KENNEDY SPACE CENTER ANNUAL REPORT FY2002



FORTY YEARS
PIONEERING THE FUTURE





Table of Contents

Center Director's Message 2

NASA Vision and Mission 4

KSC Goals and Principles 5

The President's Mgmt. Agenda 6

Significant Events 10

Expendable Launch Vehicle Program 12

Space Shuttle Program 14

Shuttle Upgrades 18

International Space Station
and Shuttle Payload Processing 22

Payload Carriers Program 26

Spaceport and Range Technologies 28

Future Vehicles 32

Safety and Health First 34

Environmental Stewardship 36

Partnerships 38

Outreach to the World 44

Education 46

KSC Business Report 48
Economic Impact
Workforce Diversity
Procurement Report
Financial Statement

A Message from the Center Director

This year Kennedy Space Center (KSC) marked 40 years of pioneering the future. The 1960s were an exciting time at KSC as the New World set out to explore even newer worlds from our launch pads. All eyes focused on Florida as America took its first steps in the race for space. Heroes were made and everyone knew them by name. They represented everything good about our country, but especially its spirit of exploration and opening new frontiers of human experience.

During the tireless space race to see which country would first launch a satellite, orbit the Earth, and ultimately land on the moon, no one thought that we would one day work in partnership with our former principal adversary. We held our breath and prayed for the survival of those first explorers. Today we cherish those who made the ultimate sacrifice for future generations as courageous heroes.

The spirit and dreams of discovery born during those early days of the 1960s still live on at KSC as we continue to inspire the next generation of explorers – as only NASA can.

This year we commemorated the 112th Space Shuttle launch and 33rd Expendable Launch Vehicle (ELV) launch since KSC became the manager of the ELV program in October 1998. All but one of this year's Shuttle missions focused on the daunting task of building the most complex laboratory ever built, the International Space Station (ISS).

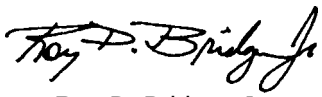
More than 390,000 pounds of ISS components are in orbit today and another 110,000 pounds will be processed during the coming year to achieve "U.S. Core Complete." KSC played a crucial role in making sure everything worked when it got to orbit, always remembering the seriousness of our responsibilities.

KSC is actively involved in the areas of Next Generation Launch Technologies (NGLT) and the development of new Spaceport and Range Technologies. With NGLT, we engaged in and have influenced the design criteria for future vehicles with operational and human factors considerations. The Spaceport and Range Technology Development initiatives are pressing forward and making steadfast progress in developing technologies that are essential for next generation spaceports and ranges.

As a result of a shared vision with the state of Florida, the Space Experiment Research and Processing Laboratory (SERPL) and the 400-acre International Space Research Park are fast becoming part of our Space Center's landscape. SERPL will soon host the world's most prominent scientists, who will push the frontiers of research using facilities and the unique environment of microgravity aboard the International Space Station.

Even as we reflected on 40 years of launches, evolving spacecraft and amazing discoveries, we unveiled our spaceport vision for the next fifty years – the Cape Canaveral Spaceport Master Plan. NASA/ Kennedy Space Center, the Air Force's 45th Space Wing, and the Florida Space Authority created this plan with support from the Canaveral Port Authority, the U.S. Fish and Wildlife Service, the National Park Service and the Department of the Navy. The plan envisions a future of low-cost, safe and efficient space travel and provides a way to expand our spaceport capabilities and facilities while protecting the Space Coast's unique environmental treasures.

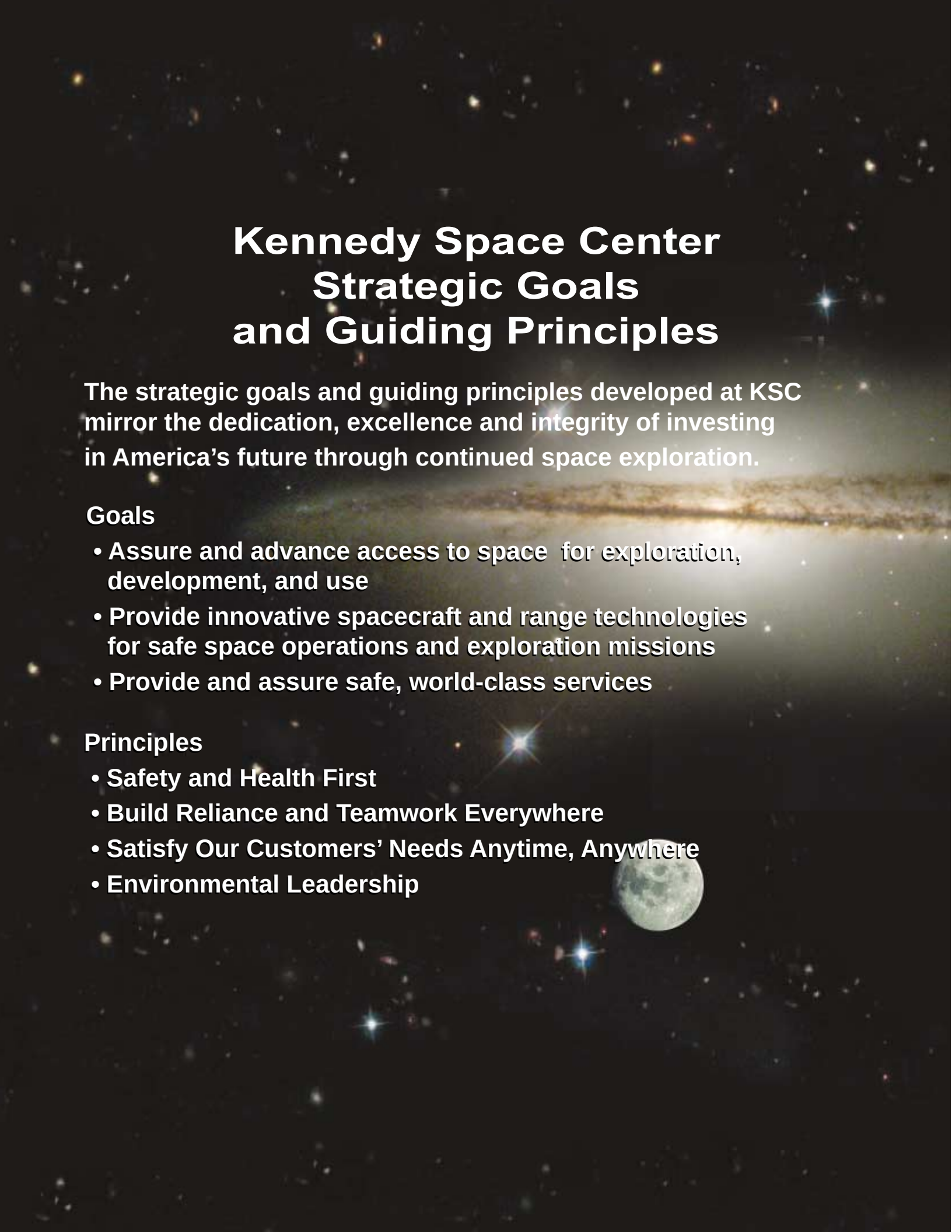
We hope you will join with us as partners in our future efforts to explore space as a One NASA team of NASA Centers, and support industry and academia organizations. Together, we will share in the excitement and new discoveries that will come as we commit our passion and excellence to advancing the state of the art in space launch operations and in Spaceport and Range Technologies to serve our customers and civilization well in the future.



Roy D. Bridges Jr.

Ivor Webster art rendering of a future Kennedy Space Center spaceport.


NASA
www.nasa.gov
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.
NASA Core Values
Safety, People, Excellence, Integrity.



Kennedy Space Center Strategic Goals and Guiding Principles

The strategic goals and guiding principles developed at KSC mirror the dedication, excellence and integrity of investing in America's future through continued space exploration.

Goals

- Assure and advance access to space for exploration, development, and use
- Provide innovative spacecraft and range technologies for safe space operations and exploration missions
- Provide and assure safe, world-class services

Principles

- Safety and Health First
- Build Reliance and Teamwork Everywhere
- Satisfy Our Customers' Needs Anytime, Anywhere
- Environmental Leadership

The President's Management Agenda

NASA and the Kennedy Space Center fully embrace the principles of the President's Management Agenda as a tool to improve government performance. NASA has received accolades from the Office of Management and Budget (OMB) for leading other government departments and agencies in implementation of the five government-wide initiatives, and KSC is proud to play a role in the Agency's progress in these areas:

Strategic Management of Human Capital

KSC's most valuable asset is its workforce and recognizes that the issues associated with an aging workforce and an increasingly competitive hiring environment pose a challenge to building capabilities for the future. NASA has formulated a detailed Strategic Human Capital Implementation Plan to guide the Agency; and in support of these strategies, KSC successfully completed deployment of a Centerwide competency management system pilot project to identify competencies and skill gaps in key technical and functional areas.

Competitive Sourcing

KSC continues to use competitive procurements to obtain a vast majority of our programs and services. Even though the Agency will continue to undertake scientific and technical projects on its own, KSC is committed to expanding the use of competition to accomplish the mission in the most affordable and efficient manner. In accordance with the Federal Activities Inventory Reform (FAIR) Act, KSC submitted a comprehensive update to the FAIR Act Inventory and a Competitive Sourcing Plan, and has exceeded the initial competitive sourcing goals set by the OMB.

