and government personnel that travel to KSC to conduct business, KSC Visitor Center's sales to out-of-state visitors, and the federal, state and local taxes these sales generate.

KSC annually conducts an Economic Impact Analysis to measure NASA's effect on the economy at the local, regional and state levels. Since 2002, the report has been conducted by the *Transportation Economics Research Institute* of Mount Dora, Fla.



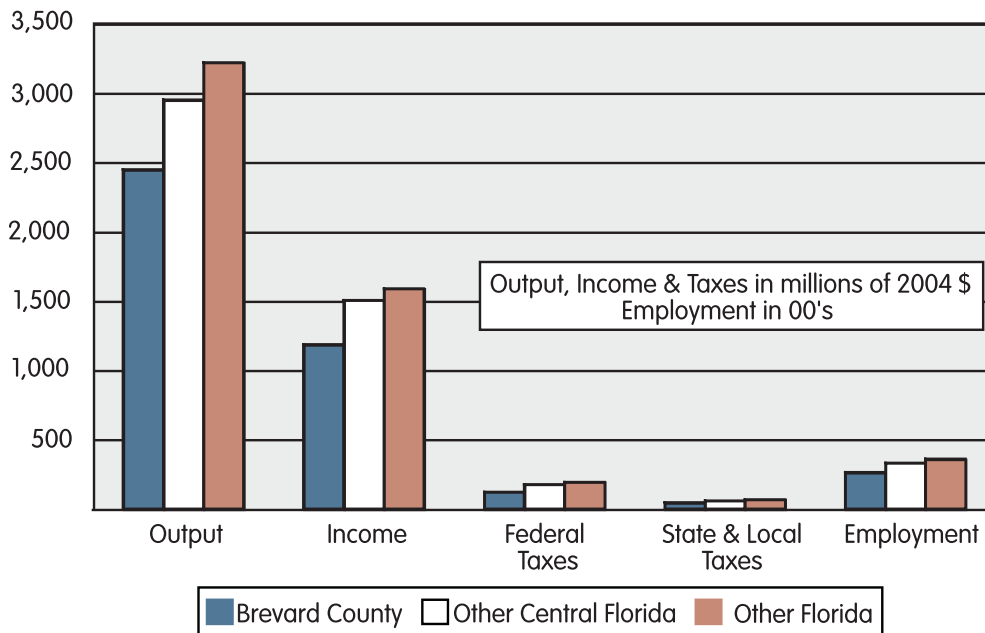
TOTAL INJECTIONS INTO FLORIDA ECONOMIES BY KSC/NASA ACTIVITIES SPENDING, LOCAL TRAVEL EXPENDITURES OF KSC BUSINESS VISITORS AND KSC VISITOR CENTER PURCHASES BY OUT-OF-STATE VISITORS FY 2004



	(Millions of 2004 \$)			
	Brevard	Other Central Florida	Other Florida	Florida Total
Commodity Purchases	540	25	64	629
Income Paid to Household	795	79	17	890
Total Direct Injections	1,335	104	80	1,520

In FY 2004 all KSC/NASA activities injected \$1.52 billion of outside money into Florida's economy. This total consisted of \$890 million in direct earnings payments to households and \$629 million in direct commodity purchases from contractors. Ninety-five percent of the total injection went to Central Florida businesses and households.

THE TOTAL ECONOMIC IMPACT OF ALL NASA ACTIVITIES AT KSC IN FLORIDA BY GEOGRAPHIC AREA FY 2004



Area of Economic Impact	(Millions of 2004 \$)				(Jobs in 00's)
	Output	Income	Federal Taxes	State & Local Taxes	Employment
Brevard County	2,498	1,265	108	51	273
Central Florida Region	2,912	1,496	155	67	311
State of Florida	3,285	1,576	166	76	329

Output: The total generated economic impact resulting from direct expenditure of earnings and commodity purchases by NASA, multiplied by the subsequent effects that this economic injection has on downstream activities.

