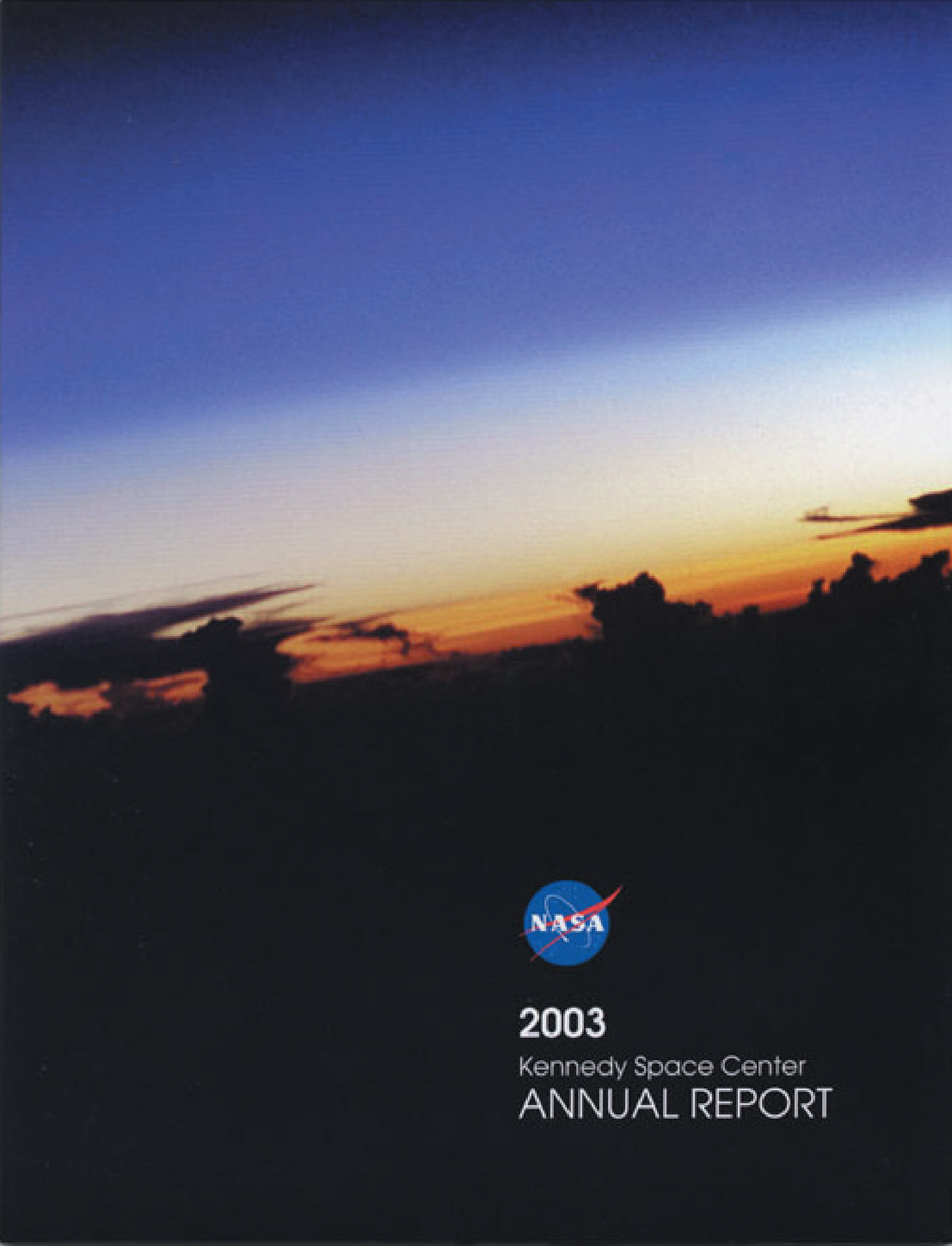


2003

Kennedy Space Center

ANNUAL REPORT

2003
ANNUAL REPORT
TABLE OF CONTENTS

A MESSAGE FROM THE CENTER DIRECTOR

With the loss of STS-107 and the Space Shuttle Columbia in February 2003, the public may have expected NASA and the Agency's John F. Kennedy Space Center to stop meeting the challenges of space exploration. However, the challenge of restoring the Space Shuttle program to safe flight serves as the perfect platform for KSC to flourish.

As a Center built upon inspirational visions, dedicated workers and an unquenchable thirst for exploration, we accept unexpected diversions as opportunities to test our strength. With our mettle now forged by fire, we'll succeed in the future by overcoming challenges and leading the world in space exploration.

Fiscal Year (FY) 2003 was marked by amazing milestones, especially our workforce's dedication to our Core Values and acceptance of our Guiding Principles. This approach is a passion of mine because a shared vision provides a foundation for future success.

We excel because our inclusive setting not only respects differences, but treasures everyone's unique qualities. We recognize the importance of each person's contribution to the Center and how their perspective only makes our results richer. By avoiding stagnant management, the Center's leadership is fluid, serving as a catalyst for endless new ideas.

The safety of our workforce, astronauts and public remains our top priority, serving as the Center's backbone. Whether supporting an awe-inspiring event or routine task, safety is always the unifying factor in everything we do. While the Center prompts many special professional and personal bonds, I realize our families are what are most important in life and I never forget that.

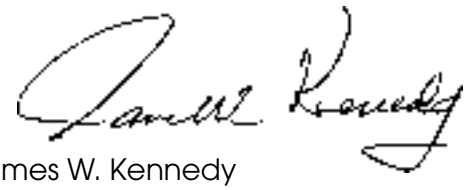
We remain good stewards of the environment by protecting the serene National Wildlife Refuge. KSC is living proof our world can continue progressing while responsibly caring for our resources.

None of these principles are successful without serving our customers with excellence at all times and relying on teamwork to accomplish this important task. Our truly collaborative approach creates a productive stability.

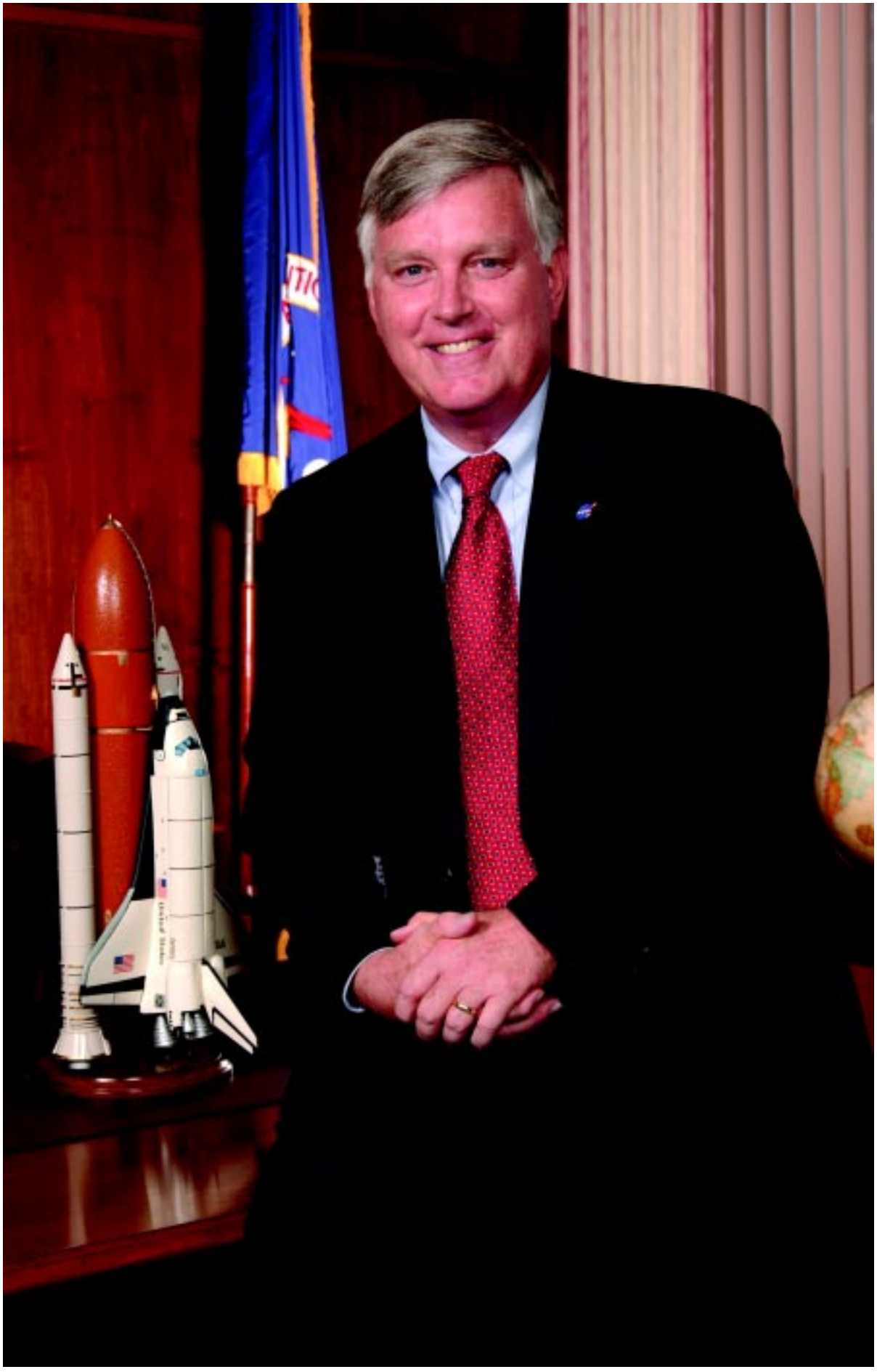
When my leadership journey with KSC began this fiscal year, I joined a tremendous heritage. I intend to continue this legacy by expecting much from the workforce, thus ensuring we meet the public's expectations of continuing our space exploration journey for the benefit of humankind.

Through remarkable teamwork in FY 2003, KSC supported eight Expendable Launch Vehicle missions, three Space Shuttle launches and two landings, International Space Station processing, our reservists fighting the war on terror and much more. Our future comprises ambitious goals as well, including returning our Space Shuttle fleet to safe flight and developing new technologies and future vehicles supporting the Vision for Space Exploration.

As KSC continues tirelessly inspiring future generations and exploring the universe, we should all look forward to KSC's future impact on our world.



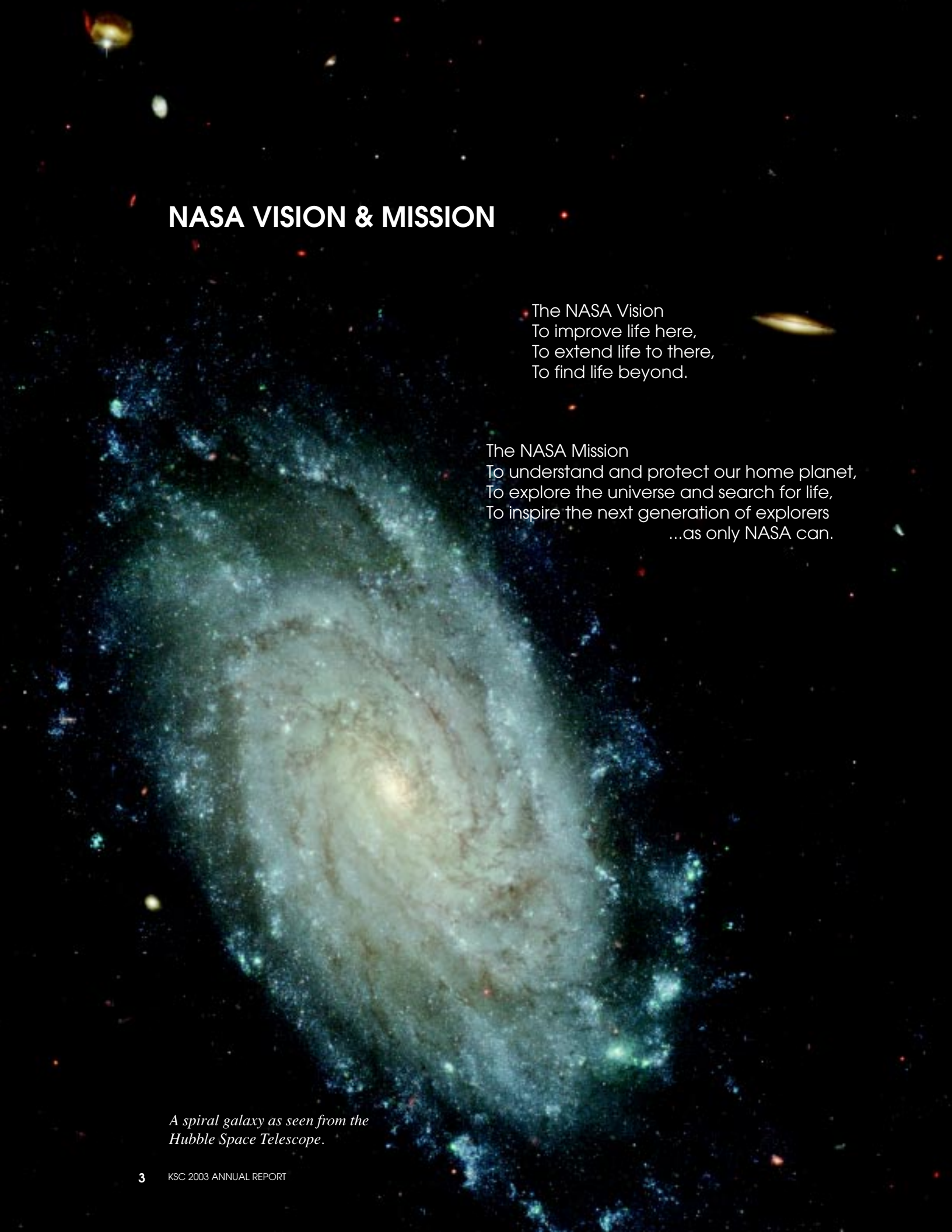
James W. Kennedy



NASA VISION & MISSION

The NASA Vision
To improve life here,
To extend life to 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.