Improved Financial Performance

The Center is committed to improving systems and procedures for financial planning, reporting and management. KSC is making final preparations for implementation of the Core Financial Module, a critical subsystem of NASA's Integrated Financial Management Program (IFMP), in FY2003. Other system modules for functions such as time and attendance reporting and personnel management have already been activated as tools to enhance the Center's financial accountability.

e-Government

KSC is enhancing the way it uses information technology and electronic tools to improve communication of the Agency's mission results, products, plans and programs, and to enhance information exchange among employees and contractors. KSC has historically demonstrated web-based systems leadership, and continues to champion initiatives to enable more citizen-centered electronic government.

Budget and Performance Integration

KSC continues to improve the linkage between the budget and performance planning to ensure programs are accountable for their results. KSC's FY2004 budget submittal was formatted to support NASA's Full Cost Initiative and Integrated Budget and Performance Document (IBPD).

Sunset-shaded clouds fill the sky as the launch tower on pad 17-A, CCAFS, rolls back to reveal the Boeing Delta II rocket with NASA's Comet Nucleus Tour (CONTOUR) spacecraft

Inside an Orbiter Processing Facility bay, Space Shuttle Columbia readied for its move to the Vehicle Assembly Building. The orbiter was being prepared to fly on mission STS-107, which launched Jan. 16, 2003. The STS-107 mission was dedicated to microgravity research. Columbia and her seven member crew were lost during reentry, Feb. 1, 2003.

The Lockheed Martin Atlas IIA rocket lifts off from Launch Pad 36-A, CCAFS, with NASA's Tracking and Data Relay Satellite-I (TDRS-I) aboard, March 8, 2002.

Significant Events During Fiscal Year 2002

11/13/01 - NASA Kennedy Space Center (KSC) received the prestigious Franklin Covey Team Award for Synergy and Impact for "outstanding effectiveness in the workplace and community."

12/05/01 – Launch of STS-108/Endeavour to the International Space Station on the 12th ISS assembly mission, also designated Utilization Flight 1.

12/07/01 – Launch of NASA's Jason-1/TIMED satellites on a Delta II rocket from Vandenberg Air Force Base, Calif. Jason-1 will study the Earth's oceans over a five-year period. TIMED (The Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics) will study the effects of the Sun and outer space on Earth's upper and lower atmospheres.

12/11/01 – NASA KSC awards the Life Sciences contract to Dynamac Corp.

12/21/01– Sean O'Keefe is sworn in as the new NASA Administrator.

1/25/02 – The Cape Canaveral Spaceport Planning and Customer Service Center opens at Cape Canaveral Air Force Station (CCAFS). The facility is a joint partnership between NASA, the Air Force and the state of Florida to create a one-stop shop for new launch and program customer needs.

2/05/02 – Launch of NASA's High Energy Solar Spectroscopic Imager (HESSI) spacecraft from the Pegasus XL vehicle at CCAFS on a mission to explore the basic physics of particle acceleration and release in solar flares.

2/5/02 – NASA announces that the Space Shuttle Orbiter Major Modifications (OMM) Program will be relocated from Palmdale, Calif., to KSC.

2/12/01 – KSC takes part in a Space Day celebration in Tallahassee. NASA astronauts participated and a Space Art Contest winner received a U.S. Savings Bond.

2/14/01– New NASA Administrator Sean O'Keefe visits KSC to tour the Center's facilities and meet space workers.

3/01/02 – Launch of STS-109/Columbia on the fourth Hubble Space Telescope Servicing mission. The launch begins the third decade of Columbia's space flights.

3/08/02 – Launch of NASA's Tracking and Data Relay System-I (TDRS-I) satellite on an Atlas II from CCAFS. TDRS-I is the second in a series of three Advanced Tracking and Data Relay Satellites.

4/08/02 – Launch of STS-110/Atlantis on the 13th ISS assembly mission to deliver and install the Starboard-0 (S0) Truss Segment and the Mobile Transporter.

4/23/02 – KSC tests the Smart Umbilical Mating System in support of NASA's Space Launch Initiative.

5/04/02 – Launch of NASA's Aqua-EOS (Earth Observing System) satellite aboard a Delta II rocket from VAFB, Calif. Aqua-EOS will provide a six-year chronology of Earth and its processes including a long-term study of the scope, dynamics and implications of global change.

5/14-15/02 – The NASA MarsPort Engineering Design Student Competition 2002 draws teams to KSC from universities around the country to present ideas for a MarsPort Deployable Greenhouse.

From left: The Bumper V-2, the first missile launched at Cape Canaveral, lifted off on July 24, 1950; the original seven Mercury astronauts posed beside an Air Force F-102 jet, July 24, 1950. Standing from left are Scott Carpenter, Gordon Cooper, John Glenn, Virgil "Gus" Grissom, Walter Schirra Jr., Alan Shepherd Jr. and Donald "Deke" Slayton; launch of the Mercury Atlas-9 carrying Gordon Cooper from Launch Complex 14 occurred May 15, 1963.

5/20/02 – KSC awards a two-year contract to prominent historians and authors Dr. Kenneth Lipartito and Dr. Orville Butler to write the history of KSC.

6/05/02 – Launch of STS-111/Endeavour on the 14th ISS mission, designated Utilization Flight 2, and the delivery of the Expedition 5 crew to the Station and return of the Expedition 4 crew.

6/06/02 – KSC senior executives meet with community leaders at the KSC Visitor Complex for the annual Community Leaders Briefing, during which NASA's new mission and vision statements were unveiled. The theme was "Commemorating 40 Years of Space Exploration."

6/24/02 – Launch of the NASA/NOAA-M satellite on a Titan II from VAFB, Calif., on a mission to improve weather forecasting and monitor environmental events around the world.

6/28/02 – NASA KSC and the Florida Space Authority host an industry briefing to talk about plans for the International Space Research Park at KSC.

7/01/02 – Kennedy Space Center begins a yearlong celebration of 40 years as a NASA launch center. Originally named the Launch Operations Center on July 1, 1962, the nation's premier space launch site was later renamed the John F. Kennedy Space Center.

7/03/02 – Launch of the NASA CONTOUR (Comet Nucleus Tour) spacecraft aboard a Delta II from CCAFS. CONTOUR, which was designed to take pictures and collect and analyze the dust in the nucleus of two comets, fell silent after firing its solid rocket motor on Aug. 15, 2002. NASA is studying the mission loss and considering options for recovery of the lost science.

7/30/02 – KSC develops a precision launch pad lightning detection sensor system, known as the Sonic Lightning Locator, that may have commercial applications.

8/28/02 – NASA KSC, the 45th Space Wing and the Florida Space Authority unveil their first-of-its-kind Cape Canaveral Spaceport 50-year Master Plan during a briefing to government representatives, community leaders and the media at Port Canaveral's Cruise Terminal 10. Attending the event were U.S. Senator Bill Nelson and U.S. Representative Dave Weldon.

9/03/02 – The first Orbiter Major Modifications (OMM) began at KSC on Orbiter Discovery, after the program was relocated from Palmdale, Calif., in a cost-saving effort.

Historical Footnote

Kennedy Space Center was created in 1962 and this year, 2002, marked our 40th Anniversary. It was a time to look back at where we've been. A time to reflect on those who laid the foundation, in space and on the ground, during the early years of the U.S. space program. A time to remember and honor those achievements. A time to reflect on how far we've come...and where our path will take us next. This year's Annual Report features a historical timeline along the lower portion of the pages. There are so many wonderful events and memories and each one is significant in its own way. As our 40-year story unfolds we hope you will enjoy the photographs that appear in this report which only provide a glimpse of a rich history of significant accomplishments.

From left: John Glenn enters the spacecraft for his Mercury-Atlas-6 flight, Feb. 20, 1962; Werner von Braun witnesses the Saturn I launch from the blockhouse at Launch Complex 37B, Feb. 16, 1965; President John F. Kennedy visits Launch Complex 15 at Cape Canaveral during a Presidential tour, circa 1962.

Expendable Launch Vehicle (ELV) Program

Kennedy Space Center's ELV Program continues to develop strategies for ensuring the availability of affordable, reliable access to space for all NASA missions. During this past year, the ELV Program managed six successful launches, inserting seven spacecraft into their intended orbits:

- Jason/TIMED (Two Spacecraft on one Launch Vehicle)
- High Energy Solar Spectroscopic Imager (HESSI)
- Tracking and Data Relay Satellite (TDRS-I)
- Aqua Earth Observing System (EOS)
- NOAA-M (National Oceanic and Atmospheric Administration)
- CONTOUR

The Program received a 94 percent satisfaction rating from its customers for its work on these missions. The customers included spacecraft programs and projects managed by other NASA Centers, other government agencies, private industry and universities.

The ELV Program continued to build partnerships with other government agencies and began certification efforts for the new fleets of ELV's in support of manifested NASA missions.

- The ELV Program managed approximately 20 missions that were on contract with Launch Service Providers for services on Pegasus, Delta II, Atlas IIA and Atlas IIIB.
- In addition, the ELV Program supported more than 30 manifested spacecraft/missions during their early design and development stages. These customers received early trade studies, integration expertise and launch vehicle data to assist with launch vehicle planning.