Income: That portion of the economic output generating employee salaries and related.

Employment: Number of jobs created by the initial and subsequent economic output.

In FY 2004, the total economic impact of NASA in Florida was \$3.3 billion in output, \$1.6 billion in household income and 33,000 jobs. This activity also generated \$166 million of federal taxes and \$76 million of state and local taxes.

Work Force Diversity

ON DUTY FULL TIME SERVANTS	1,796
ON DUTY OTHER-THAN-FULL TIME SERVANTS	163

TOTAL CIVIL SERVANTS	1,959
-----------------------------	--------------

CIVIL SERVANT SKILL MIX

SCIENTIFIC & ENGINEERING	60%
ADMINISTRATIVE	25%
TECHNICAL	8%
CLERICAL	7%

ON-SITE CONTRACTOR EMPLOYEES	10,061
OFF-SITE CONTRACTOR EMPLOYEES	949

TOTAL CONTRACTOR EMPLOYEES	11,010
-----------------------------------	---------------

TOTAL CONSTRUCTION EMPLOYEES	573
------------------------------	-----

TOTAL TENANTS	1,332
---------------	-------

TOTAL KSC POPULATION	14,874
-----------------------------	---------------



Procurement Report

Industry Partners at a Glance

The companies listed below were KSC's top support contractors or Launch Services contractors in terms of dollars obligated in FY 2004. Following is a brief description of their work for the Agency:

United Space Alliance (USA)

Under a Johnson Space Center contract, USA is the prime contractor for the Space Flight Operations Contract. USA's primary purpose is to ensure mission success for the Space Shuttle Program. KSC is the primary point of responsibility for launching and landing the Space Shuttle. USA supports Ground Operations and Orbiter Logistics elements of the Space Shuttle Program at KSC.

Space Gateway Support (SGS)

SGS, a joint venture of Northrop Grumman, Wackenhut and Shaw Environmental and Infrastructure Inc., provides base operations support for KSC and Cape Canaveral Air Force Station (CCAFS). SGS is responsible for roads and grounds maintenance, facilities, custodial needs, fire, security, calibrations and propellants handling.

The Boeing Company

Boeing Space Operations Company is the prime contractor for the Checkout, Assembly and Payload Processing Services (CAPPS) contract. Its primary purpose is to support payload processing for the International Space Station, Space Shuttle and Expendable Launch Vehicles (ELVs). Boeing performs all aspects of payload processing, including the planning and receiving of payloads, maintenance of associated payload ground systems, integration of payloads with the Space Shuttle, launch support and Space Shuttle post-landing payload activities.

InDyne, Inc.

InDyne, Inc. provides communication services under the Kennedy Space Center Integrated Communications Contract (KICS) supporting the Space Shuttle, Payload Carriers, Launch Services and the International Space Station. InDyne provides hardware and software integration and development for voice, video and data communications. InDyne also supplies motion picture, still photographic, digital and video products and services for NASA, commercial ELV and Department of Defense customers. InDyne handles the operation, administration and maintenance of the administrative telephone system in support of all KSC residents.

Analex, Inc.

Analex is the prime contractor on the ELV Integrated Support contract. The contractor is responsible for performing and integrating the overall programmatic ELV business and administrative functions, including program/project planning, risk management, evaluation and information technology. Services include the management, operation, maintenance and "sustaining engineering" of the NASA ELV telemetry stations located at CCAFS and Vandenberg Air Force Base (VAFB); engineering services/studies and technical services for various ground/flight ELV systems and payloads; and management, operation, maintenance and "sustaining engineering" of assigned NASA facilities, systems and equipment at VAFB.



The Arctic Slope Research Corp. (ASRC) Aerospace

ASRC Aerospace provides research and engineering services and technical support to the KSC Spaceport Engineering and Technology organization and other Center operational customers. The support ranges in scope from providing research, engineering development and management of complex research and development and technology projects, to offering engineering and technical support of various KSC laboratories and test beds. ASRC Aerospace uses a group of affiliated universities in performing applied research and technology development efforts. ASRC Aerospace also provides technology outreach to foster awareness and reliance upon KSC's unique capabilities.