A spiral galaxy as seen from the Hubble Space Telescope.

THE PRESIDENT'S MANAGEMENT AGENDA

KSC fully embraces the President's Management Agenda (PMA) to achieve NASA's Mission as safely and efficiently as possible. Within the PMA 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 Capitol

NASA strives to attract and retain the best and brightest scientists and engineers. KSC is enhancing recruitment efforts, increasing technology-based training opportunities and establishing and aligning student programs to assure a future "pipeline" of employees. In FY 2003, KSC rolled out the Agency's Strategic Human Capital Plan and hosted expos to discuss new initiatives and demonstrate new human capital tools to employees. KSC actively participates in the NASA Corporate Recruiting Program, including leading the recruiting trip to the University of Puerto Rico, and spearheading additional KSC-specific recruiting trips. Using competency management and training and development strategies, KSC is aggressively seeking ways to optimize its workforce to facilitate staffing for Return to Flight, Orbital Space Plane, the NASA Engineering Safety Center and other Agency priorities.

Competitive Sourcing

In the framework of the NASA Competitive Sourcing initiative, KSC is working to achieve efficient and 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 exceeded the 15 percent OMB requirement for FY 2003. Future plans for KSC include providing 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

Significant achievements included implementation of the Integrated Financial Management Program's (IFMP) Core Financial and Travel Manager modules in February 2003; supporting the audit of NASA's FY 2003 financial statements by providing financial data and analysis to independent auditors and NASA

Headquarters; and working with the Competency Center to support full cost configuration in Core Financial for FY 2004 operations. Progress continued in addressing Core Financial stabilization and data issues.

e-Government

KSC continued implementation of a common network infrastructure for NASA e-Gov activities, as well as participating in federal e-Gov initiatives. This year, KSC completed its network infrastructure upgrade plan, designed systems to support the One NASA portal, and led an Agency-wide pilot at seven NASA Centers for the Agency Security Update System. KSC also leads the One NASA ePresence pilot, and implemented Phase 1 of the NASA Management Information System. In addition, KSC manages the Agency's Cyber Identity Management System Project, and leads the Office of Space Flight ODIN WebEx pilot.

Integrated Budget and Performance

KSC prepared for implementation of full cost accounting procedures in FY 2004. These included establishing a Full Cost Team to implement full cost practices at KSC; delivering a training program for approximately 200 end-users; and updating and developing a full cost budget submission for FY 2004 thru FY 2009. KSC also worked with NASA Headquarters and the IFMP program to standardize structures; reconfigure the accounting system and resolve operational issues; as well as develop and deploy a program of Change Management for the Center, which included a "Full Cost 101 Road Show" offered to all Center employees.

Through this framework, KSC realizes its strategic goals to assure and advance access to space for exploration, development and use; provide innovative spacecraft and range technologies for safe space operations and exploration missions; and provide and assure safe, world-class services.

SIGNIFICANT EVENTS

10/7/02 –STS-112/Atlantis launches to deliver the S1 Truss to the International Space Station, and attach it to the S0 Truss.

10/17/02 – The Tracking and Data Relay Satellite-J (TDRS-J) arrives at KSC's Shuttle Landing Facility. The TDRS System is the primary source of space-to-ground voice, data and telemetry for the Space Shuttle.

10/18/02 –STS-112/Atlantis lands at KSC.

11/23/02 – STS-113/Endeavour launches to transport the Expedition Six crew, and deliver and attach the Port 1 Integrated Truss Segment to the ISS.

12/4/02 - NASA's third TDRS, TDRS-J, lifts off from Cape Canaveral Air Force Station (CCAFS), Fla., aboard an Atlas IIA rocket.

12/6/02 – NASA chooses the Delta II expendable launch vehicle, provided by Boeing Launch Services, Inc., to launch 19 NASA and NASA-sponsored medium-class scientific payloads between 2006 and early 2009.

12/7/02 –STS-113/Endeavour lands at KSC.

12/17/02 – Final pieces for the Station's football-field-long backbone arrives at KSC's Shuttle Landing Facility.

1/12/03 – NASA's Ice, Cloud and Land Elevation satellite and Cosmic Hot Interstellar Spectrometer satellite lift off from Vandenberg Air Force Base (VAFB), Calif., aboard a Delta II launch vehicle.

1/16/03 – Launch of STS-107/Columbia, a microgravity research flight and an Extended Duration Orbiter mission.

1/25/03 – NASA's Solar Radiation and Climate Experiment successfully launches aboard a Pegasus XL rocket from CCAFS.

2/1/03 – A Space Shuttle contingency is declared in Mission Control, Houston, as a result of the loss of communication with the Space Shuttle Columbia at approximately 9 a.m. EST as it descended toward a KSC landing. No communication and tracking information are received in Mission Control after this time. The STS-107 crew members and Columbia are lost because of a breach in the left Reinforced Carbon Carbon wing leading edge.

2/7/03 – Private KSC employee memorial service occurs honoring the departed STS-107 Columbia crew.

2/12/03 – Columbia Accident Investigation Board (CAIB) arrives at KSC.

2/24/03 – First of two Mars Exploration Rovers, MER-2, arrives at Center from the Jet Propulsion Laboratory in Pasadena, Calif. The rovers serve as robotic geologists to seek answers about the evolution of Mars.

2/25/03 – Groundbreaking for the second Operations Support Building (OSB II). The site of the new six-story, 189,000-square-foot building is in the Launch Complex 39 area near the Vehicle Assembly Building.

3/6/03 – The Space Infrared Telescope Facility (SIRTF) arrives at KSC for launch preparations. On Aug. 25, SIRTF is renamed the Spitzer Space Telescope in honor of the late Dr. Lyman Spitzer Jr.

4/28/03 – NASA's Galaxy Evolution Explorer spacecraft launches from a Pegasus XL rocket from CCAFS. The mission features an orbiting telescope to observe millions of galaxies across 10-billion years of cosmic history.

6/1/03 – A major Station component, NASA's Node 2, arrives at the Center. The European Space Agency (ESA) in Italy built Node 2 for NASA.

6/4/03 – A major Station component, the Japanese Experiment Module (JEM), arrives at KSC. The pressurized module is Japan's primary contribution to the Station.

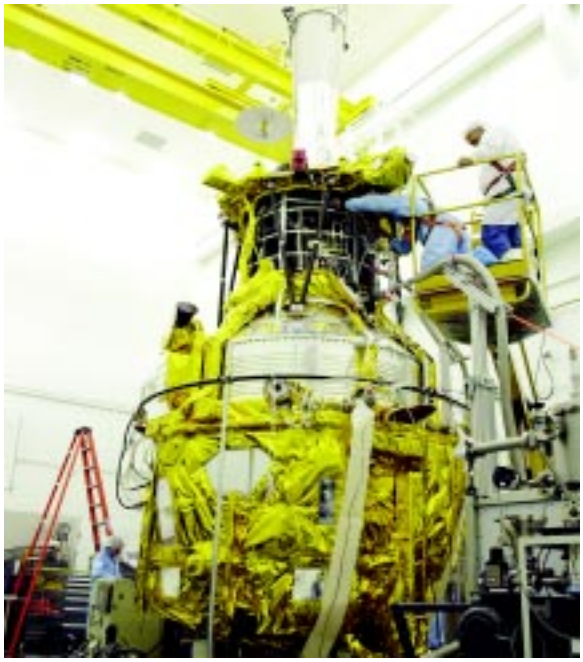
6/5/03 – KSC's Web site celebrates its first-time online coverage of an expendable vehicle mission with the first MER mission and its associated events.

6/10/03 – MER-A launches aboard a Delta II launch vehicle from CCAFS.

6/18/03 – KSC ceremony highlights arrival of Node 2 and JEM. The event includes official transfer of ownership of Node 2 between ESA and NASA.

7/7/03 – MER-B launches aboard a Delta II launch vehicle from CCAFS.

7/7/03 – Several days of tours begin for the workforce and their guests to view Columbia debris. Experts are available to provide information and answer questions.



7/11/03 – NASA spacecraft, designed to test two of Albert Einstein's Theory of General Relativity predictions, travels to the VAFB launch site for the Gravity Probe B mission.

7/15/03 – Flight demonstration tests KSC-managed Space-based Telemetry And Range Safety (STARS) at NASA's Dryden Flight Research Center demonstrating a more effective, economical tracking and communication technology.

7/28/03 – Two new security gates complete the opening of Space Commerce Park and a new roadway. This provides an alternate route for the general public between Titusville and Merritt Island, Fla.

8/10/03 – James W. Kennedy becomes 8th KSC Director after serving as Deputy Director since Nov. 2002. Gen. Roy D. Bridges, former KSC Director, becomes Director of the Agency's Langley Research Center, Hampton, Va.

8/12/03 – The Canadian Space Agency's Scientific Satellite Atmospheric Chemistry Experiment launches aboard an Orbital Sciences Pegasus XL at VAFB.

8/20/03 – The Center inaugurates the Agency's One NASA leader-led workshops, helping employees better understand the Agency's overall strategy and direction. One NASA is a cultural change emphasizing a strong commitment to teamwork, accessible tools and a greater collaboration across the Agency.

8/25/03 – The Spitzer launches aboard a Delta II launch vehicle from CCAFS.

8/26/03 – CAIB releases its report on the Columbia investigation. NASA Administrator Sean O'Keefe accepts CAIB Report recommendations and findings.

9/17/03 – The Multi-Element Integrated Test between the JEM and NASA's Node-2 is successfully completed inside the Space Station Processing Facility.

9/23/03 – Atlantis continues preparations for Return to Flight. Some of the work includes reinstallation of the Reinforced Carbon-Carbon panels on the Shuttle's wing leading edge, wiring inspections, and checks of the Shuttle's engines in the Orbital Maneuvering System.

SAFETY AND HEALTH FIRST

Top: Promoting wellness, the annual Spaceport Super Safety and Health Day included a blood pressure check station.
Right: Spaceport Super Safety and Health Day offers the workforce informative presentations and exhibits to reinforce safe and healthful behaviors.

Addressing safety and health concerns and continuously improving employee wellness, the Center tirelessly supports its top priority and one of KSC's four Guiding Principles — Safety and Health First.

After a two-year endeavor, KSC became Voluntary Protection Program (VPP) qualified by the Occupational Safety and Health Administration (OSHA). The Center selected VPP to ensure continuous safety and health program enhancements, and certification as a "Star" site constitutes recognition as an exemplary safety and health program. At least 78 percent of KSC's workforce, including two major contractors, are VPP Star certified. The Center is currently the only federal site in the region (Florida, Georgia, Mississippi and Alabama) VPP Qualified.

During the VPP certification audit, OSHA representatives conducted formal and informal interviews with civil servants, gauging employee awareness and involvement in KSC's safety and health program. OSHA representatives also reviewed safety and health documentation, and inspected work sites verifying consistency and compliance.