Advanced Programs

The ELV Program is integrally involved in the advanced planning efforts for many future NASA missions. The new endeavors are:

- missions to Mars, Pluto, and the other outer planets.
- follow-on missions in support of Earth Sciences.
- flight demonstrations for Next Generation Launch Technologies .
- reimbursable missions from other Government agencies, such as the Department of Defense (DoD) and NOAA.

Mars Reconnaissance Orbiter (MRO)

KSC awarded a Launch Service Task Order (LSTO) to Lockheed Martin Commercial Launch Services, Inc. in June 2002 for the Atlas IIIB launch services in support of the Mars Reconnaissance Orbiter (MRO) mission, scheduled for launch in August 2005.

- The acquisition of commercial launch services for the MRO mission represents the first competitive LSTO award under the NASA Launch Services (NLS) contracts.
- MRO was the first head-to-head competition between the two major domestic providers of launch services in several years. The NLS LSTO acquisition took just a little more than six months to complete, or around one-third of the typical procurement lead time for a multi-million dollar acquisition of this type and complexity by the government.
- MRO also resulted in a substantial price reduction from NLS not-to-exceed prices, that was passed on to the MRO Project managed by the Jet Propulsion Laboratory (JPL), Pasadena, Calif.

From left: The Gemini 4 lifted off from Launch Complex 19, June 3, 1965; Gemini 12 prime crew James Lovell and Buzz Aldrin went up the ramp prior to their launch, wearing signs "The End," marking the last Gemini mission and the beginning of the Apollo era; and Gemini 12 lifted off from Launch Complex 14, Nov.11, 1966.

- LSTO team members responsible for this milestone were from KSC's ELV Program, JPL and KSC's procurement and legal directorates.

Launch Summary

Jason/TIMED (Thermosphere Ionosphere Mesophere Energetics and Dynamics)

- Launched Dec. 7, 2001, on a Delta II launch vehicle from VAFB.
- Johns Hopkins University Applied Physics Lab built TIMED for NASA.
- It is the second flight of the Dual Payload Attach Fitting developed for NASA missions.
- This effort marked increased international cooperation with the French Space Agency for the integration and launch of the Jason mission.

HESSI (High Energy Solar Spectroscopic Imager)

- Launched Feb. 5, 2002, on a Pegasus vehicle from CCAFS.
- Mission objective is to explore the basic physics of particle acceleration and explosive energy release in solar flares.
- First launch service ordered under the KSC/ELV SELVS (Small Expendable Launch Vehicle Services) contract.

TDRS-I (Tracking Data and Relay System)

- Launched March 8, 2002, on an Atlas IIA rocket from CCAFS.
- Second in a series of three replenishment spacecraft for the existing on-orbit constellation.
- Successfully placed in a Geo-Transfer Orbit.

Aqua EOS (Earth Observing System)

- Launched May 4, 2002, on a Delta II from VAFB.
- Aqua is one of a series of EOS spacecraft.
- Aqua's six state-of-the-art instruments will gather information about the Earth's water including global precipitation, evaporation and cycling.
- Aqua is a joint project between the U.S., Japan and Brazil.

NOAA-M (National Oceanic and Atmospheric Administration)

- Launched June 24, 2002, on a Titan II from VAFB.
- NOAA-M will provide worldwide weather, environmental monitoring, and search and rescue capability.
- Was the last NASA launch of the Titan II fleet.
- Team effort of NASA, NOAA and the U.S. Air Force.

CONTOUR (Comet Nucleus)

- Launched July 3, 2002, on a Delta II vehicle from CCAFS.
- Johns Hopkins University Applied Physics Lab built CONTOUR for NASA.
- CONTOUR was designed to take pictures and analyze dust in the nucleus of two comets.
- CONTOUR fell silent after firing its solid rocket motor, Aug.15, 2002. NASA is considering recovery options for the lost science.

From left: Early construction of the Vehicle Assembly Building (VAB), June 1964; VAB construction with the Launch Control Center in the foreground, January 1965; Dr. Kurt Debus signed a beam during the VAB opening ceremonies, April 14, 1965.

Space Shuttle Program

Several new processing improvements, Shuttle upgrades and development of more efficient processing components and procedures were just some of the highlights of KSC's Space Shuttle Program last year. These improvements helped contribute to the success of each Space Shuttle processing and launch from KSC.

The Space Shuttle processing team successfully processed three orbiter vehicles for four launches during the year.

- Three missions: STS-108 aboard Endeavour on Dec. 17, 2001; STS-110 aboard Atlantis on April 8, 2002; and STS-111 aboard Endeavour on June 5, 2002, carried several ISS assembly components and science experiments to the Station.
- Two crew rotations also occurred: Expedition 4 replaced the Expedition 3 crew on the ISS during Mission STS-108 and Expedition 5 replaced the Expedition 4 crew during Mission STS-111.
- Mission STS-109, which launched aboard Columbia on March 1, 2002, was the fourth Hubble Space Telescope Servicing Mission. The seven-member crew replaced several crucial elements of the telescope to upgrade and extend its view of the universe. Mission STS-109 also marked Columbia's return to flight after refurbishment.
- The launch of Mission STS-110 marked a milestone, as Mission Specialist Jerry Ross became the first human to fly in space seven times, breaking his own and other astronauts' records of six space flights.

A total of 28 astronauts flew on missions during the fiscal year and logged a cumulative total of approximately 19 million miles in space. Total flight time in space was 48 days, 7 hours and 23 minutes.

NASA's Orbiter Major Modifications (OMM) program was relocated to KSC from Palmdale, Calif., in early 2002.

For the first time in the history of KSC's Space Shuttle Program, an orbiter vehicle (Discovery) is undergoing its OMM inside the Orbiter Processing Facility. Beginning in early September, the vehicle began its regularly scheduled maintenance and upgrade for approximately one year before returning to flight in 2004.

The Shuttle processing team also embraced the new President's Management Agenda by initiating three new automated systems to create easy-to-find, single points of information access, reduce the burden of reporting this information and make the sharing of information across departments more efficient and convenient.

There are two new systems:

- Constraint Automated Tracking System, a web-based system that provides viewing capability of active Shuttle flight hardware and Ground Support Equipment Work Authorizing Document Constraints.
- Automated Change Processing System (Change Express), a joint effort between NASA Shuttle Processing Change Management System and United Space Alliance (USA) Ground Operations. It is a web-based system that provides a single point of access for data reports and queries.

The Time, Age, Cycle Control System was upgraded to a new Silverstream tracking system. The system tracks and provides historical data on orbiter and mission equipment hardware, including approximately 44,000 serialized components.

Process Improvements

Orbiter Logistics Long-Term Support

NASA KSC Logistics and USA Integrated Logistics conducted a wide range of assessments to forecast support capability a year or more into the future by:

- analyzing 80,000 items in the orbiter inventory.
- conducting an in-depth evaluation of the remaining 2000 items for insight into supply chain health, engineering resources, repair capability, reliability, and aging or obsolescence issues, as well as potential recovery time if there was a break in the supply chain.
- identifying items at risk due to loss of support capability or hardware degradation.
- collecting and analyzing data from a variety of Shuttle support functions, including NASA Space Shuttle Vehicle Engineering Office; Shuttle Processing Operations, Safety, Reliability, and Quality Assurance; USA Integrated Logistics; Orbiter Element; Business Management; Upgrades; and Boeing Engineering.
- prioritizing a list of high-risk items with risk mitigation plans, hardware upgrade recommendations, maintenance, repair and replacement strategies, improved supplier information and budget input.

The assessment will be performed annually, allowing tracking and feedback for budget submission, NASA management reviews, and the Shuttle Integrated Investment Strategy. By integrating long-term risk assessment with other management processes, cost identification is improved.

Hypergolic Maintenance Facility Quick Disconnect

The Hypergolic Maintenance Facility Quick Disconnect (QD) Lab initiated a process change to eliminate an unnecessary purge filter from the FairChild manual Ground Half-Coupling QD's. This will be an ongoing process until approximately 350 filter assemblies are removed from service. Once removed the filters will be decontaminated, cleaned, and returned to stock for use in the pneumatic Ground Half-Coupling QD's. This resulted in significant cost savings to the Space Shuttle program.

Orbiter Operations and Processing Achievements

Orbiter Major Modifications (OMM)

- Orbiter Discovery started its third OMM on Sept. 3, 2002, the first OMM to be perfomed at KSC. Preplanning activities began in March 2002 to develop new planning and implementation tools, enhance current processes and increase the existing workforce.
- During the OMM, Discovery's airframe, wiring and subsystems will be thoroughly inspected. Several modifications will also be implemented, including the Multifunction Electronic Display System that will replace Discovery's mechanical cockpit instrumentation with computerized displays.
- In addition, orbiter cooling and power capabilities will be upgraded to meet future Space Station science mission requirements.

From far left: The Apollo 11 prime crew, Michael Collins, Neil Armstrong and Edwin "Buzz" Aldrin, rehearsed for their Moon landing mission; stacking of the Saturn V space vehicle inside the VAB, April 4, 1969; rollout of the Saturn V space vehicle from the VAB's High Bay 1, May 20, 1969; the 3.5 mile trek atop the crawler transporter to Launch Complex 39A, May 20, 1969; Apollo 11 launch, bound for the Moon, occurred on July 16, 1969; former President Lyndon B. Johnson and Vice President Spiro Agnew viewed the Apollo 11 launch from the VIP viewing site.