Dynamac Corp.

The Life Sciences Services Contract provides a broad range of life sciences services to NASA. These include medical operations for Space Shuttle and International Space Station programs; environmental compliance and stewardship; life sciences payload operations; support to the Agency Occupational Health Program Office; biological science; life sciences payload development; work force protection; fitness and musculoskeletal rehabilitation; and education outreach.

The Boeing Company

Delta Launch Services, Inc. provides the Agency with launch services using its Delta II vehicle. Boeing is the contractor for one of two existing NASA Launch Services multiple-award Indefinite Delivery Quantity task order contracts. Principal location for the Delta II vehicle assembly is in Decatur, Ala. The Delta II is launched from CCAFS and VAFB.

Lockheed Martin Co.

Lockheed Martin Commercial Launch Services, Inc. provides the Agency with launch services using its Atlas vehicle. Lockheed is the contractor for one of two existing NASA Launch Services multiple-award Indefinite Delivery Quantity task order contracts. Principal location for the Atlas vehicle assembly is in Denver. The Atlas is launched from CCAFS and VAFB.

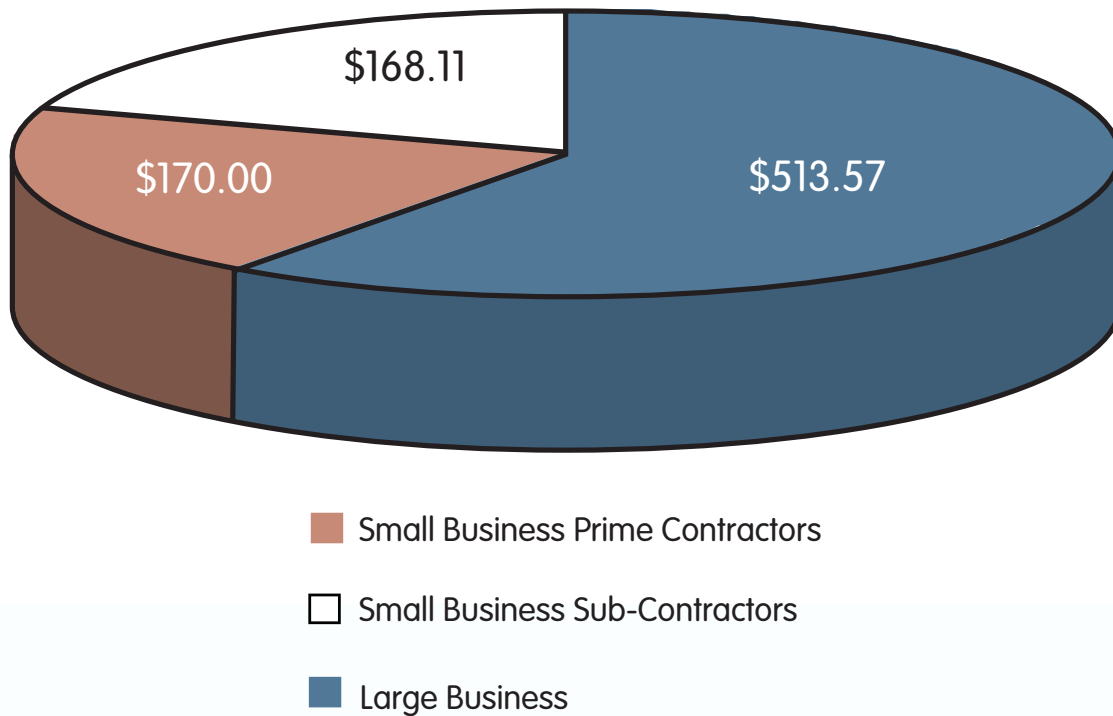
Orbital Sciences Corp.