KSC not only complied with approximately 500 OSHA requirements, but several areas were also recognized as best industry practices. These included the Center Director's use of electronic communications to the entire workforce highlighting safety and health aspects, such as employee and management's safety and health roles and responsibilities, employee rights such as "stop work authority," incident and close call reporting, and unannounced monthly workplace inspection results.

OSHA also noted the establishment of "RehabWorks" (an on-site occupational health rehabilitation center), employee awareness and knowledge of VPP, the Center's Employee Safety and Health Pocket Guide, and KSC's Business World Web site with safety and health links.

The annual Spaceport Super Safety and Health Day increased awareness for practicing "Safety and Health First" both in professional and personal activities. More than 120 exhibitors, located at various Spaceport locations, offered safety and health related information, training sessions and demonstrations. Activities also included astronaut appearances, award presentations, a health fair and KSC Fitness Centers' open houses.

KSC's Occupational Health Program continuously promoted employee wellness throughout the year with activities such as Fitness Center events, physical exams, inoculation programs, health education and screening programs and the Employee Assistance Program (EAP). During the fiscal year, employees made more than 3,000 RehabWorks visits and 88,741 KSC Fitness Center visits. The Fitness Centers offered motivational programs such as the President's Adult Active Lifestyle award, which promoted physical fitness.

Screening programs include cardiovascular disease risk reduction and breast and colorectal cancer screenings. An employee health and fitness day taught employees about community health and wellness programs and provided health screenings, as well as nutrition and exercise counseling. Additionally, the workforce can receive free flu shots as well as counseling services through the EAP.

BUILD RELIANCE AND TEAMWORK EVERYWHERE

NASA worker Joy Huff (right) shows Stafford-Covey Return to Flight Task Group members a wing leading edge subsystem bonded to tile.

As we strive for mission success in all our endeavors, our dependence on one another to provide services is critical. Therefore, KSC builds upon its strengths in reliance and teamwork and commits to completing opportunities for improvement consistent with the Center's Guiding Principle to Build Reliance and Teamwork Everywhere. These efforts assure future strategic goals of KSC and the Agency are realized.

Perhaps the most poignant display of the Center coming together in the fiscal year was the STS-107 Space Shuttle Columbia recovery project. To collect debris, 870 KSC civil servants and contractors helped with the tasks in East Texas. Workers searched a ground area corridor 250-miles-long by 10-miles-wide. About 38 percent of Columbia's dry weight was recovered. Additional in-depth information about the loss of Columbia and its crew can be found throughout this document.

Last year, the Senior Management Team reviewed the Center-wide KSC Reliance and Teamwork Survey; subsequently, a One KSC Team formed to address feedback results. This team initially focused on a targeted approach to achieving One KSC and making changes to make reliance and teamwork a way of life at the Center.

In addition to One KSC, the Agency initiated One NASA, a cultural change emphasizing a strong commitment to teamwork, accessible tools and a greater collaboration across NASA. Selected by NASA Headquarters, KSC hosted the first One NASA leader-led workshop Aug. 20, a direct response to workforce feedback. One NASA also introduced key leaders from other enterprises participating in Center workshops. KSC Director James Kennedy visited the Jet Propulsion Laboratory Oct. 16-17 to participate in its One NASA activities, including a town hall meeting.

U.S. Forest Service members walk a grid during a Columbia Recovery search near the Nacogdoches, Texas site. A space program worker able to identify potential hazards of Shuttle parts accompanies the group.

SATISFY OUR CUSTOMERS' NEEDS ANYTIME, ANYWHERE

Integral to KSC's strategic planning is building and maintaining customer satisfaction through relationship management. Satisfying Our Customers' Needs Anytime, Anywhere is one of KSC's four Guiding Principles. The Customer Assurance and Analysis Office serves as an independent advocate for systematically managing customer knowledge and feedback to develop strategies for improvement and new opportunities.

The ultimate goal is to ensure a customer focused culture with customers consistently choosing KSC as their launch site. To achieve this, our core customers use customer satisfaction data to drive change and lead continuous improvement. KSC's core customers are Launch Services Program (LSP), Shuttle/International Space Station (ISS) and Spaceport Engineering and Technology.

The LSP acquires commercially available ELV launch services for NASA and its customers. LSP ensures mission success, provides low cost services on time and maximizes customer satisfaction. LSP improvements include a *Launch Services Connections* newsletter and a new launch services mission budget policy. Responding to customers' requests, these additions facilitate additional communication, thus educating customers on financial regulations, launch services, outreach materials and more.

The Shuttle Processing Directorate prepares the Space Shuttle for safe and successful missions. The ISS/Payload Processing Directorate identifies and satisfies ground processing and support, as well as test and integration requirements, ensuring a successful mission. Shuttle/ISS Improvements include updating the Directorate Information Technology Policy, publishing a Payload Processing Guide, and documenting standard/ nonstandard international customer services. There is an ongoing effort to update customer orientation packages and establish a single point of contact for communicating capabilities and requirements.

The Spaceport Engineering and Technology Directorate provides innovative and integrated solutions to complex technical problems with customer satisfaction as a priority. New to this effort, the directorate established its customer base. The directorate will use both internal and external customer feedback to improve processes and customer support.

With cables released, the first of two Mars Exploration Rovers sits on the floor of the Payload Hazardous Servicing Facility.

An owl is held just before its release.

ENVIRONMENTAL LEADERSHIP

Nature thrives with technology as seen in this photo of the Vehicle Assembly Building and surrounding grounds and water. In the foreground, perched on a plant, is an anhinga—a common Center inhabitant.

Situated on 140,000 acres, that include a wildlife refuge, the Center continues to operate in the ultimate marriage of nature and technology. KSC spent the fiscal year preserving and improving that union.

The Merritt Island Spaceflight Tracking and Data Network won the Federal Energy and Water Management Award. It was chosen by the Department of Energy for its long-term efforts to improve energy efficiency at the tracking and data relay station. This group saved KSC approximately $100,000 annually in energy bills.

Thousands of sites across the world are contaminated with dense, non-aqueous phase liquids (DNAPLs). DNAPLs commonly come in the form of cleaning solvents. KSC implemented new clean-up technologies to help fight this battle.

Launch Complex-34 areas were polluted during the space program's early history when DNAPLs cleaned Apollo rocket parts. Because DNAPLs tend to sink to the bottom of the water table and collect in pools, these solvents can contaminate fresh water sources when left untreated in the ground.

Methods to clear up this potential problem are bio-augmentation, which degrades some environmental contaminants through the addition of nutrients, and Emulsified Zero-Valent Iron. This approach uses environmentally friendly oil and water to neutralize DNAPLs. Micro-organisms are also added, rendering contaminating chemicals harmless.

A Florida Power and Light (FPL) alternatively financed project remedied some of the Center's inefficient energy operations. FPL provided a loan for up-front project costs and KSC uses energy bill savings generated by the project for financing.

Projects in the high bays of the Space Station Processing and Operations and Checkout facilities produced significant energy savings of about $500,000 annually. A Payloads/Station Team reduced heating, ventilation and air

New methods of environmental cleanup are explained at Launch Complex 34A.

conditioning system energy costs to one-tenth the previous levels while improving temperature and humidity conditions. The team received a 2002 KSC Environmental & Energy Bi-Annual Award for their success.

Similarly proactive, KSC's Energy Working Group provided educational opportunities, making the workforce knowledgeable about energy efficiency. Included were tours of KSC's largest mechanical equipment room and the Central Heat Plant, covering topics such as resourcefully maintaining critical work conditions.

Learning about Earth-friendly personal and professional practices was stimulated by Environmental and Energy Awareness Week (EEAW) traveling presentations, tours, seminars and exhibits.

Dr. Stuart D. Strahl, President/CEO of Audubon of Florida, spoke at the EEAW Opening Ceremony. Audubon works to ensure that conservation becomes a common interest in Florida rather than being relegated to a special interest group. Audience members learned the importance of discovering and protecting Florida's environmental diversity.

Supporting environmentally friendly transportation, employees inspected an Alternative Fueled Vehicle and Global Electric Motorcar (GEM). The workforce also test-drove a Segway Human Transporter, and discovered using the device is as natural as walking.

Providing an opportunity to put knowledge to use, Amnesty Days allowed KSC workers to dispose of unwanted government chemicals excluding biohazardous, radioactive or explosive materials. In all, 20,166 pounds of excess materials were collected.

Furthermore, KSC is home to some 25 threatened and endangered species, both permanent residents and annual migratory types. The U.S. Fish and Wildlife Service manages the Center's land. Efforts to increase population and habitat usage included controlled burning, wetlands enhancement and exotic, invasive plant removals. These species continue to use KSC lands for wintering, spawning and thriving.

SPACE SHUTTLE PROGRAM

The afternoon sun casts a shadow on Space Shuttle Atlantis as it launches on its journey to the International Space Station (STS-112).

Although STS-112 (launched 10/07/02) and STS-113 (launched 11/23/02) were processed and launched during FY 03, the tragic loss of Columbia and her seven-member crew prior to landing Feb. 1, 2003, brought Space Shuttle launch activities at KSC to a halt. The loss changed the focus of processing activities to support the investigation. For the next several months, KSC and contractor workers were involved in Columbia debris recovery and reconstruction efforts and Columbia processing reviews, and they assisted the Columbia Accident Investigation Board in determining the root cause of the accident.

NASA and contractor workers concentrated on implementing process improvements, performing upgrades to the remaining fleet of orbiter vehicles and developing new processes, hardware and tools to comply with CAIB recommendations to prepare the orbiters for Return to Flight.

With a renewed emphasis on safety and reliability, a number of new processes and upgrades were implemented at KSC to support future Space Shuttle missions.

Shuttle Processing and Return to Flight Activities

As part of Return to Flight activities and in consideration of CAIB recommendations, Non-Destructive Evaluation (NDE) testing was performed on all orbiter vehicle Atlantis (OV-104) wing leading edge Reinforced Carbon Carbon (RCC) panels. Insulator hardware was disassembled, and Atlantis' wing leading edge RCC panels were shipped to Lockheed Martin Missiles and Fire Control Division to re-perform the original NDE testing and visual inspections. KSC Logistics packed and shipped the panels, and developed and coordinated turnaround schedules to support the upcoming launch schedule. Attachment hardware for wing leading edge reinstallation and panel reassembly were identified and procured.

Spaceflight Operations Contractor United Space Alliance (USA) and NASA

continuously improve risk-management decisions regarding ground operations. The latest improvement uses the Process Failure Modes and Effects Analysis (PFMEA) tool to analyze a process. The objective of PFMEA is to document potential failures that could occur during a particular process and to recommend actions to eliminate the failure mode or control the hazard. The analysis quantifies risks to personnel safety, flight hardware and schedule delays. The PFMEA tool was used to complete more than 13 assessments this year.

KSC Shuttle Processing implemented an updated electronic logbook (ELOG) to disseminate information between Shuttle Processing engineering, quality and operations personnel and other Space Shuttle program projects on a daily basis.

ELOG's future uses include surveillance database modules for Shuttle Processing Engineering and Safety & Mission Assurance, closed-loop accounting of surveillance plans and generating surveillance metric reports.

In conjunction with Agency experts, KSC Shuttle Processing successfully completed the inspection of Main Propulsion System Propellant Feed Line Ball Strut Tie Rod Assembly (BSTRA) components following the observation of a cracked BSTRA ball in Discovery (OV-103). The inspection required development of new tools and techniques at KSC and a multi-Center failure analysis investigation. KSC developed new procedures resulting in the execution of the first-ever removal of a 17-inch (diameter) liquid oxygen propellant feed line from Discovery in order to return it to the vendor for repair.

USA accomplished a substantial procedural improvement by utilizing the Boeing Delta Mariner facility at Port Canaveral. Starting with the delivery of External Tank (ET)-119, the ET Barge, temporarily moored at the facility, is transported up the Banana River to the newly developed temporary mooring site at the Vehicle Assembly Building basin, allowing for easy ET offload. During launches, the barge is moved to the VAB turn basin, eliminating the need for towing back to Port Canaveral and returning after launch. The combined use of the Boeing Delta Mariner facility and the temporary VAB mooring site resulted in savings of more than $40,000 on each delivery.

A team of KSC engineers and technicians and the Cryogenics Test Laboratory developed a safe and reliable technique to isolate a column of liquid oxygen behind a plug of frozen liquid precision-cleaning agent (Freon). The technique permitted successful replacement of a cracked gasket in a liquid oxygen block valve at Shuttle Launch Pad 39A without draining (and potentially wasting) thousands of gallons of liquid oxygen. The technique will undergo further development for use on larger line sizes with different fluids. A U.S. patent is pending.