Space Shuttle Program (continued)

Orbiter Atlantis Improvements

Prior to Mission STS-110, orbiter Atlantis' time in the Orbiter Processing Facility was extended to allow for the installation of new flight hardware to enhance the orbiter's capabilities.

- A new Modular Memory Unit (MMU) was installed that integrates the existing functions of the Space Shuttle MMUs, operational recorders and payload data recorders into a single unit.
- The Device Driver Unit (DDU) was replaced with an upgraded DDU that provides power to the orbiter manual controllers, rudder pedal transducers, nose-wheel position transducers and associated amplifiers. New DDUs are scheduled for installation on Discovery and Endeavour during their next OMM.

Energy Management Activities

KSC Shuttle Processing formed a partnership with Florida Power and Light that when fully implemented will result in more than $400,000 worth of savings on annual electricity costs at KSC. KSC Shuttle Processing researches the latest trends in energy-efficient facility subsystems, and if proven energy-efficient, cost effective and technically reliable, they are installed as a part of energy efficiency projects. The cost-saving efforts resulted in the installation of cutting-edge technologies in Shuttle-managed facilities including:

- the Ground Systems Division managment of a $3.2 million energy efficiency project to retrofit and redesign aging Shuttle facilities at KSC.
- emphasizing efficient operation of existing system controls in building automation systems for cooling and lighting control.

KSC's Shuttle program also supports energy management activities across the Federal Government. This year KSC Space Shuttle program managers spoke about energy-savings initiatives at the Dept. of Energy's Federal Energy Managers Conference in Washington, DC.

Orbiter Endeavour rolled from the Orbiter Processing Facility to the Vehicle Assembly Building, Sept. 30, 2002, in preparation for mission STS-113.

From left: The Apollo 11 Lunar Module began its descent to the Moon; Astronaut Neil Armstrong descended from the Apollo 11 Lunar Module to become the first man and first American to step on the Moon, July 20, 1969; Astronaut Buzz Aldrin posed for a photo near the U.S. Flag during an Apollo 11 extravehicular activity, July 20, 1969.

Space Shuttle Atlantis roared into the sky on Mission STS-110, April 8, 2002, from Launch Pad 39B, as birds beat a swift retreat. Mission STS-110 was the 13th assembly flight to the International Space Station.

Shuttle Upgrades

New processing techniques, equipment, tools and a new control and monitoring system were some of the enhancements developed to improve the Shuttle processing and upgrades program at KSC. These included the development of lightweight orbiter component materials, a ground measurement system and a tool to aid in orbiter stacking prior to launch.

These orbiter processing enhancements and upgrades helped to ensure and continue KSC's commitment to safety in all aspects of Space Shuttle processing activities.

Convoy Command Vehicle Delivered

- A new convoy command vehicle was delivered, replacing the 15-year-old model. The vehicle will be used during launch and landing operations.
- The vehicle will be used following Shuttle landings as the prime vehicle to control critical communications between the orbiter, the crew and the Launch Control Center, monitoring the health of the systems and directing post-landing convoy operations at the Shuttle Landing Facility.

Hazardous Gas Detection System (HGDS 2000) Installation Completed

- The system was installed and tested on Mobile Launch Platform (MLP) 2 and was first used during the STS-109 processing at the launch pad and countdown.
- HGDS 2000 was subsequently installed on MLP-1 and MLP-3 and successfully supported STS-110 and STS-111.
- A fourth and final unit was delivered and is functional in the Vehicle Assembly Building.
- The new system greatly increases the reliability, maintainability and supportability of the MLPs' hazardous warning systems.

Solid Rocket Motor Stacking Enhancement Tool

The Mechanical Systems Division led the effort to design, develop, test and deploy the Solid Rocket Motor Stacking Enhancement Tool (SSET). The SSET:

- is a specialized mobile data acquisition system that is designed to measure the weight distribution of a suspended Solid Rocket Motor segment on a lifting beam and the distance between the suspended segment and the mated joint during vertical segment assembly operations.
- replaces and enhances the capability of two existing systems with a single instrument rack that improves data accuracy, uses off-the-shelf components, features an enhanced graphical user interface, and significantly increases the amount of data recorded during critical Solid Rocket Booster segment mating operations.

Fail-Safe Jackscrew

The recent failure of one of the more than 4,000 jackscrews at KSC made apparent the need for a fail-safe design. A jackscrew is a portable or fixed device for lifting a heavy load a short distance by means of a screw mechanism. It is used to lift or exert pressure. An engineering team:

- designed a fail-safe jackscrew.
- developed a retrofit kit for several of the jackscrew types in use at KSC.
- used as much of the existing hardware as possible and minimized the length added to the actuator, or device that holds the jackscrew.

From left: Astronaut Alan Shepard suited up for his Apollo 14 mission; Apollo 14 launched from Launch Pad 39A, Jan. 31, 1971; Dr. George Lowe and Dr. Von Braun monitored the launch from KSC.

- successfully designed a retrofit kit for several of the jackscrew types in use at KSC: installation of the retrofit kit transforms an ordinary jackscrew into a fail-safe design.
- is working to retrofit and test a prototype unit in the Launch Equipment Test Facility.

Lightning Induced Voltage Instrumentation System and Catenary Wire Lightning Instrumentation System Upgrades

An upgrade to the Lightning Induced Voltage Instrumentation System (LIVIS) and Catenary Wire Lightning Instrumentation System (CWLIS) was completed. The centerpiece of this upgrade was the development of a digitizer board that replaces an older analog system. This upgrade provides:

- data directly to the operator console in the Launch Control Center.
- access to recorded data, including waveforms to the users moments after the data has been recorded.

Ground Measurement System

The Ground Measurement System (GMS) replaced the Pad Measurement System and:

- feeds data from myriad sensors, including pressure, acoustic, accelerometers, load cells and strain gauges, to the Launch Control Center for processing and distribution.
- captures data during critical operational activities, such as solid booster stacking, mobile launch platform rollout from the Vehicle Assembly Building to the pad and actual launch operations.
- introduces a new, universal signal conditioning amplifier assembly and an advanced data acquisition system.
- provides quick access to the data with accuracy and connectivity to large storage capacity units for later data retrieval.

Facility Systems Control and Monitoring

The Kennedy Complex Control System (KCCS) is being deployed and will replace obsolete facility control and monitoring systems presently in use at the Launch Complex 39 area. KCCS will:

- reduce the cost of system maintenance.
- increase system interface capability.
- target deficiencies.

KCCS provides control and monitoring services at several KSC facilities including the Launch Control Center, Mobile Launch Platforms and launch pads. The open architecture of KCCS has allowed the project to:

- integrate control and monitoring of equipment installed by other projects much more cost effectively than would be possible with the old system.
- provide the core system into which other smaller systems can be integrated.

A technician checks an orbiter Thermal Control System Blanket that will be used on a future flight.

From left: Apollo 15 rollout, May 18, 1971 for launch July 26, 1971; Apollo 17 astronauts Eugene Cernan, Ronald Evans and Harrison Schmitt on Moon Rover during rollout; launch of Apollo 17 from Launch Pad 39A, Dec. 17, 1972. It was the first manned nighttime mission, the first mission with a geologist astronaut on the lunar surface and the last mission to the Moon.

Shuttle Upgrades (continued)

- provides KSC with a state-of-the-art Facilities Monitoring/Control and Energy Management System.

Power System Restoration within the Launch Complex 39 Area

The age of the launch pads and major processing facilities, environmental factors, launch blast, Solid Rocket Booster residue and hardware obsolescence issues dictate replacement and modernization of the Launch Complex 39 facility power and distribution system.

- Electrical distribution schemes are being resized to more efficiently serve Space Shuttle program loads.
- Restoration will yield significant savings in energy and yearly maintenance costs.
- Future projects are planned to replace the deteriorating electrical power distribution systems for all critical processing facilities.

Nondestructive Evaluation of Orbiter Flight Crew System Lightweight Components

In a weight reduction effort, Flight Crew System (FCS) engineering converted several orbiter components from metallic structures to graphite-epoxy composite honeycomb. The components included pallets, lockers, a mid-deck accommodations rack and tool storage assembly.

KSC and Johnson Space Center developed reliable Nondestructive Evaluation (NDE) methods, Shearography and Thermography, that can be used for frequent handling of these components in space and on the ground. The new techniques:

- are both effective and affordable.
- complete the inspections in much less time than conventional ultrasound.
- are more accurate than visual inspection.

As a result, inspections of FCS lightweight components are more cost effective and save more time than ever before.

Technicians install the first of three Space Shuttle Main Engines on Atlantis in preparation for mission STS-112.

A tile technician inspects tile on orbiter Endeavour in preparation for the next flight.

From left: The Apollo-Soyuz Test Project Saturn 1B sat on the pad's "milkstand" ready for launch July 15, 1975 and rendezvous with the Russian Soyuz spacecraft; the Skylab module with solar array shield floated above Earth after launch May 14, 1973; the Skylab 3 astronauts, launched July 28, 1973. Alan Bean, Owen Garriott and Jack Lousma spent 59 days and 11 hours in orbit.

A United Space Alliance Shuttle Systems Inspector checks the flow liner on Columbia after the engines were removed. The inspection was the result of small cracks being discovered on the Liquid Hydrogen (LH2) Main Propulsion System flow liners in two other orbiters.