Orbital Sciences provides small ELV services for the Agency, using the Pegasus and Taurus small ELVs launched from CCAFS, VAFB, Wallops Flight Facility in Virginia, and equatorial launch ranges.



SUPPORTING SMALL BUSINESS

Supporting small business is a NASA priority. During the fiscal year, KSC obligated \$170 million to small businesses in all designations (small disadvantaged, woman-owned, etc.), achieving 113 percent of its total small business goal of \$150 million. This amount was a significant increase from the \$127 million in small business prime contracts awarded in FY 2003. Additionally, KSC's large businesses obligated \$168 million in sub-contracts to small businesses. Therefore, KSC obligated almost 40 percent of its business base of \$851.7 million to small business through prime contracts and sub-contracts from large businesses.



TOP 20 KSC BUSINESS CONTRACTORS FOR FISCAL YEAR 2004

Contractor Obligated	Number of Contracts	Dollars (in Thousands)
Space Gateway Support	1	266,424
Delta Launch Services, Inc.	3	156,689
Lockheed Martin Corp.	3	101,230
The Boeing Company	5	76,627
InDyne, Inc.	1	33,130
Analex Corp.	1	31,495
ASRC Aerospace Corp.	1	26,143
Orbital Sciences Corp.	1	25,900
Dynamac Corp.	6	16,550
Ivey's Construction, Inc.	3	14,615
OA0 Corp.	2	10,277
Air Liquide America Corp.	2	5,752
Praxair Inc.	4	5,583
Canaveral Construction Co, Inc.	4	3,511
SGT Inc.	2	3,219
All Points Logistics, Inc.	9	3,212
Jones Edmunds & Associates	35	2,924
Redux Inc.	1	2,557
Cendant Mobility Services Corp.	1	2,460
Infinite Energy, Inc.	1	2,152
TOTAL	86	790,450

Johnson Space Center's Space Flight Operations Contract held by United Space Alliance recorded \$802.63 million managed by the KSC Procurement Workforce in FY 2004.

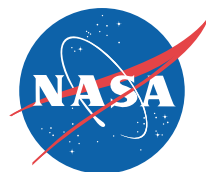
YOUR PROCUREMENT DOLLARS AT WORK

GEOGRAPHICAL DISTRIBUTION BY STATE (FISCAL YEAR 2004 OBLIGATIONS)

State	Total(\$K)
Alabama	750
Arkansas	32
Arizona	26,205
California	11,905
Colorado	1,891
Connecticut	8,483
District of Columbia	139
Delaware	26
Florida	799,401
Georgia	1,879
Hawaii	16
Iowa	116
Illinois	843
Indiana	52
Kansas	29
Kentucky	516
Louisiana	99
Massachusetts	1,398
Maryland	6,187
Maine	15
Michigan	464
Minnesota	1,142
Nevada	5
New Hampshire	307
New Jersey	442
New Mexico	6,371
New York	367
North Carolina	226
Ohio	1,811
Oklahoma	150
Oregon	167
Pennsylvania	842
South Carolina	250
South Dakota	3
Tennessee	57
Texas	2,531
Utah	161
Virginia	2,974
Washington	180
West Virginia	7
Wisconsin	1,278
Wyoming	100
Total: *	879,817

During the fiscal year, the Center obligated approximately \$879 million within the U.S. in support of the NASA mission. As indicated by the chart, 42 different states received procurement dollars from KSC.

* Includes Intragovernmental, Grants, Agreements and Bank Card Transactions.



(Front Cover) Sea oats gently sway in the breeze against the magnificent backdrop of blue sky and ocean along the coastline of America's spaceport.

FY 2004 Annual Report produced by InDyne Inc.,
graphic designer Lynda Brammer, and
writers Linda Herridge and Jennifer Wolfinger.
Copy-editing by Corey Schubert,
All Points Logistics