Upgrades

A new Space Shuttle Main Engine (SSME) horizontal handling truck arrived to supplement the single truck in service since the beginning of the program. The new truck features an updated design, increased capabilities and improved portability for support of SSME removal in the event of a Trans-Atlantic Landing.

During performance of normal refurbishment programs on Crawler Transporters 1 and 2, failed bearings were found on the jacking and leveling cylinder bearings. USA ground operations engineering removed and replaced 64 bearings on each of 32 cylinders, which weighed 10,000 pounds each. Extensive modifications to the Crawler Transporter 2 cab and exhaust system were also completed during the window provided by Return to Flight activities.

Workers in the Orbiter Processing Facility remove one of two Orbiter Maneuvering System pods from Endeavour.

Infrastructure Improvements and Modifications

FPL and the Shuttle Program completed the largest energy conservation project in KSC history with no up-front cost to the taxpayer. The project, which in total addresses $3.2 million worth of energy efficient upgrades and revitalization, was financed by FPL with loan payments repaid completely from the accrued savings. The project earned KSC the Department of Energy's "Energy Champion" award as NASA's most outstanding initiative for the year.

For the first time in KSC history, a detailed account of energy transferred in the form of chilled and hot water is on the horizon. A Center-wide project, begun this year, will provide instrument readings (in BTUs) from KSC's north and south ends. Installation of ultrasonic flow measurements at key locations will tie them into the Kennedy Complex Control System (KCCS) through the Ethernet. Completion of this measurement project, in conjunction with ongoing KCCS installations, will place KSC at the forefront of all NASA Centers in network-based facility management.

KSC recruited nationally recognized technical experts from the Department of Energy to develop projects for energy savings opportunities. These audits, as well as those performed in-house by the Shuttle Program and FPL, form the basis for future energy reduction initiatives. Future projects may include additional Launch Complex 39-area generation capability and software-based load control.

Following the loss of Columbia, infrastructure modifications continued at Launch Pads 39A and 39B. Pad A projects included upgrades to the following:

- Orbiter Mid-body Umbilical Unit Support System,
- Corrosion Control and Pneumatic Tubing Replacement,
- Slidewire System Cable Replacement, and Rotating Service Structure Elevator Control System Upgrade,
- Payload Ground Handling Mechanism Enhancement Modification including Stem Strain Modification, and
- Engine Service Platforms "Frog" Rails repair.

Pad B modifications included:

- Corrosion Control of the Rotating Service Structure,
- Payload Change-Out Room Door Repair, and
- New Hydraulic Power Unit fuel servicing carts fabrication testing and validation.

INTERNATIONAL SPACE STATION AND PAYLOAD PROCESSING

Astronaut Soichi Noguchi (left), with the Japanese Aerospace Exploration Agency, examines data during a Multi-Element Integrated Test of the U.S. Node 2 and the Japanese Experiment Module in the Space Station Processing Facility.

KSC's Space Station Processing Facility (SSPF) is one of the world's most unique processing resources. It is home to all Station elements prior to launch from KSC on their journey to the International Space Station (ISS). It is inside this facility that Station assembly components from U.S. and international partners are received, tested, integrated and validated, in preparation for their final destination. Reflight carrier elements, which are required for logistics and science resupply and return-to-earth, are processed here. In addition, the SSPF supports the final integration and checkout of ISS science prior to flight.

KSC currently houses 10 Station elements, in various processing and testing stages. As NASA looks forward to Return to Flight in 2004, planning and processing for the third phase of Station assembly has begun.

During the fiscal year, the Center completed its third Multi-Element Integration Test (MEIT 3), which included the European-built Node 2 module, the Japanese Experiment Module (JEM) Kibo Pressurized Module and an ISS simulator. MEIT 3 required assembly of an integrated international and multi-Center/contractors team at KSC, and proved the hardware/software relationships of these elements met requirements.

To accomplish the test, multiple cables were connected between the two modules and the on-orbit Station emulator, providing electrical power, data, command, and cooling to validate the compatibility of the systems. Test results confirmed that both modules would interact properly when delivered and attached to the Station. On future ISS missions, Node 2 will be attached to the U.S. Lab Destiny and the JEM "Kibo" module will be attached to Node 2.

Following delivery of Node 2 from Italy, an integration systems test was completed successfully. This included emulating the Space Station on-orbit configuration, testing the command and tracking systems that support the audio and video systems on-orbit, and the caution and warning systems that monitor life support systems in the module.

Additional significant ISS elements processed for ISS missions included:

- Starboard 1 Integrated Truss segment for Mission STS-112
- Port 1 Integrated Truss segment for Mission STS-113

STS-113 astronauts Michael Lopez (red stripe) and John Herrington service the newly installed International Space Station Port One truss

Technicians supervise the transfer of the Integrated Equipment Assembly, a major component of the International Space Station's Starboard 6 truss segment.

- Starboard 6 Truss segment, final sections of the Station's truss system, arrived at the SSPF for testing and validation for a future Station mission.

Columbia Recovery Support

The ISS and Payloads Processing team supported the recovery and reconstruction of Columbia. At the KSC Columbia debris hangar, experienced payload engineers combed through debris to separate and identify payload and experiment hardware. Amidst the payload debris, the team found intact experiment samples that contained valuable science.

The Biological Research in Canisters (BRIC) experiments still contained living worms and moss growth. The Zeolite Crystal Growth Furnace (ZCG) contained crystal samples, and the Commercial ITA, Inc. Biomedical Experiment (CIBX) still held samples of an experiment that might yield new anti-cancer drug delivery systems.

The BRIC experiment yielded two surviving types of samples. First, living C. Elegan worms were recovered from canisters on April 28, 2003. Since the worms have only a seven to ten day life cycle, it was determined they were fourth or fifth generation descendants of the worms launched on STS-107. Second, researchers found moss intact with growth patterns that will enable researchers to learn how gravity and light affect cell organization. BRIC was able to download temperature data recorded on three data loggers, including temperatures recorded while on the ground in Texas.

Liquid was extracted from the ZCG Furnace autoclaves thought to still contain Zeolite crystals flown in zero gravity that could be recovered later in the lab. The durable and complex crystals are known for their high adsorption properties and are often used as catalysts in petroleum and pharmaceutical industries.

Samples recovered from the CIBX-2, that studied developing technology for drug delivery systems to combat cancerous tumors and cancer metastasis, revealed microencapsulation. The drug delivery technology uses co-encapsulation of antibodies and immune stimulants into micron microcapsules.

FUTURE LAUNCH OPERATION

The Center workforce looked forward this year and positioned KSC for future launch operations.

The Space-Based Telemetry And Range Safety (STARS) project demonstrated a space-based platform's Range Safety and Range User capabilities for various launch vehicles. Range Safety includes flight-termination processing from both space and ground resources and vehicle tracking using the Global Positioning System satellites. Range User includes high-return link data rates for voice, video and vehicle data. The brain of STARS, is known as the Command and Data Handler. Estimates show that these new methods could reduce costs by up to $40 million per year.

Much of the STARS hardware was put to the test during the fiscal year. The trials exercised the equipment as it will be used during flights. These tests prepared for Flight Demonstration 1, which analyzed different functions, capabilities and environments. This was a "high dynamics" flight with STARS hardware and antennas located in an F-15B aircraft. At NASA's Dryden Flight Research Center in California, the aircraft performed the dynamic maneuvers to determine antenna coverage.

The latest in ground-based operations, launch and payload check-out automation systems were demonstrated as well, using a combination of flight qualification and ground hardware. The Advanced Checkout, Control and Maintenance System (ACCMS) optimizes ground resources and processes needed to meet possible Reusable Launch Vehicle (RLV) turnaround goals, safety standards and efficiency objectives.

This technology will help alleviate the complexity of many time-consuming personnel tasks, automate routine tasks and reduce organization support requirements. Most significant for RLV operations, ACCMS will reduce risk and time associated with unplanned maintenance activities.

Additionally, Sierra Lobo, Inc., a contractor supporting KSC's efforts, won NASA's Small Disadvantaged Business Prime Contractor Award. The Ohio-based company was recognized for its Densified Propellant Management System contract work. The densified propellants project is considered an "enabling technology" for some RLVs because it can decrease vehicle mass.

Another KSC effort is the Operations Concept Development (OCD). The OCD turns operational concepts into transportation elements. It clarifies system operations, requirements, ideas and boundaries. KSC's significant OCD expertise included pre-launch processing, launch operations, landing operations and system design.

KSC also supported the Lessons Learned Database. This key development

Members of the Space-based Telemetry and Range Safety project support a flight demonstration, which tested hardware on an F-15B aircraft.

captures knowledge from previous and existing human space flight programs and dozens of space flight experts.

To maximize industry's creativity and technical proficiency, NASA defined necessary capabilities for a potential, new transportation system. KSC also provided technical leadership. The Center assessed these requirements that will ensure final contractor products have the integrity needed to progress.

KSC completed seven trade studies to determine feasibility of future operation requirements, supported a Systems Requirements Review milestone, compared various spacecraft concepts, and provided data for the future evaluation of contractor proposals. The Center also began two trade studies analyzing facility, launch site and control center requirements.

KSC also supported a Marshall Space Flight Center acquisition project by contributing Ground Operations, Ground Processing Systems, Integrated Logistics Support, and Ground Operations Training sections for the Alabama-based Center's drafting process.

The Launch Services Program (LSP) is integrally involved in these efforts, as well. LSP workers, including contractors, provided and analyzed ELV data supporting concept development efforts. The LSP also evaluated modifications required for existing ELV designs and launch complexes. Additionally, the LSP is participating in human and risk analyses and continuing development of independent and reliable ELV modeling capabilities.

International Space Station elements are processed for future Space Shuttle flights. The JEM pressurized module and the U.S. Node 2 are a few of the elements that line the SSPF's high bay walls.

PAYLOAD CARRIERS

The U.S. Node 2 moves toward a workstand in the Space Station Processing Facility. The Italian-built component is the second of three ISS connecting modules.

Program Improvements

The Payload Carriers Program continued efforts to improve carrier support for International Space Station payloads and initiated structural rework of the Lightweight Multi-Purpose Experiment Support Structure to provide required support for Return to Flight activities.

A study by Kansas State University to determine the useful life of payload carriers was expanded to document all payload carriers throughout NASA. The database expansion provides corporate memory to future generations of the science community for delivery systems. It also provides life expectancy analysis capability for each individual carrier, as well as the fleet. These analyses allow informed carrier selection and cost estimation decisions.

The NASA/Boeing Launch Services Simulation and Analysis Laboratory (LSSAT) team developed an innovative strategy and integration tool used to analyze payloads and achieve the best use of carrier space for payloads to be installed in the Shuttle. The tool incorporates precise 3-D modeling and real-time simulation.

KSC's LSSAT was recently recognized by the National Systems Training Association as the best application in 2002 for Modeling and Simulation Analysis. The tool has the potential for future applications in other programs including ELVs.

Mission Support

Payload processing support was provided for mission STS-107. Experiments supported by payload carriers in the Shuttle's payload bay included the Fast Reaction Experiments Enabling Science, Technology, Applications and Research (FREESTAR) Hitchhiker, which comprised six experiments.

The program supported the CAIB by providing flight hardware identification, flight documentation support and personnel interviews during debris recovery and reconstruction efforts.

LAUNCH SERVICES PROGRAM

During the year, LSP managed the launch of eight missions, including two powerful new Mars Exploration Rovers (MER) that traveled to the red planet aboard Delta II launch vehicles. MER-A "Spirit" launched June 10, 2003, and MER-B "Opportunity" launched July 7, 2003. The identical rovers reached Mars in January 2004 and are exploring different areas of the planet's surface in search of evidence of water that may have been present in the planet's past.

TDRS-J, the second TDRS of three, launched aboard an Atlas IIA launch vehicle Dec. 4, 2002. TDRS-J will provide improved communications to the Space Shuttle, ISS, Hubble Space Telescope and other Earth-orbiting satellites well into the 21st century.

NASA's Ice, Cloud and land Elevation Satellite (ICESat) and Cosmic Hot Interstellar Plasma Spectrometer (CHIPSat) launched Jan. 12, 2003, aboard a Delta II. ICESat is the benchmark Earth Observing System mission for measuring ice sheet mass balance, cloud and aerosol heights, as well as land topography and vegetation characteristics. CHIPSat, a University-Class Explorer mission funded by NASA, will use spectroscopy to study very hot plasma believed to fill the local interstellar bubble.