International Space Station and Shuttle Payload Processing

The International Space Station (ISS)/Payload Processing mission is to direct and manage the launch site support, ground processing and integration of Space Shuttle payloads, payload carriers and Space Station components, including assembly elements, resupply cargo and utilization experiments.

Ground Processing of International Space Station Elements

KSC's ISS ground processing team prepared, tested and integrated Space Station elements for ISS missions, instituting new cost- and time-saving procedures while maintaining safety and reliability.

The processing team assembled, integrated, tested and performed checkouts for successfully flown missions during the year. Accomplishments for missions included the following:

Mission STS-108/Utilization Flight-1 (UF-1)

- Installed ISS cargo into the Multi-Purpose Logistics Module (MPLM) at the pad for the first time, using newly developed support equipment that allowed access into the MPLM while in the vertical position.

Mission STS-110

- Completed powered-on acceptance tests and verification of more than 6000 acceptance test requirements.
- Instituted a S0 Truss and Mobile Transporter copper path matrix to provide positive proof of interface integrity.
- Inspected the S0 Truss soft dock springs for incorrect alignment; discovered two EVA connector adapter positions that would have failed to mate on orbit.
- Discovered shroud interference with Global Positioning System (GPS) antenna.

Mission STS-111/Utilization Flight-2 (UF-2)

- Cleaned the MPLM to highly sensitive cleanliness after mission 7A.1 since foreign object debris was an issue on orbit.
- Integrated the fullest MPLM to date (15 racks) and installed the first Bungee Web for temporary on-orbit stowage in the MPLM as an on-orbit time saver for the crew.
- Delivered the Canadian Mobile Base System (MBS), the second major Canadian Space Station element, to continue the assembly of the Mobile Servicing System (MSS).
- Delivered the first European-built Facility Class rack, the Microgravity Science Glovebox (MSG), to support experimental studies in materials science, combustion, fluids and biotechnology.
- Extensively tested the MPLM Support Vehicle (MSV). The MSV will trail the Shuttle after landing and will be used to carry powered-on Earth experiments and science that return from the Station for return to the principal investigators.

Assembly, integration, testing and checkout was accomplished on several missions that were also in process at KSC during the year:

- Starboard 1 (S1) (STS-112) and Port-1 (P1) (STS-113) Trusses including the External Active Thermal Control System, Crew Equipment and Translation Aid and Antennas.
- Utilization and Logistics Flight-1 (ULF-1) Mission STS-114 with its Minus Eighty Degree Laboratory Freezer (MELFI) for ISS.

From left: Inside Hangar AM at CCAFS, workers mate the Pioneer 6 to a Delta third stage on Oct. 7, 1965; and Pioneer 6 launched aboard a Delta rocket from Launch Pad 17-A at CCAFS, Dec. 16, 1965.

- P3/P4 Truss (STS-115) with its two Unpressurized Cargo Carrier Attach Systems, Solar Array Rotary Joint (SARJ) Integrated Equipment Assembly and two Solar Array Wings.
- the P5 and S5 Truss Elements (STS-116 and STS-118).
- S3/S4 Truss (STS-117) with its four Payload Attach Systems (PAS), SARJ, Integrated Equipment Assembly and two Solar Array Wings.

Ground Processing of Primary Shuttle Payloads for their Missions:

- STS-109/Hubble Space Telescope (HST) Servicing Mission 3B – Completed highly successful integration, test, launch and recovery of the four HST Servicing Mission carrier elements and the associated Orbital Replacement Units/Orbital Replacement Instruments.
- STS-107/SPACEHAB-RDM and FREESTAR – Provided facilities and processing support during and after the mission was rescheduled to early 2003.

KSC Utilization

The Utilization Team provided laboratory accommodations and support services to a diverse group of payload developers and principal investigators, including the European and Japanese Space Agencies, enabling critical commercial and educational research to be conducted on the Station. The team provided:

- launch site integration services, including operation of test systems used for final design verification and ISS interface verification testing.
- carrier and vehicle physical integration.
- late stowage and early access operations for a host of ISS Research Experiments, and assistance for the Marshall Space Flight Center Payload Operations Center with ISS payload on-orbit activation and troubleshooting.

The ISS Payloads Program and NASA's Office of Biological and Physical Research reached its initial goal of ten payload facilities onboard the ISS. The testing also contributed to the successful resolution of anomalies detected before flight, which ultimately led to:

- improvements in on-orbit crew procedures.
- enhancements to primary hardware configurations.
- updates to critical ground and flight software/ databases.

Payloads processed at KSC during FY02 represented a number of scientific disciplines including:

- **Microgravity Research:** Microgravity Science Glovebox; Space Acceleration Measurement System II; Protein Crystal Growth – Single Thermal Enclosure System; Dynamically Controlled Protein Crystal Growth; Human Life Sciences; Human Research Facility – 2; Fundamental Biology and Biomass Production System.
- **Earth Science:** Window Observational Research Facility.
- **Commercial Research/Space Product Development:** Advanced Astroculture; Plant Generic Bioprocessing Apparatus; Commercial Generic Bioprocessing Apparatus and Zeolite Crystal Growth Furnace.
- **Refrigerator/Freezers:** MELFI and the Advanced Thermoelectric Refrigerator/Freezer. (ARCTIC)
- **Payload Carriers**: Expedite the Processing of Experiments to Space Station (EXPRESS) Rack 6.

From left: The Mariner 9 space probe underwent final checkout May 20, 1971, at CCAFS prior to launch; an Atlas Centaur soared skyward, May 30, 1971, from CCAFS Launch Pad 36B, carrying the Mariner 9 space probe; an Intelsat V launched aboard an Atlas Centaur rocket, Dec. 15, 1981, from Launch Pad 36-B.

International Space Station and Shuttle Payload Processing (continued)

Safety and Mission Assurance

The KSC Ground Safety Review Panel (GSRP) continues to be recognized as one of NASA's Best Practices. Due to the panel's efforts, there have been no catastrophic mishaps occurring during KSC ground processing operations, and no fatalities or permanent injuries. These efforts were a result of 72 ground safety reviews,163 flight safety data package reviews and completion of 89 Government Furnished Equipment ground safety checklists.

Payload Canister Transporter Replacement

Two new Payload Canister Transporters, which replaced the 20-year-old transporters, were delivered to KSC this year. Each can transport, to the OPF or launch pads, a maximum payload and canister weight of 172,000 pounds. In addition, the canisters' upgrades and new technology make them more reliable.

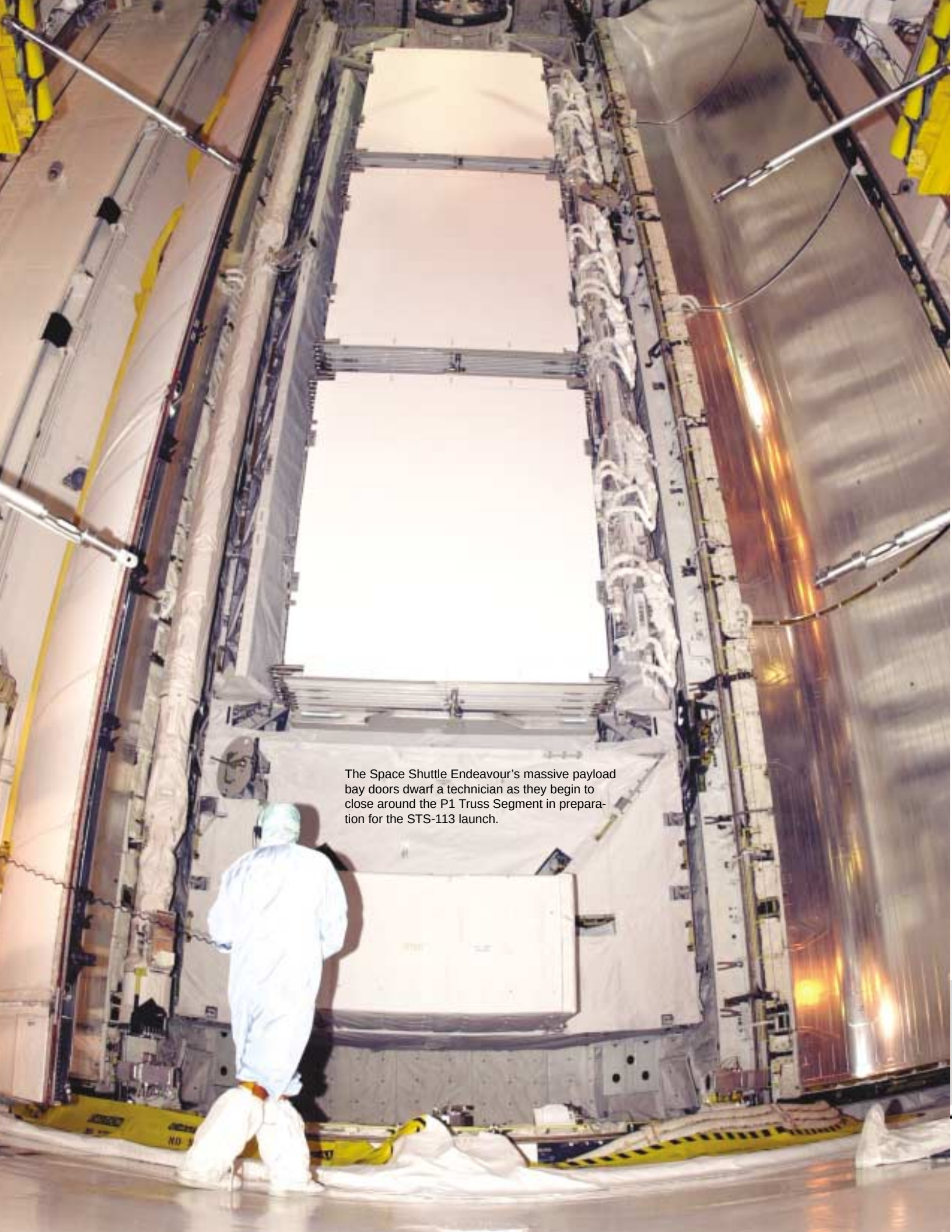
Logistics Warehouse and Consolidation

The ISS Support Equipment Control Board members and the Boeing Payload Ground Operations Contractor LEAN Team worked together to perform a Warehousing Consolidation Initiative in the KSC ISS Logistics warehouses to reduce costs. The team helped relocate, consolidate and excess items stored in the on-Center warehouses and freed up enough space to consolidate all Space Station warehousing on-Center resulting in a direct cost savings of $1.6 million.