The first time a spacecraft was mated at KSC to an ELV occurred inside the Multi-Payload Processing Facility Jan. 15, 2003. The Solar Radiation and Climate Experiment (SORCE) vehicle was mated to the Pegasus XL during pre-launch processing. A successful launch aboard Pegasus Jan. 25 sent SORCE to orbit the Earth and provide accurate measurements of solar energy.

NASA's Galaxy Evolution Explorer (GALEX) launched April 28, 2003, from a Pegasus XL vehicle. GALEX, an ultraviolet imaging and spectroscopic surveyor, will map the global history and probe the causes of star formations and their evolution.

Scientific Satellite Atmospheric Chemistry Experiment (SCISAT-1/ACE), the first Canadian scientific small satellite in more than 30 years, launched aboard a Pegasus XL vehicle Aug. 12, 2003, from VAFB. SCISAT's two-year mission will monitor and collect information about Earth's ozone providing improved measurements and understanding of the chemical processes that control the distribution of ozone in the Earth's atmosphere, particularly at high altitudes.

The Mobile Service Tower begins to roll back at Cape Canaveral Air Force Station's Launch Complex 17B, revealing the Delta II Heavy launch vehicle carrying the rover "Opportunity" on the second Mars Exploration Rover mission.

Another milestone was reached when the Spitzer Space Telescope (formerly SIRTF) launched on a Delta II ELV Aug. 25, 2003. Spitzer, named for Dr. Lyman Spitzer Jr., one of the 20th century's most distinguished scientists, is the largest infrared telescope ever launched into space and the last of four missions in NASA's Great Observatories Program. Previous missions included the Hubble Space Telescope, the Compton Gamma-Ray Observatory and the Chandra X-Ray Observatory.

At any given time, KSC's LSP manages 30 to 40 current and future ELV missions. The LSP team works with other NASA Centers—Jet Propulsion Laboratory: 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 on ELVs.

Missions involve multi-year planning and development between KSC's program office and NASA Centers. Ground Operations, Payload Safety and Mission Integration Working Groups are involved in planning and processing for all launches. Facilities at KSC and VAFB in Calif. are used to process payloads and launch vehicles. Facilities outside NASA, such as Astrotech in Titusville, Fla. and Spaceport System International in Lompoc, Calif. are sometimes used to process payloads.

As the year winds down, the Launch Services team prepares for future Eastern and Western Range launches. Mission Integration and Ground Operations Working Groups continue to monitor planning and processing of vehicles and spacecraft. Among future scientific missions are Aura, NASA's follow-up mission to Aqua and a key part of the Earth Observing System; SWIFT, a mission that will study the "afterglow" of gamma ray bursts; and the Geostationary Operational Environmental Satellite (GOES-N) that will launch aboard NASA's first flight of Boeing's Delta IV launch vehicle.

Future planetary missions include the MErcury Surface Space ENvironment GEochemistry Ranging (MESSENGER) spacecraft that will fly by and then orbit the planet Mercury to conduct the first study of the planet; and Deep Impact, a mission that will use an infrared spectrometer to study a comet.

SPACEPORT AND RANGE TECHNOLOGIES

Dr. Richard Arkin records data as the hazardous gas detection system Aircraft-based Volcanic Emission Mass Spectrometer analyzes the toxic gases produced by Costa Rica's Turrialba volcano. The system detects toxic gas leaks and emissions in the Shuttle.

Continuously electrifying NASA's technology efforts, KSC made several contributions this year in areas of applied research & development, engineering development and laboratory services.

R&D Magazine selected a KSC researcher as the recipient of the prestigious "R&D 100 Award" for the product, "Flexible Aerogel Superinsulation." *R&D* considered the creation to be one of the most technologically significant products of the year. This is the first such award won by KSC.

Water intrusion into Space Shuttle Thermal Protection System tile is an old problem. During ascent, water can flash off, potentially causing tile damage. Due to this concern, for many years heat lamps were used for hours on end to dry out tiles in case an orbiter was exposed to rain. Rectifying this tedious task, KSC developed a method to detect water intrusion in tile, as well as a method for water removal using a small vacuum system attached to existing waterproofing holes.

KSC laboratories provided critical support to the CAIB. This included working in both the hangar and the laboratories providing real-time failure analysis, metallurgical and chemical support. Activities included developing an X-ray dot map of slag harvested from Reinforced Carbon Carbon leading edge wing debris using a scanning electron microscope and energy dispersive X-ray spectrometer, as well as development of lexan wing models for display of the RCC debris.

A KSC research and development team used a new hazardous gas detection system to study Costa Rican volcanic emissions. The new prototype system, Aircraft-based Volcanic Emission Mass Spectrometer (AVEMS), also applies to the Space Shuttle program. It is a step toward an advanced system that detects toxic gas leaks and emissions in Space Shuttle engine and crew compartments, providing an added level of protection. From air and the volcano's crater, the team analyzed gases vented from Costa Rica's Turrialba volcano. The study was the first to sample and quantitatively analyze fresh volcanic gases in their natural state. The new system shows commercial promise and could be used for breath, blood and workplace air quality analyses.

NASA, the National Oceanic and Atmospheric Administration (NOAA)

Dr. Grant Gilmore sits alongside undersea expedition equipment used to characterize the condition of the deep-sea coral reefs and reef fish populations in the Oculina Banks, a marine protected area, 20 miles offshore of the east coast of Florida.

and other ocean scientists studied and mapped deep-sea corals off Cape Canaveral's shore. A multi-beam sonar system provided the first high-resolution, 3-D map of the Oculina Banks. Formed by a single species of coral, Oculina Banks' deep coral reefs occur nowhere else on Earth.

NASA, NOAA, the Navy, the Coast Guard and the Florida Fish & Wildlife Commission performed underwater acoustic research involving sensor technology demonstrations, studying fields ranging from marine biological research to homeland security. The work also served as a pilot project assessing the agencies' cooperation.

This is the fourth consecutive year KSC earned more Space Act Award dollars than any other NASA Center. The fiscal year 2003 award amount of $195,700 is proportionately divided among award areas.

More than 100 inventors received recognition at the Sixth Annual KSC Space Act Awards Luncheon. The winners individually collected $500 to $21,000. NASA retiree and exceptional Space Act Award recipient Adam Kissiah not only received praise for inventing the cochlear implant 25 years ago, but also accepted $21,000—the largest award to a single inventor in KSC history.

Aside from recognizing and granting monetary awards for inventions and other scientific and technical contributions that support NASA's aeronautical and space goals, the Space Act Awards program stimulates and encourages creation and reporting of similar contributions in the future.

KSC's Technology Commercialization Office received 128 New Technology Reports for innovations developed at KSC. These include patent and copyright licenses, cooperative agreements and Space Act Agreements. Some of KSC's recent patent and license awards and license offerings include the Advanced Self-Calibrating, Self-Repairing Data Acquisition System, the Multipurpose Thermal Insulation Test Apparatus, and the Cable and Line Inspection Mechanism.

Technology Successes

KSC's Technology Transfer Office transfers developed technologies to industry 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 KSC Technology Transfer Office identifies partners for both and facilitates agreement negotiations with industry partners. Occasionally, a company licenses a NASA technology for commercial use and that company partners with NASA to advance that technology to better meet KSC's needs through a Space Act Agreement. In 2003, KSC signed seven technology license agreements and five technology Space Act Agreements, listed below.

KSC's patent license with Toxicological and Environmental Associates, Inc., in Baton Rouge, La., prompts the use and sale of **Emulsified Zero-Valent Iron**. NASA, University of Central Florida, Department of Energy, Department of Defense, Environmental Protection Agency, and GeoSyntec, Inc. created the innovative solution, which is described further in the Environmental Leadership section.

Through a patent license, Pacific Instruments, Inc.'s (Concord, Calif.) **Signal Conditioning Amplifier Recorder** (SCAmpR) provides signal conditioning, amplifying and recording capabilities in a single circuit board. SCAmpR significantly improves reliability, reduces cost and provides more flexibility than pre-existing systems used during Space

Shuttle launches. A Space Act Agreement for co-development of SCAmpR and KSC's use of client-server software for SCAmpR supports the agreement.

NASA provided TABER Industries in North Tonawanda, N.Y., with a patent license to develop and commercialize the **Multi-Sensor Array pressure transducer**. Working with sensors around Space Shuttle launch pads, it records physical phenomena. The technology enables sensor clusters to uniquely monitor their own health and estimate their own remaining lifespan.

The patent license with Armor Holdings Forensics in Jacksonville, Fla., supports the manufacturing and sale of a **scaling device** and accompanying software. KSC engineers developed the device to assess Space Shuttle external tank damage following hailstorms. When a photograph is taken, a pattern, projected by lasers, appears with the investigated object's image, allowing the viewer to quantify the size of the object. Accompanying software calibrates the pattern in the photo image and computes the distance scale for the entire image, saving valuable time in establishing and documenting measurements.

A reimbursable Space Act Agreement with Phoenix Systems International supports development of a **Nitrogen Oxides (NOx) emissions reducer** in fossil fuel-burning power plants. This effort is a continuation of previous KSC developments. Previously, Phoenix obtained exclusive rights for all commercial applications of the KSC NOx technologies, which reduced costs and elimination of hazardous waste streams. Additionally, this development could directly apply to the Space Shuttle launch pad NOx scrubbers and Center boiler plants. Participation under this Agreement demonstrates NASA's commitment to environmental stewardship.

Due to the Center's proximity to the Atlantic Ocean, KSC is a corrosive environment. Cortec Corporation in St. Paul, Minn., licensed a NASA-developed corrosion inhibiting technology—a **Galvanic Liquid Applied Coating System**—for concrete structures. This inorganic coating slows or stops corrosion of reinforcing steel inside concrete structures, thus protecting launch support structures, highway bridges and KSC buildings.

Detcon, Inc. in The Woodlands, Texas, signed an Exclusive Patent License agreement for the **UV/IR Hydrogen Flame Detector** (U.S. Patent No. 5,625,342). The ultraviolet/infrared hydrogen flame detector reduces false alarms due to reflections from a known flame source or from non-flame sources that emit UV, such as lightning or welding arcs. The company is tailoring the technology to meet the needs of their commercial market through a non-reimbursable Space Act Agreement with KSC.

A meeting with Circuit Avenue Netrepreneurs, in Camden N.J., at the National Design Engineer Show (March 2002) led to a partially exclusive license for the **Advanced Data Acquisition System** (ADAS) in the fields of chemicals, pharmaceuticals and biotechnology. A minority owned business, it will use ADAS to develop their command, control and monitoring system, which collects data from telemetry-enabled instruments and makes command decisions.

Via a Space Act Agreement, the **Open Channel Foundation** and KSC offer the public software for researching NASA-KSC technologies at **http://www.openchannelfoundation.org/cosmic/**. The download is free for any U.S. citizen or U.S.-owned company, and returns the taxpayer's investment to the U.S. economy. Each technology's forum, providing outlets for user comments, is monitored by the innovators themselves, allowing users

Researchers conduct underwater acoustic research in the Launch Complex 39 area turn basin.

direct contact with the NASA expert for that particular technology. A minimum of nine technologies totaling 64 transactions of KSC-developed software have been downloaded.

Also enhancing KSC's technology base through industry partnerships is the Small Business Innovation Research (SBIR)/ Small Business Technology Transfer (STTR) program managed by KSC's Technology Transfer Office. In 2003, the Office managed 50 SBIR/STTR contracts valued at $18.1million.

SBIR/STTR funds early-stage research and technology development designed to address future mission needs. In 2003, four SBIR/STTR funded projects were successfully implemented at KSC and are described below.

KSC engineers employed Optimal Engineering Solution's **P.I. EXPERT,** ensuring Shuttle maintenance operations run efficiently. Recognizing a need for versatile statistical software, three former university professors developed a prototype integrating traditional statistical quality assurance tools with robust optimization techniques in a user-friendly format that is also visually compelling. With SBIR/STTR funding, the company in Daytona Beach, Fla., created the process improvement technology, which is critical to businesses looking to restructure or accelerate operations in order to gain a competitive edge.

Orbital Technologies Corporation (ORBITEC) in Madison, Wis., partnered with Utah State University to develop a **Temperature and Moisture Acquisition System** (TMAS) under the SBIR program. The TMAS measures moisture in small root modules used for plant research in microgravity and can be used wherever pinpoint moisture readings are desired. TMAS is the moisture sensor chosen for use in ORBITEC's Plant Research Unit (PRU)—a plant growth facility under development by NASA's Space Station Biological Research Program for Space Station experiments. TMAS also complements ORBITEC's other biomass production systems, previously used by NASA Ames Research Center.

A SBIR success model, NASA highlighted a unique software system, jointly developed with SENTEL Corp. in Alexandria, Va. The **Electronic Portable Information Collection** system (EPIC) is the first paperless procedure system used to launch rockets into space. EPIC recently supported two Atlas V launches. SENTEL developed EPIC to record and maintain hundreds of mission-critical procedures that must be completed before each launch. To manage those resources, EPIC offers a wireless network that communicates a series of work authorization procedures almost in real time.

PARTNERSHIPS

The Center's capabilities and research potential endlessly grows through its relationships with pioneering organizations.

KSC, the Air Force, the Secretary of Defense office and the Federal Aviation Administration addressed space launch needs associated with low-cost, routine and safe space access. As a result, the Future Interagency Range and Spaceport Technology Program (FIRST) emerged. FIRST develops key technologies to achieve global, interoperable spaceports and ranges.

Agency, Dynamac Corp., Bionetics and University of Florida researchers and scientists moved to the 100,000 square-foot Space Life Sciences (SLS) Laboratory located at the International Space Research Park (ISRP). This facility serves as a research hub for plant growth experiments, resource recovery and microbiology/microbial ecology studies. Built by the state of Florida and NASA, the laboratory also contains analytical chemistry labs, space flight experiment facilities and a flight hardware development growth chamber.

After SLS Lab completion, a developing 320-acre tract outside the KSC security zone will expand the ISRP for access by academic and commercial tenants supporting NASA's mission. The collaborative NASA and Florida Space Authority effort provides sites for commercially-developed research, technology and academic facilities. The year's major focus was the Environmental Impact Statement and related analysis. This investigation helped NASA determine facility locations and provide Florida a long-term lease of the site. The park will accommodate up to 2 million square feet of development over a 20-year period.

The Center, Dynamac Corp., 45th Space Wing, Jet Propulsion Laboratory, the National Oceanic and Atmospheric Administration, and National Marine Fisheries Service developed a passive acoustic monitoring systems prototype. These systems monitor vital fishery life history activities such as reproduction and human activity. The Naval Undersea Warfare Center and U.S. Coast Guard Research and Development Center may deploy these technologies for Cape Canaveral homeland security endeavors.

The system can distinguish between marine life and possible human and/or underwater craft movements. If marine life is observed, it can tell the type of fish and how many. It can even hear shrimp walking around and clicking their claws. If human, it can tell if the noise is a diver, a small submarine, etc.

KSC, GeoSyntec Environmental Consultants, the DoD and U.S. Navy tested the NASA-developed Emulsified Zero-Valent Iron environmental cleanup technique. This technology is described further in the Environmental Leadership section.

KSC and Phoenix Systems International, Inc. developed an application of the Center's oxidizer scrubber technology for use at coal- and oil-fired electric power plants. The new system should be

Hundreds of guests attend a ribbon cutting ceremony officially opening the U.S. Astronaut Hall of Fame as part of the KSC Visitor Complex.

more cost effective, reduce nitrous oxide emissions and extend the nation's coal reserves.

NASA's Office of Space Science selected KSC, Cornell University, Florida Institute of Technology, University of Arkansas at Little Rock, and Arctic Slope Regional Corp. to develop a Mars dust particle analyzer for future landers or rovers. Meeting stringent size, weight and power guidelines, this miniaturized instrument intends to perform real-time, simultaneous measurements of Mars dust particles.

Since the mid-1960s, the partnership between KSC and the U.S. Air Force's 45th Space Wing has highlighted the vast array of facilities, infrastructure, processes and intellectual talent both groups share. During the fiscal year, the partnership grew and evolved as KSC adapted to the Return to Flight environment.

Relying on the NASA/USAF Cape Canaveral Spaceport Planning and Customer Service Office, some key developments progressed through the relationship. The Advanced Technology Development Center provides a demonstration and testing environment closely resembling a launch facility. The Space Exploration Technologies (SpaceX) launch system is a privately funded commercial space launch company. The Underwater Technology Development Program and its Passive Acoustical Monitoring System supports research.

KSC RESERVISTS CALLED TO SERVE

While orbiter processing and Columbia investigation work continued at KSC, world events called many KSC civil servants and contractor workers away from families, friends and the Space Coast. Nearly 100 dedicated men and women were called to serve and defend our country as reservists in the nation's armed services.

As they serve in the Air Force, Army, Coast Guard or Navy, they carry with them the spirit, hope and determination of their "space" family at KSC.

Though some have returned home, many KSC reservists are still serving today.

KSC honors these brave men and women as they continue to defend our country and work to ensure liberty and justice for all, whether at home or on foreign soil.

THE COLUMBIA RECOVERY AND RECONSTRUCTION

Workers place the final piece of the STS-107 mission patch on the outside of the hangar, where pieces of Columbia debris were collected and identified.

KSC Assists in Columbia Recovery Efforts

KSC civil servants and contractor workers went to Texas, Feb. 1, 2003, as the result of the Columbia (OV-102/STS-107) tragedy. The first Rapid Response Team (RRT), comprising about 40 NASA and contractor personnel, traveled to Barksdale Air Force Base, La., within 10 hours of the accident. Within 72 hours, 120 USA managers and employees were deployed to Texas and Louisiana.

Upon arrival at Barksdale AFB, the RRT set up a command center to manage resources and establish the infrastructure necessary to support such a large-scale effort. NASA coordinated the overall effort, along with USA and other contractors, the Federal Emergency Management Agency, Environmental Protection Agency, the Texas Forestry Service and other assisting agencies, eventually encompassing 16,500 workers at all debris recovery sites. USA quickly pulled together the necessary communications support effort by Feb. 2 and provided computer workstations and laptops with connectivity to the NASA sites at Barksdale AFB, and Texas locations in Nacogdoches, Hemphill, San Augustine, Lufkin and Palestine. By the conclusion of debris recovery efforts, more than 800 KSC employees were at 16 locations in six states. Search efforts were conducted on land, by air and at sea.

Columbia Reconstruction at KSC

In the first days following the accident, a team formed to plan Columbia's reconstruction. The state's Reusable Launch Vehicle hangar at the Shuttle Landing Facility was selected as the optimal reconstruction facility, based on its size, available technical workforce, access to the vehicle ground-processing infrastructure and its proximity to materials science laboratories. The facility became known as the Columbia Reconstruction Hangar.

The Reconstruction Team established several critical processes for safe handling and management of the debris, which included receiving, handling, decontamination, tracking, identification, cleaning and assessment of the debris, with an emphasis on evidence preservation. The team comprised engineers, technicians, inspectors and managers from NASA, USA, Boeing and the National Transportation Safety Board.

The reconstruction effort spanned five months, during which 27 truckloads of Columbia debris arrived at the Columbia Reconstruction Hangar from Barksdale AFB. The debris recovery workers collected an estimated 38 percent of the orbiter's dry weight, or approximately 84,900 pounds comprising 83,900 items. The majority of items were no larger than half a square foot. More than 40,000 items could not be positively identified. The remaining balance of debris was instrumental in steering the investigation toward a root cause—with 876 pieces associated with Columbia's left wing as the most critical.

Initially, a two-dimensional reconstruction of the orbiter outer mold line was developed to facilitate assessment of the debris. As debris was positively identified, the left wing leading edge became the investigation's main focus area. This initiated a three-dimensional reconstruction of panels one through 13 of the left wing leading edge.

Technicians used virtual reconstruction to create a replica of the orbiter left wing leading edge. A full-scale left wing was also built on tables to display lower surface thermal protection tiles and structure. These reconstruction techniques, used in conjunction with material sampling and failure analyses, allowed investigators to extract the greatest amount of information possible from the debris.

During Columbia's reconstruction, systems experts hosted more than 60 guided tours of the Columbia Reconstruction Hangar and Launch Complex 39 Shuttle processing facilities, provided presentations and led discussions for the CAIB, the media, visiting Center personnel and other interested officials. At the completion of the CAIB's investigation, ground operations personnel supported a Columbia Reconstruction Hangar walk-through for more than 11,000 KSC workers and their families during six days in July 2003.

Workers inventoried, packed and moved Columbia debris to the Long-Term Storage Facility in the Vehical Assembly Building. Parts of the vehicle will be available to scientific, research, academic and governmental organizations for hypersonic studies and design of future aircraft and spacecraft.

Large items of Columbia debris seem to lay in an endless line.

NASA Administrator Sean O'Keefe (left) looks over Columbia debris with Shuttle Test Director Steve Altemus, also a Columbia Reconstruction Project Team member.

EDUCATION

Students place flowers at the Space Mirror Memorial to honor the fallen crew of Space Shuttle Columbia.

The Education Programs and University Research Division assists NASA in inspiring and motivating students to pursue careers in science, technology, engineering and mathematics; and engaging the public in shaping and sharing the experience of exploration and discovery. Education Programs (EP) is one of 18 NASA Themes.

This year, the Division supported the development and implementation of NASA's Educator Astronaut Program. Nearly 9,000 nominations generated from the Center's service area. KSC continues to follow the selection process and interacts with many applicants offering guidance and support.

KSC also helped implement a second new Agency initiative—the NASA Explorer Schools Program. Five KSC regional service area schools are participating to acquire new teaching resources and technology tools for their fifth to eighth grade classes. The Center welcomed 22 Florida and Georgia educators for an intensive, hands-on summer workshop including a Station link-up to interact with Expedition 7 crew members. The KSC Education office is in the process of strengthening these relationships by visiting all five schools chosen from our regional service area.

Educators and students depend on the Center continuously for on- and off-site space-related workshops that provide curriculum material and classroom techniques. The office hosted 498 K-12 schools, 46,004 K-12 students and 15,406 K-12 teachers.

This year, the Division strengthened its activity with the Workforce and Diversity Management Office to integrate efforts for the NASA Corporate Recruiting activity. This partnership strengthened NASA's recruiting and hiring of students who competently fill gaps, and prepared for existing employee retirements. It also funneled EP participants into KSC vacancies.

In the research area, the Division worked closely with the Spaceport Engineering and Technology directorate to identify KSC's top technology requirements. With KSC's Technology Planning Team, Education identified potential technology research projects. Adhering to the Team's guidelines, participating faculty and students acquired projects supporting one of six Center Strategic Technology Development Initiatives.

Students pause during work on their experiments that flew on Space Shuttle Columbia. STS-107 launched experiments designed and developed by students from six different countries.

Following the Columbia tragedy, countless students encouraged the Center and NASA family with letters, pictures and other sympathetic expressions.

Columbia Elementary School's (Palm Bay) sixth graders greeted Kirstie McCool Chadwick, STS-107 Pilot William "Willie" McCool's sister, attended science demonstrations and placed carnations at the Space Mirror Memorial. Gifted fourth and fifth graders contributed a memorial quilt and wrote letters to the Astronaut families, President Bush, NASA employees and Administrator Sean O'Keefe. A Sanford school created an STS-107 Memorial Garden. Education and KSC's ISS and Payloads Processing Directorate collaborated with the Japanese Aerospace Exploration Association to welcome a group of Japanese high school students whose experiments flew on STS-107. They honored the Columbia crew with a floral tribute at Spacehab's STS-107 memorial stone in Cape Canaveral.

By working with elementary and secondary students and teachers, the Division will keep improving the public's understanding and appreciation of NASA's missions, and promote awareness of NASA EP's vital role in supporting the nation's education efforts.

OUTREACH TO THE WORLD

This aerial view of the KSC Visitor Complex shows full-scale solid rocket boosters and external tank in the foreground, a full-scale model of a Space Shuttle orbiter behind them, the Launch Status Dome to the right, and the Astronauts Memorial Space Mirror next to the pond.

Kennedy Space Center Visitor Complex

Kennedy Space Center Visitor Complex (KSCVC) helped spread NASA's message to more than 1.4 million guests from all over the world in 2003. The number is expected to grow steadily through the continuous additions of new attractions, exhibits and tour stops.

The addition of the Astronaut Hall of Fame as part of the KSCVC experience perfectly compliments the existing exhibits and attractions. Balanced against the machines and hardware that make space exploration a reality, the Astronaut Hall of Fame tells the other side of the story, the human side. It focuses on the astronauts who took those first brave steps into space, offering a glimpse at the formative years of these pioneers, and a first-hand look at the NASA training that molded them into heroes.