The team inventoried and categorized items in storage using a new process developed by the team that allowed quick and easy identification of items that were obsolete or unusable.

Workers in the Space Station Processing Facility look over the Mobile Base System (MBS), part of the payload on mission STS-111 to the International Space Station.

From left: Columbia was lowered to the External Tank in the VAB in preparation for the first Space Shuttle launch, STS-1; John Young and Robert Crippen, the STS-1 crew; Launch of Columbia, STS-1, April 12, 1981, from Launch Pad 39A.



The Space Shuttle Endeavour's massive payload bay doors dwarf a technician as they begin to close around the P1 Truss Segment in preparation for the STS-113 launch.

Payload Carriers Program

Program Improvements

The Payload Carriers Program consolidated its major analytical integration, sustaining engineering and Operations and Maintenance activities.

- Design center activities were transferred from Marshall Space Flight Center to Goddard Space Flight Center in order to streamline activities and reduce costs.
- A study began during a summer faculty assistance program to document all carriers within the inventory and determine their remaining useful life. It expanded into a continued study in conjunction with Kansas State University faculty and students.
- The Program completed modifications to deliver the third Lightweight Multi-Purpose Experiment Support Structure (MPESS) Carrier (LMC). The MPESS's lighter-weight configuration improved the Shuttle's cargo carrying capability by utilizing the normally unused Bay 13 area. The LMC is projected to be used frequently on future Space Shuttle flights.
- The Program continued its support for the Intelligent Synthesis Environment technology specifically to meet any Launch-On-Need requirement for future flights and was successfully used to validate the cargo capabilities for Mission STS-108.

Mission Support

The Payload Carriers Program provided payload-processing services for four Space Shuttle flights including:

- two International Space Station (ISS) assembly flights.
- one mixed ISS Utilization and Shuttle-based science flight.
- one Hubble Space Telescope Servicing Mission.

The Program successfully supported Mission STS-109/Hubble Space Telescope Service Mission 3B with:

- a Flight Support System.
- MULE (Multi-Use Lightweight Equipment).
- Spacelab Pallet carrier.

These payload carriers contained The Advanced Camera for Surveys; four large flexible solar array panels; a new Power Control Unit (PCU) to replace the original PCU that was on the telescope for 11 years; and a new experimental cooling system.

The Payload Carriers Program provided the LMC carrier hardware and four Get-Away Special Payloads along with the MACH-1 Hitchhiker payload that carried six of the 10 experiments on Mission STS-108/ISS Utilization Flight-1.

From left: Columbia rolled to Launch Pad 39A, Feb. 16, 1982, for STS-3; Columbia launched from Launch Pad 39A on STS-4 carrying the first Getaway Specials payloads; workers lowered the Anik C-3, the first commercial satellite, into the payload assist module for flight on STS-5; Anik C-3 was deployed on STS-5, Nov. 11,1982.

Payload Carriers team members check the Spacelab Pallet in the Operations and Checkout Building.

Spaceport and Range Technologies

The development of new technologies that will impact future spaceports and communities characterizes KSC.

Space Act Awards

For the third consecutive year, KSC innovators earned more Space Act Award dollars than any other NASA civil servant center.

- The fiscal year 2002 award amount of $190,850 is divided among four areas. The software release area won $51,600; patent applications received $23,000; TechBriefs awards totaled $47,600; and board action awards reached the highest amount at $68,650.
- This year's award dollars show a significant increase from the total amount of $12,000 awarded just 10 years ago.

Technology Spinoffs

Each year KSC's technical contributions, originally designed for the space program, are mainstreamed into the civilian world to better the lives of millions of people.

Remote Monitoring and Alarm System (RMAS)

This electronic central monitoring system checks the health of remotely located equipment modules of transmitting and receiving equipment in KSC's fiberoptic communication network. RMAS includes a central monitoring unit conveniently located for easy access by technicians, plus a remote terminal unit at each remote site. The "backend" software used on the UNIX-based platform in the central management center to monitor the remote sites has a graphical user interface (GUI), which simplifies operation. The technology (Case Number KSC-11655) was patented and licensed for commercialization.

Potential commercial applications include:

- telephone, cable television, and cable Internet providers for monitoring remotely located switching, power and fiber optic equipment.
- manufacturing for industry for monitoring production lines and automated assembly equipment from remote locations.
- conventional and nuclear power plants for monitoring the status of remote sensors, pumps, actuators and motors.
- hospitals and healthcare facilities for monitoring the status of their patients.
- safety and security firms for monitoring clients' valuable or sensitive equipment.

Improving Effectiveness of a Permeable Treatment Wall with Ultrasound

A unique system is being developed at KSC for in situ treatment of groundwater contaminated with chlorinated solvents. The method involves installing a water-permeable treatment wall at significant depths — 40 to 70 feet below the surface — like a strainer across the flow path of a contaminant plume, allowing groundwater to move passively through while precipitating, gripping, or degrading the contaminants. This treatment method is most commonly applied to treat chlorinated solvents using zero-valent metals such as iron as the reactive media. Reductive dechlorination occurs by reaction of the contaminant with the surface-bound iron at the treatment wall border. The iron may be installed as pure iron filings or mixed with sand or gravel to improve permeability.

A fairly recent innovation, treatment walls are becoming widely used and have been proven highly effective. The most significant factor that limits the applicability of this method is the cost associated with

From left: Astronauts Story Musgrave and Donald Peterson performed the first space walk of the shuttle program during Mission STS-6, which launched April 7, 1983; Astronaut Sally Ride became the first woman in space during Mission STS-7, aboard Challenger, June 18, 1983.

installation. Permeable treatment walls are most commonly installed using traditional excavation and backfilling or trenching, which require removal and offsite disposal of the contaminated soil. These costs become excessive when the reactive material must be placed far below the surface, which is the case at KSC. Deep installation using current placement methods requires the removal of existing soil and offsite disposal of the contaminated soil, which dramatically increases treatment costs.

KSC's innovative technology (Case Number KSC-11959) will provide a significantly more effective and cheaper alternative to existing systems.

In-Situ Reductive Dehalogenation of DNAPLs Through the Use of Emulsified Zero-Valent Iron Particles

Similar to the previous technology, this process employs the use of zero-valent iron in an emulsion formula to reductively dechlorinate dense nonaqueous phase liquid (DNAPL) sources in polluted water. This technology replaces the pump and treats technique due to their slow dissolution of the solvents. A patent was filed and is currently pending; the technology (Case Number KSC-12246) is available for commercialization.

Potential commercial applications for both technologies include:

- dye and paint manufacturers.
- dry cleaners.
- chemical manufacturers.
- metal cleaning and degreasing facilities.
- leather-tanning facilities.
- pharmaceutical manufacturers.
- adhesive and aerosol manufacturers.
- government/military facilities.

Personal Cabin Pressure Monitor and Altitude Warning System

This new device may prevent aircraft accidents by warning the crew of potentially dangerous or deteriorating cabin pressure conditions and reminding them of the need for supplemental oxygen. This personal, portable device can be used in a variety of aviation, aerospace and nonaerospace applications where warning of one's exposure to high-pressure altitude is important. A patent was filed and issued and the technology (Case Number KSC-12168) was licensed for commercialization.

Market applications include:

- pressurized and nonpressurized aircraft.
- human-tended space operations.
- ground-based aerospace systems (e.g., vacuum test chambers).
- altitude chambers.
- environmental simulation vessel.
- mountain climbing.
- meteorology.

From left: Astronaut Guion Bluford became the first African-American astronaut in space, Aug. 8, 1983, when Challenger launched on Mission STS-8; inside the Operations and Checkout Building, technicians prepare Spacelab 1 for flight on Mission STS-9; the first Space Shuttle flight carrying six crew members was Mission STS-9, aboard Columbia, Nov. 28, 1983. STS-9 also carried the first European Space Agency astronaut.

Spaceport and Range Technologies (continued)

Signal-Conditioning Amplifier Recorder (SCAmpR)

SCAmpR replaces the existing Ground Measurement System (GMS) Phase 2 Data Acquisition System (DAS) used by NASA to support Space Shuttle launch pad measurements. The SCAmpR meets performance requirements established by the GMS. In addition, the SCAmpR DAS greatly improves reliability, significantly reduces cost of ownership and provides users with much more flexibility than the existing GMS. A patent was filed and the technology (Case Number KSC-12296) is available for commercialization.

Advanced Data Acquisition System

Similar to SCAmpR, this technology is a self-healing, self-calibrating signal-conditioning amplifier designed for current and future requirements of the aerospace sensors and transducers field. New designs incorporate self-health, self-calibration and self-repair capabilities, allowing for greater measurement reliability and extended calibration cycles. With the addition of power management designs and components, state-of-the-art data acquisition systems allow data that can be processed and presented with increased efficiency and accuracy. This device provides increased reliability by utilizing techniques to automatically reroute signals through different paths when the processor identifies a component malfunction. A patent was issued for this technology (Case Number KSC-12301) and it is available for commercialization.

Potential applications include:

- aerospace vehicles.
- engine test stands.
- medical diagnostics.
- power generation facilities.
- wind tunnels.
- crash-test facilities.
- monitoring of industrial processes.

Liquid Applied Galvanic Coatings for Protection of Steel in Concrete

This innovation involves a liquid coating applied to the outer surface of reinforced concrete to protect the embedded rebar from corrosion. The coating contains one of several types of metallic particles—magnesium, zinc or indium. An electrical current established between metallic particles in the applied coating and the surface of the rebar provide the necessary electric charge to offer cathodic protection. The current forces a flow of metal ions from the coating onto the rebar, preventing the loss of metal ions that would normally occur as part of the natural corrosion process. This technology is innovative because it can be applied (1) to the outside surface of reinforced concrete and (2) with a conventional brush or sprayer. A patent was filed and the technology (Case Number KSC-12049) is available for licensing.

Potential applications include:

- highway and bridge infrastructures.
- piers and docks.
- concrete balconies and ceilings.
- parking garages.
- cooling towers.
- pipelines.

From left: Space Shuttle Challenger sat on Pad 39A for launch on Mission STS-41B, Feb. 3, 1984; during Mission STS-41B Astronaut Bruce McCandless operated Manned Maneuvering Unit during an EVA for the first time; STS-41B was the first Shuttle landing at KSC, Feb. 11, 1984.

Capacitive Detection of Water in Orbiter Thermal Protection System Tiles

In March 2001, during recovery operations at Dryden Flight Research Facility, orbiter Atlantis was subjected to an unusual amount of rain. This resulted in the thermal protection tiles becoming more waterlogged than had ever been observed in the history of the Shuttle program and led to a lengthened flow because of the additional infrared (IR) scanning and baking of tiles to dry them.

As a result of this situation, NASA KSC Labs developed some new methods that improved the orbiter tile drying process, including:

- a vacuum system to remove water from the tiles.
- a tool that detects water in tiles and takes measurements immediately after water removal.

In the future the vacuum process and water detection tool will be used in addition to the current IR scan and baking process to shorten tile drying time.

Spaceport and Range Technologies Lines of Business and Outputs

In order to satisfy its customers and achieve its mission, KSC has three synergistic external lines of business: Spaceport Operations, Spaceport Design and Systems Development, and Spaceport & Range Technology and Science.

Spaceport Operations is divided into three product/service lines:

- Reusable Launch Vehicle Services.
- Expendable Launch Vehicle Services.
- International Space Station/Payload Services.

Spaceport Design and Systems Development includes design and development of launch vehicle processing systems, payload processing systems, and landing and recovery systems.

The Spaceport & Range Technology and Science line of business comprises six research and technology development product lines in direct support of Spaceport Design and Systems Development and Spaceport Operations. The resulting output/innovations from these six areas are also evaluated for their commercial potential and made available for licensing through the Technology Commercialization Office.

Other KSC technology successes include:

- Smart Umbilical Mating System (Case Number KSC-12138, developed under an SBIR contract).
- Liquefied Natural Gas Tank Gauging System (Case Number KSC-12302).
- Electronic Portable Information Collection (EPIC) System (Case Number KSC-11943).
- Torque Wrench Tool Adapter (Case Number KSC-11508).
- Perfluorocarbons as Fire Suppression Agents (Case Number KSC-11573, developed under an SBIR contract).

From left: The first flight of Space Shuttle Discovery was Mission STS-41D, launched Aug. 30, 1984, from Launch Pad 39A; Mission STS-41G, launched aboard Challenger, Oct. 5, 1984, was the first flight with two female astronauts aboard, Kathryn Sullivan and Sally Ride; during Mission STS-41G astronauts David Leestma (left) and Kathryn Sullivan perform an EVA in Challenger's aft cargo bay.

Future Vehicles

Kennedy Space Center holds a critical position in the Next Generation Launch Technologies (NGLT) program as a supplier to the Marshall Space Flight Center-managed development program. NGLT is the program to develop technologies necessary for future launch vehicles.

The Space Shuttle is America's first generation Reusable Launch Vehicle (RLV). KSC is providing the project leadership for ground operations technology development work, as well as providing team members to the flight vehicle/systems engineering development teams.

The KSC team established key partnerships and contracts with companies that are developing new technologies for future launch vehicles. Through these partnerships and contracts, KSC is working in the areas of:

- densified, or super-cooled cryogenic fuels.
- advanced checkout and control systems.
- integrated vehicle health management systems development.
- sharing world-class knowledge of vehicle and payload processing.

In-house KSC tasks, worked primarily by KSC civil servants, progress well in the area of future umbilical development, as well as space-based range safety, systems.

Advanced Spaceport and Range Technologies

KSC's mission in Spaceport and Range Technology Development is enabled by the technology planning efforts of both the Advanced Range Technology Working Group (ARTWG) and Advanced Spaceport Technology Working Group (ASTWG). These working groups, led by KSC, are building a "community" that is focused on:

- furthering the technology research and development for future spaceports and ranges.
- leveraging resources and soliciting input and advice from all stakeholders.

The partners in the working groups include NASA, the Air Force, Navy, Federal Aviation Authority, Department of Commerce, state spaceports, industry and academia.

Significant progress was made towards developing the national road maps. In September 2002, the Air Force co-hosted the third ARTWG/ASTWG Conference in Colorado Springs and provided a face-to-face opportunity to work together in developing the details for the road maps. Breakout sessions allowed the technology subteams to:

- prepare a function-specific road map for next-generation technology development that will be integrated into a master road map for Spaceport and Range Development work.
- prove that the working groups continue to increase in membership and broaden the stakeholder base.

KSC plays a vital role in the development of future launch vehicles, as well as spaceport and range technology, through the ASTWG and ARTWG working groups.

From left: The European Space Agency's Spacelab 3 was installed in Challenger's cargo bay, Oct. 24, 1985, in preparation for Mission STS-51B; Mission STS-51B launched aboard Challenger on Oct. 30, 1985, carrying the first eight-member crew; the Space Shuttle Program returned to flight with the launch of Mission STS-26 aboard Discovery, Sept. 29, 1988, from Launch Pad 39B.

An artist's rendering of a future
Kennedy Space Center spaceport.

Safety and Health First

Superior safety and health performance is Kennedy Space Center's top priority. And since the Sept. 11, 2001, terrorist attacks KSC has taken precautions to make the Space Center an even safer place to work. Innovative approaches resulted in a a civil service lost time injury rate of just 0.19 (lost time injuries per 100 employees), surpassing NASA's goal of 0.20. Only three lost time injuries for the entire KSC civil service workforce occurred during the fiscal year and contractor organizations performed well in addition.

OSHA's Voluntary Protection Program (VPP)

- VPP is the benchmark for improvements to KSC's safety and health programs. Since the KSC VPP readiness effort began in December 2000, more than 240 safety program improvements have been identified and implemented.
- The KSC civil service workforce, including more than 170 employees belonging to special teams, strives for STAR Certification—the highest VPP certification level. Two of KSC's largest contractors, United Space Alliance and Space Gateway Support, have gained STAR status, and new contracts for on-site services include requirements for development of VPP quality safety and health programs.

Safety Resources Web Site (http://kscsafety.ksc.nasa.gov/isqpage.htm)

- This new Web site provides one-stop shopping for Center safety information on VPP, contacts and safety and health guidelines, and provides links to all KSC safety and mission assurance organizations.

Automated Safety Variance Tracking and Processing

KSC developed and implemented an on-line safety variance review and approval process. The system allows reviewers to evaluate and approve or disapprove requests for variance from safety policy on-line. This new system allows for concurrent reviews and improves response time. It also allows for more real-time interaction between reviewers that had been previously limited.

New Safety and Health Training Program Enhancements

Supervisors were provided a complete method for assessing their departmental safety and health training needs. This needs assessment assures that each employee has a tailored safety and health training plan that addresses the unique hazards of their job. In addition all employees completed the new five core safety and health training classes to ensure a complete baseline of understanding of KSC's safety and health programs and policies.

Safety and Health Program Updates

The Goal Performance Evaluation System (GPES) was updated to include enhancements to recording and tracking safety and health information. Specifically, the supervisor inspection process was automated to include checklist generation and data tracking, to highlight safety and health concerns identified in the workplace. Also included is a new safety and health meeting section that allows employees and supervisors the opportunity to select specific topics for discussion. GPES was also updated to include the Job Hazard Analysis program to allow employees and supervisors to review and assign applicable job hazards analyses.