Space Camp facilities opened more opportunities for the public to participate in learning about human space flight. New programs, such as Astronaut Training (ATX), allow visitors to engage in a hands-on Shuttle launch and mission.

Astronauts Sally Ride, Dan Brandenstein, Story Musgrave and Robert "Hoot" Gibson were inducted into the Astronaut Hall of Fame, June 21, 2003. The event garnered extensive media coverage. ABC's Good Morning America broadcasted live from the Astronaut Hall of Fame and featured interviews with both the new inductees as well as those honored in prior years. CNN broadcast the ceremonies live nationally.

A new retail store opened mid-year at the Orlando International Airport. Its success provides daily evidence of the public's respect for NASA and reminds those visiting Central Florida how close the Visitor Complex is to Orlando. The store serves as a NASA icon to the more than 13.5 million visitors passing through the airport annually.

KSCVC education programs continued to expand in 2003. The summer day camp program had a record year with more than 900 participants. An extremely successful patch program day designed exclusively for home-schooled students attracted more than 1,500 students and parents. In November, the Visitor Complex

Employees produce a KSC Direct! Web broadcast.

partnered with NASA, the Brevard County School Board and the National Space Club to host every Brevard County sixth grade student at KSCVC for a day of hands-on learning.

Government Relations

KSC's Government Relations Office arranged several significant meetings and events, including Florida Space Day in Tallahassee, March 27. Former Center Director Roy Bridges and industry partners met with Florida Gov. Jeb Bush, Lt. Gov. Toni Jennings, Secretary of State Glenda Hood, Senate President Jim King and Speaker of the House Johnnie Byrd to reinforce NASA's Vision and KSC's mission. The NASA contingent emphasized the many economic, research and technological benefits that the Space Program brings to Florida.

The Office hosted visits to KSC by U.S. Sen. Bill Nelson, U.S. Reps. Dave Weldon and Tom Feeney, and Congressmen Tom Delay (Texas) and Mike Ross (Ark.).

The Office provided input to the Web site ***myregion.org*** project, which promotes regional cooperation and development, and assisted KSC management with presentations to the Brevard County Commission.

KSC Web site and Webcasting

Expanded capabilities and new features on both KSC's Web site and KSC Direct! highlights the year. Several new Web site features were added, including the KSC Hall of Honor Web site, which allows former and current employees to add career summary information, and a new KSC 45th Anniversary site full of informative text, photos and videos.

Earlier this year, KSC assumed Agency-wide responsibility for the content and management of the "Mission" section of the newly revised NASA Portal. Mission timeline information, feature articles and NASA Direct! video features about Earth Observation, Shuttle and ISS, Solar System, Deep Space, Science and Technology, and Research Aircraft

Young women sign a Columbia tribute poster at the Sally Ride Science Festival. Held at the University of Central Florida, Orlando, Fla., the event encourages girls to pursue science, math and technology career paths.

missions are added regularly. Since assuming this responsibility in June 2003, the Mission section has been the most frequented of the Portal's four public feature sections.

Multimedia Gallery search capabilities were improved, and archived video on-demand capabilities now enhance the site.

New ELV mission Web sites, live launch and NASA Direct! Web broadcasts were introduced this year to provide up-to-the-minute launch countdown updates, extensive mission information, and interactive question and answer sessions with program experts. This new programming began with the MER-A "Spirit" (June 10), followed by MER-B "Opportunity" (July 7) and SIRTF (Aug. 25) launches.

The first live launch Web coverage from Vandenberg Air Force Base occurred during the SCISAT launch, Aug. 12.

A redesigned KSC Site Survey now allows for better public feedback. To keep the public informed and updated on important NASA news, our Weekly News Briefs now feature a two-anchor format in English, as well as a new Spanish version.

Live Space Shuttle launch coverage Web sites and Web broadcasts were also created for Missions STS-112 (October), STS-113 (November) and STS-107 (February).

Development and launch of a Shuttle Columbia Tribute/Information site on Feb. 3 kept the public informed with the latest information. Updated daily throughout the CAIB efforts, the site included press briefings, hearings, reports, memorials, transcripts and general information.

During the year, KSC's Web site, live mission coverage and KSC Direct! programming reached more than 10 million people. U.S. visitors accounted for approximately 80 percent of those accessing the site throughout the year. An average of 859,000 visits were made to the site per month.

Exhibits

The exhibits team took the NASA message on the road to 39 events and reached more than 509,000 people—double those reached last year—across

Col. Everett Thomas (left), 45th Space Wing, presents a framed memento to astronaut John Herrington, the world's first Native American astronaut.

the country and beyond. From the National Association for the Advancement of Colored People (NAACP) Convention in Miami, Fla., to the Centennial of Flight in Dayton, Ohio, to the National Space Symposium in Colorado Springs, Colo., KSC's road show explained NASA's exciting space flight history, education programs, and new science and technology programs.

Exhibits included graphic displays of NASA-wide programs (Space Shuttle, ISS and LSP), spaceport technology, the benefits of space, spinoffs, NASA's mission and vision statement, and focused on the One NASA theme throughout the year.

KSC worked closely with the Jet Propulsion Laboratory to educate the public on the importance and safety concerns of the Mars missions. One of KSC's guiding principles, the environment, was showcased at the Environment Convention in San Diego, Calif.

Other events included exhibits in Georgia, New York, North Carolina, Texas and Utah. Beyond our own shores, KSC also took the message to the Paris Air Show at the request of the state of Florida, and to a Lisbon, Portugal workshop.

Speakers Bureau

Over the years, the demand for speakers has grown and this year was no different. KSC sent speakers to 566 events, reaching approximately 300,000 people throughout Florida and Georgia, other U.S. states, along with the Virgin Islands, England, Holland and Canada. The number of events represents approximately a 20 percent increase over last year.

KSC's Speakers Bureau supported 12 international events and 40 national events. These included the Florida State Native American Youth Program sponsored by the Governor's Office, National Space Day, and the dedication of many Columbia Memorials throughout Florida, Georgia and Puerto Rico.

A group of 25 astronauts and many others brought the NASA message to a broad base of diverse events and organizations, including the Women in Law Enforcement Conference, the Florida Department of Transportation

Conference, aviation associations, aerospace clubs, Boys Scouts, Girl Scouts and Florida Library programs.

Speakers also presented to the Hispanic Heritage Celebration in Tampa, Fla., the Hispanic Conference in Puerto Rico; American Society of Engineers of Indian Origin; Youth Leadership Program for Hispanic Students in Orlando; Society of Women Engineers; Brevard County Parks and Recreation Summer Day Camps for disadvantaged youths; and the Governor's Council on Indian Affairs.

Topics ranged from general to specific aspects of NASA's space flight programs.

Media Outreach

During a Space Shuttle launch and landing, special event, or just the day-to-day business of doing what KSC does best, the KSC News Center hosts hundreds of local, national and international media representatives, dignitaries, photographers and film crews. Stories generated at the Press Site result in millions of people around the world learning more about America's Space program.

The KSC News Center team produced a wealth of print, audio and video material, and photographic images ensuring requests were fulfilled with current information. During the year, the Press Site provided 134 news releases, 2,548 interviews, 492 audio tapes, 3,833 videotapes, 161,042 photographs, and bi-weekly issues of *Spaceport News*. Media support was provided during Missions STS-112, STS-113 and STS-107. Topics included Space Shuttle processing, rollout, crew pre-flight training and activities, and Space Shuttle launches and landings. The News Center also provided media support to the LSP for ELV launches, which included TDRS-J, ICESat/CHIPSat, SORCE, GALEX, SCISAT, SIRTF, and MER-A and MER-B.

The News Center also coordinated requests from production and documentary companies, television, radio and print news reporters from the U.S., Spain, Switzerland, Latin America, England, Hungary, Italy, Japan, the Netherlands, France, Russia and Belgium. During the year, the Press Site arranged access for and escorted 34 production companies and 20 television news crews to various locations around the Center, provided support for 31 KSC special events, and coordinated and accompanied 46 print journalists during assignments.

Among the many significant projects supported were The History Channel/ Greystone filming of a one-hour documentary on lightning; NASA TV coverage for the ISS elements Node 2 and JEM arrival ceremony; and Mars Rover viewing; also, the IMAX White Mountain Productions shoot for a movie titled, "Mars"; interviews for The Discovery Channel; and a Kazakhstan, Russia TV crew for a series of TV magazine programs.

At Launch Complex 39B, media representatives are briefed on the improved tracking cameras that will capture ascent imagery during future Space Shuttle flights.

KSC BUSINESS REPORT

Financial Highlights

Financially, FY 2003 included significant changes for the Agency and the Center. The new IFMP replaced the legacy financial systems used for more than 20 years. In February 2003, KSC began recording transactions in the new Agency-wide Core Finance system. During that time, a new Travel Manager system was also initiated as part of the integrated system to manage all Center travel-planning and expenses.

Additional financial activities included preparation and planning for future modules of the integrated system, including Budget Formulation, Asset Management, E-Payroll and E-Travel. Another significant change was the implementation of the Full Cost Initiative beginning in FY 2004. The Full Cost Initiative ties direct and indirect costs to NASA's major programs, projects and institutional activities. KSC's institutional and infrastructure costs, such as civil service salaries and the use of facilities and support services, are now linked to the Center's programs and projects.

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 costs required to perform the activity. Full Cost principles will be used to formulate future annual budgets. Financial operations under this practice began in October.

Both the IFMP implementation and Full Cost Initiative support the Administration's "President's Management Agenda," focusing on improving performance and demonstrating results.

KSC successfully maintained and increased its share of the NASA budget (see accompanying chart). The FY 2003 KSC-managed budget totaled $1.760 billion, which including the JSC-managed Space Flight Operations Contract, with 5,000 workers located at KSC. While this budget level essentially remained constant with FY 2002 levels, the Center projects an increase to more than $2 billion for FY 2004.

This funding fuels the local economies of Brevard County and Central Florida, with the resulting economic impact measured, analyzed and published annually. While FY 2003 results are incomplete to date, they are summarized and projected in the next section.

FY 2003 was a productive year that will pay significant future dividends for the Agency, the KSC workforce and the local economy.

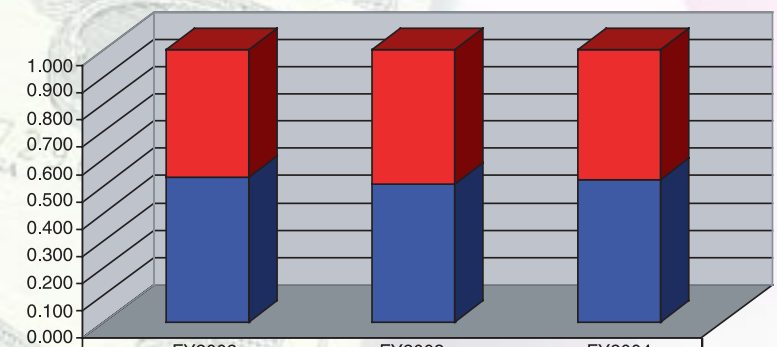
ECONOMIC IMPACT

Just as the sights and sounds of a rocket launch brings excitement to the lives of many Central Floridians, 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 thrill of the launch is relatively short-lived, the economic effects of NASA operations in Florida are continuous and sustained. In FY 2003, of the $15 billion NASA budget, NASA-KSC and other NASA centers injected over $1.4 billion into Florida's local and state economies. This spending prompted 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.

To conduct its exploration of space, NASA requires an extraordinary range of commodities including fuel, missile engines, computers and photographic equipment. The range of services it purchases is just as wide, including communications, laboratory testing, Space Shuttle processing, payload integration and testing, expendable launch services and university research. To meet NASA's demand for these goods and services, local contractors employ workers, 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 spending recirculates NASA's initial demand among Florida's businesses and households, multiplying the direct impact on the economy.

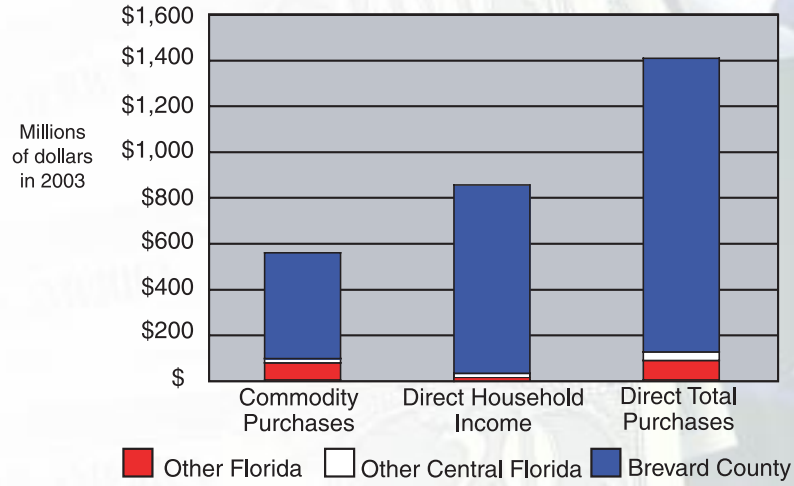
There are a number of other activities directly associated with NASA that also add to its total economic impact in Florida. These include the local travel expenditures of out-of-state business and government personnel that travel to KSC to conduct business and the KSC Visitor Complex sales to out-of-state visitors.

KSC BUDGET AUTHORITY SUMMARY
FY 2002 THRU FY 2004 (DOLLARS IN MILLIONS)



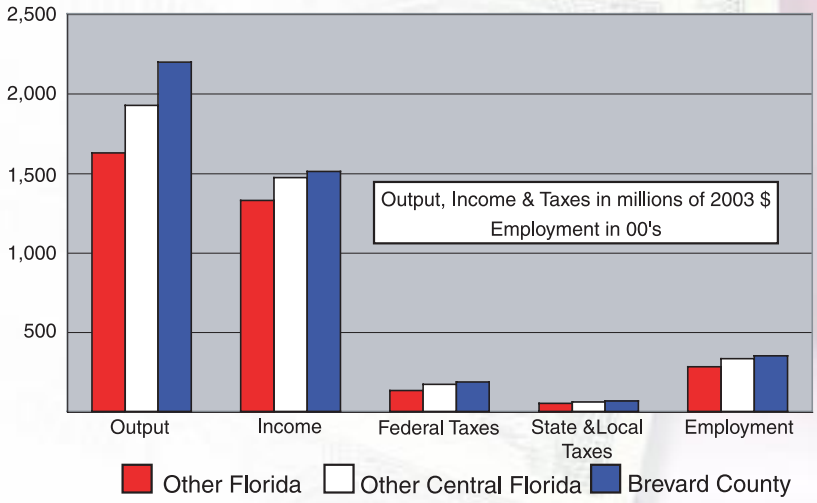
	FY2002	FY2003	FY2004
SFO	$814	$867	$1,008
KSC	$928	$893	$1,102

DIRECT PURCHASES FROM CONTRACTORS AND PAYMENTS TO HOUSEHOLDS BY KSC AND OTHER NASA CENTERS IN FLORIDA IN FY 2003 (Preliminary)



	Other Florida	Other Central Florida	Brevard	Florida Total
Commodity Purchases	$ 75	$ 17	$ 462	$ 554
Direct Household Income	$ 10	$ 19	$ 821	$ 850
Total Direct Purchases	$ 85	$ 36	$ 283	$ 1404

THE TOTAL ECONOMIC IMPACT OF ALL NASA ACTIVITIES AT KSC IN FLORIDA BY GEOGRAPHIC AREA FY 2003 (Preliminary)



	(Millions of 2003 $)				(Jobs in 00's)
	Output	Income	Federal Taxes	State &Local Taxes	Employment
Commodity Purchases	1,626	1,328	131	52	282
Direct Household Income	1,924	1,470	171	59	332
Total Direct Purchases	2,197	1,510	186	65	348

KSC annually conducts an Economic Impact Analysis to measure NASA's effect on the economy at the local, regional and state levels. The University of Central Florida conducted the 2002 report. The 2003 report is not yet completed, but estimates for 2003 are provided.

WORKFORCE DIVERSITY

KSC is the most broadly based, complex and successful launch center in the world. Through NASA, KSC acts as a premier national landmark capable of showcasing the United States' prowess in science and technology. KSC is able to help the nation achieve its objectives in Space due primarily in part to the dedication of its workforce, which not only includes civil service employees, but also a large number of contractor employees. Together they are essential in making KSC's vision a success.

To accomplish the various missions expected of the Space Center, employees carry out a multitude of tasks. At the end of each year, the Center takes a "snapshot" of its workforce. This picture includes all federal and contract employees chartered to work for KSC. Other organizations, such as the European Space Agency and Patrick Air Force Base, have roles here, but are not reflected in these numbers. As of Sept. 30, 2003, the KSC workforce was as follows:

Kennedy Space Center Workforce

On-Duty Full Time Civil Servants	**1,748**
On-Duty Other-than-Full Time Civil Servants	**91**
Total Civil Servants	**1,839**

Civil Servant Skill Mix

Scientific & Engineering	**59.2%**
Administrative	**25.7%**
Technical	**8.3%**
Clerical	**6.9%**

On-Site Contractor Employees	**9,738**
Off-Site Contractor Employees	**753**
Total Contractor Employees	**10,491**
Total Construction Employees	**379**
Total Tenants	**1,303**
TOTAL KSC POPULATION	**14,012**

PROCUREMENT REPORT

Industry Partners at a Glance

The companies listed below were KSC's top business contractors (in terms of obligations) for FY 2003. The following briefly describes their work for the Center:

Space Gateway Support (SGS)

SGS, a joint venture (with Northrop Grumman, Shaw and Wackenhut) provides base operations support for KSC, CCAFS and PAFB, including roads and grounds maintenance, facilities maintenance, custodial, fire, security, calibrations and propellants handling. They held one contract valued at $2.7 billion over the life of the contract.

United Space Alliance (USA), Limited Liability Corp.

USA is the prime contractor for the Space Flight Operations Contract (SFOC) whose primary purpose is to ensure mission success (including meeting the manifest) for the Space Shuttle Program. KSC is the primary point of responsibility for launch and landing of the Space Shuttle, and supports Ground Operations and Orbiter Logistics elements of the Space Shuttle Program. KSC partnered $100 million in FY 2003 on the SFOC contract. USA performs at KSC, JSC, MSFC, SSC, DFRC, White Sands and worldwide Trans Atlantic Landing sites. The SFOC has a total award value of $12.7 billion.

Boeing Space Operations 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 ISS, Space Shuttle, ELVs and other payload programs. Boeing performs all aspects of payload processing, including the planning and receiving of payloads, payload processing, maintenance of associated payload ground systems, integration of payloads with the Space Shuttle, launch support and Space Shuttle post-landing payload activities. CAPPS is a cost-plus performance/award fee contract with a basic four-year period of performance and options to extend the contract for an additional six years. The value of the contract for the initial four year period is $332 million. Work is performed at the Center, CCAFS, VAFB, Space Shuttle landing sites and at various payload associated work locations within and outside the U.S.

Delta Launch Services Inc.

Delta Launch Services Inc., the Boeing Company, is the prime contractor for one of two existing NASA Launch Services (NLS) multiple award Indefinite Delivery Indefinite Quantity (IDIQ) task order contracts. Principal work location for the Delta II vehicle assembly is Decatur, Ala. Launches occur from CCAFS and VAFB.

Lockheed Martin Commercial Launch Services Inc.

Lockheed Martin Commercial Launch Services, Inc. is the prime contractor for one of two existing NLS multiple award IDIQ task order contracts. Principal work location for the Atlas vehicle assembly is Denver, Colo. Launches occur from CCAFS and VAFB.

The Artic 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, management of complex research and development and technology projects to engineering and technical support of various KSC laboratories and test beds. ASRC Aerospace utilizes a consortium of affiliated universities in performing applied research and technology development efforts. ASRC Aerospace also provides technology outreach to foster awareness and utilization of KSC unique capabilities.

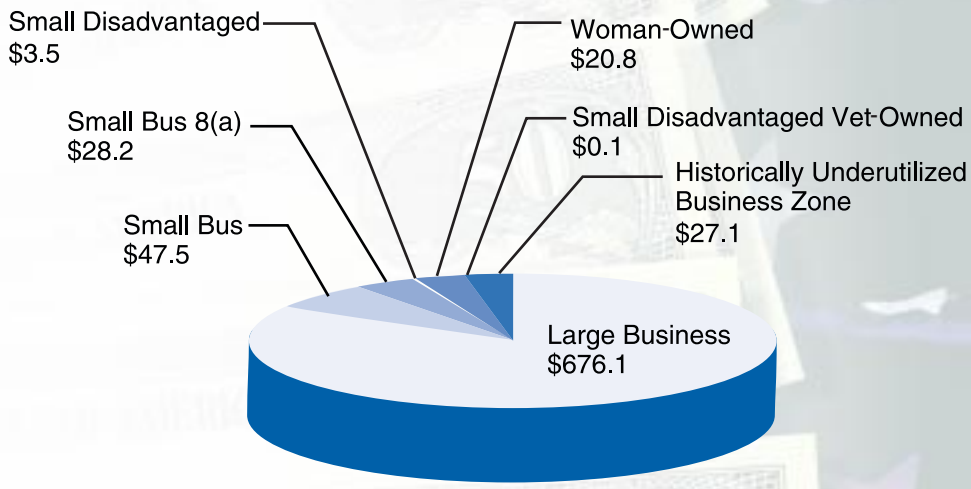
Orbital Sciences Corp.

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

Dynamac Corp.

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

DISTRIBUTION OF FISCAL YEAR '03 OBLIGATIONS BY BUSINESS TYPE (IN MILLIONS)



$803.3 Total Dollars Obligated through Contracts*
$127.2 Total Dollars Obligated to Small Business

*Does not include Intragovernmental, Grants, Agreements or Bank Card Obligations

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 provided include the management, operation, maintenance and sustaining engineering of the NASA ELV telemetry stations located at CCAFS and VAFB; engineering services/studies and technical services for various ground/flight ELV systems and payloads and; management, operation, maintenance and sustaining engineering of the assigned NASA facilities, systems and equipment at VAFB. Services are provided at KSC, CCAFS, VAFB and other launch sites and launch service provider facilities.

Supporting Small Business

Supporting small business is a NASA priority. During the fiscal year, KSC obligated $127.2 million dollars to small businesses, achieving 141.33 percent of the small business goal of $90 million. This was a significant increase from the $102.9 million dollars in small business awards made in FY 2002.

YOUR PROCUREMENT DOLLARS AT WORK

During the fiscal year, the Center obligated approximately $856 million within the U.S. in support of the NASA mission. As indicated by the chart below, 34 different states received procurement dollars from KSC.

GEOGRAPHICAL DISTRIBUTION BY STATE
(FISCAL YEAR 2003 OBLIGATIONS)

State	Total ($k)
Alabama	543
Arizona	11,741
California	81,737
Colorado	2,397
Connecticut	7,027
District of Columbia	99
Florida	720,020
Georgia	2,790
Hawaii	93
Illinois	411
Kansas	139
Kentucky	1,340
Louisiana	345
Massachusetts	3,554
Maryland	3,022
Michigan	241
Minnesota	825
Mississippi	99
North Carolina	382
North Dakota	27
New Hampshire	301
New Jersey	288
New Mexico	3,813
New York	2,509
Ohio	2,597
Oklahoma	362
Pennsylvania	661
Rhode Island	52
South Carolina	455
Texas	4,853
Virginia	2,907
Washington	131
Wisconsin	295
Wyoming	225
Total: *	$856,281

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

TOP 20 KSC BUSINESS CONTRACTORS FOR FISCAL YEAR 2003

Contractor Obligated	Number of Contracts	Dollars (in Thousands)
Space Gateway Support	1	297,222
The Boeing Company	8	162,728
Delta Launch Service Inc.	1	107,127
Lockheed Martin Integrated Systems Inc.	3	33,878
Boland David A Inc.	1	23,989
Analex Inc.	1	17,406
A S R C Aerospace Corp.	1	16,868
Dynamac Corp.	4	14,439
Orbital Sciences Corp.	1	11,422
O A O Corp.	1	10,711
Air Liquide America Corp.	2	9,592
Praxair Inc.	5	8,258
Dynacs Engineering Company Inc.	1	6,507
Air Products & Chemicals Inc.	2	5,213
Military Construction Corp.	9	4,843
Johnson Controls World Services	1	4,115
Advanced Electrical Installation	4	2,528
Telephonic Corp.	1	2,364
All Points Logistics Inc.	4	2,257
Jones Edmunds & Associates	17	2,209
TOTAL:	68	$741,467

* Note: The JSC managed Space Flight Operations Contract recorded $690 million managed by the KSC Procurement Workforce in FY 2003.

Attached underneath the L-1011 aircraft is the Pegasus XL rocket, containing NASA's Solar Radiation and Climate Experiment.