From left: The Long Duration Exposure Facility orbits above Earth after launch aboard Challenger on Mission STS-41C, April 6, 1984; the Magellan spacecraft was deployed from Atlantis' payload bay after launch May 4, 1989 on Mission STS-30; the Hubble Space Telescope was lifted into workstands in the Vertical Processing Facility for processing prior to Mission STS-31's launch, April 24, 1990.

Automated Heat Stress Monitoring

This innovative notification system for heat illness prevention uses continuous monitoring of ambient Wet Bulb Globe Temperatures (WBGT) for shade and direct sunlight. It sends real time WBGT measurements to desktop computer, and provides current WBGT and informational material on a Heat Stress Web site. The system also sends e-mail and pager notification of heat stress conditions, which can be tailored to personalized operational requirements of KSC subscribers. The messages include appropriate set-point WBGT for particular work and describes prevention measures.

Employee Health

- Informational programs on improving employee health along with nutrition and fitness programs were offered to the workforce.
- Utilizing KSC's outstanding facilities, employees made more than 2,800 visits to the Rehab Works Center and 97,000 visits to KSC Fitness Center.
- Free screenings for such concerns as cardiovascular disease indicators and breast and colorectal cancer were offered to employees.
- Monthly employee wellness training and information sharing on such topics as skin cancer prevention and hearing conservation were provided to all employees.
- An employee health and fitness day was held that allowed employees to learn about health and wellness programs throughout the community and provided health screenings of a number of concerns, as well as nutrition and exercise counseling.
- A number of health advisories were issued to employees to address breaking health concerns in such areas as West Nile virus protection and prevention, as well as providing education to employees on bioterrorism response.
- And flu shots were provided to more than 2,000 employees in an preventative health effort to address employee wellness.

A vendor displays safety garb during Spaceport Super Safety & Health Day at KSC. Dozens of presentations and exhibits across the Center focused attention on safety at work and home.

From left: Crawler Transporter No. 2 reached its 1,000 mile mark April 22, 1990, while carrying Space Shuttle Columbia to the pad for Mission STS-35; during Mission STS-49, launched May 7, 1992, crew members used Endeavour's robotic arm to capture the Intelsat VI satellite. It was the first orbital flight to feature 4 EVAs—two being the longest in U.S. history; technicians connected the U.S. Microgravity Laboratory-1 to orbiter Columbia for Mission STS-50 that launched June 25, 1992.

Environmental Stewardship

As one of KSC's four guiding principles, the Center continues to preserve and enhance a wildlife sanctuary intertwined with KSC's dynamic spaceport.

Major Efforts

The Payloads/Station team reduced the cost of the Operations and Checkout Building's high bay heating, ventilation and air-conditioning system. By modifying equipment and procedures within their routine operations and maintenance budget, energy costs were reduced to one-tenth of previous levels while improving temperature and humidity conditions.

As part of the Center's pollution prevention program, more than 800 tons of steel and 300 tons of paper and cardboard were recycled, and a new recycling contract was awarded to enhance the program's return.

In an effort to restore Center environmental quality, more than 11,000 tons of contaminated soil from three KSC sites were disposed of properly. In addition, KSC closed ten locations after investigations found environmental pollution and then took appropriate steps to remedy any discovered contamination.

NASA, the Florida Department of Environmental Protection and Cape Canaveral Air Force Station continued a long-term permitting and compliance partnering effort. Air Resources Management, Water Resources Management, Hazardous/Solid Waste Management and Environmental Awareness and Integration determine best management practices and how to streamline activities, along with other process improvements. Some of the results are:

- recycling initiatives.
- electronic dissemination of monitoring reports and permits.
- streamlined issuance of air emissions permits.
- combined training efforts.

KSC's Ecological Program members work closely with the U.S. Fish and Wildlife Service Endangered Species Office for the continued survival of the federally protected Florida Scrub Jay in east central Florida. Members are developing complex population viability models. The models include relationships between habitat quality and habitat management approaches and influences of wildfires, land development and landscape fragmentation on the reproductive success and survival of individual scrub jays. This data can be used to assess the risk of extinction for isolated populations of the unique animals. Results of these studies, which have been published in peer-reviewed scientific journals, are used by Florida's land management agencies and the Endangered Species Office to develop the Species Recovery Plan required by the Endangered Species Act.

Achievements and Recognition

The Presidential Award for Leadership in Federal Energy Management was presented by U.S. Vice President Dick Cheney to NASA's energy team. KSC's energy program achievements contributed to earning this award.

The Department of Energy recognized energy saving efforts at KSC with two awards:

- KSC-Boeing employee Doug Thom was named NASA's *Energy Champion* for reducing energy consumption and costs by aggressively improving operations and maintenance practices in Payload/Station processing facilities.
- KSC received the Federal Energy and Water Management Award for results of long-term efforts to improve energy efficiency at the tracking and data relay station.

From left: Mae Jemison, the first African-American woman in space on Mission STS-47 aboard Endeavour, Sept. 12, 1992, works in the Spacelab Japan Module prior to launch; during Mission STS-61, the first Hubble Space Telescope servicing mission, astronauts Story Musgrave and Jeff Hoffman concluded their final spacewalk; Sergei Krikalev, the first Russian cosmonaut on a Space Shuttle, talks to school children during Mission STS-60 aboard Discovery, Feb. 3, 1994.

Roseate Spoonbills wade in the water near KSC while another takes flight. The birds are named for their brilliant pink color and paddle-shaped bill.

Inset photos: A Scrub Jay perches in a tree. Kennedy Space Center's inland waterways provide an oasis for the Manatee, Florida's gentle sea cow.

Partnerships

By forming business relationships with other innovative organizations, Kennedy Space Center is able to develop new assets for the Cape Canaveral Spaceport, and better serve its customers while growing the Center's research and technology development capabilities.

Space Experiment Research and Processing Laboratory (SERPL)

SERPL will provide a world-class facility to support both International Space Station life sciences experiment processing and fundamental biological research.

- KSC's SERPL partner is the state of Florida, including Florida Space Authority and Florida Space Research Institute.
- Florida funded and initiated the construction that began in 2002.
- The new 100,000-square-foot laboratory is at 40 percent completion and scheduled for total completion in October 2003.

Space Agricultural Biology Research and Education (SABRE) Institute

SABRE will support scientific research with a focus on discovery and development of technology aspects of advanced life support strategies.

- University of Florida's Institute for Food and Agricultural Sciences is KSC's partner. SABRE plans for a significant presence at the SERPL.
- Program Rollout was held by University of Florida on April 29, 2002, at the KSC Visitor Complex, Debus Center.
- Interdisciplinary biotechnology programs will emphasize the fundamental biology of organisms involved in spaceflight applications, including those involved in advanced life support.
- Program focus parallels Earth-based applications for solving problems in agricultural and environmental sciences, and thus presents key elements of future agricultural and ecological systems.

International Space Research Park (ISRP)

The ISRP will attract and foster research and technology development at KSC to support the use and commercialization of the Station, KSC's growth as a Spaceport Technology Center, and the exploration and development of space by Cape Canaveral Spaceport customers.

- KSC partnered with the state of Florida to support ISRP.
- ISRP evolved from SERPL.
- The yearlong concept development effort was completed in May.
- Forecasts indicate an additional two million square feet of facilities, employing about 8,000 ISRP employees by 2023.
- Draft guidelines for prospective park tenants and developers were published in June's *Federal Business Opportunities*.
- Other significant progress was made through initiation of an Environmental Impact Statement (EIS) and associated environmental studies, land use planning and discussions with prospective tenants.
- The first construction phase was completed on Space Commerce Way, a new highway leading to the ISRP tract.
- Delaware North Park Services initiated construction of the second phase that will wind around the back of the Visitor Complex and extend onto NASA Causeway.

From left: Chiaki Mukai, the first Japanese woman in space, entered the IML-2 Spacelab module in Columbia's payload bay during Mission STS-65 that launched July 8, 1994; during Mission STS-64, that launched Sept. 9, 1994 aboard Discovery, mission specialists Mark Lee and Carl Meade performed the first untethered U.S. spacewalk in 10 years; Eileen Collins became the first female Shuttle pilot on Mission STS-63 aboard Discovery, Feb. 3, 1995.

- When completed next year, the new Space Commerce Way will enable 24-hour access to both the park and the Visitor Complex.

KSC Master Plan

A collaborative effort between KSC, U.S. Air Force and the state of Florida developed a comprehensive Master Plan for the geographic designation of the Cape Canaveral Spaceport. The 50-year vision of the Spaceport's future was unveiled Aug. 28.

- Plan partners are Florida Space Authority, 45th Space Wing Command, Naval Ordnance Test Unit, Merritt Island Fish and Wildlife Refuge, and the Canaveral National Seashore.
- The plan provides a demand-based Master Plan documentation outlining three planning horizons (25-year, second generation technology, third generation technology).
- A Memorandum of Understanding between NASA and the Air Force was developed to advance a cooperative atmosphere among the Spaceport stakeholders to facilitate creation of a world-class Spaceport that benefits all stakeholders and customers.
- The plan illustrates sub area planning for the KSC Visitor Complex/Industrial area, the CCAFS Industrial area, and the Port property.
- Launch Activity Prediction Model outlines market demand-based launches through third generation technology (approximately 250 land-based launches).
- It outlines two new horizontal launch facilities through the first two planning horizons, and a total of six new vertical launch complexes through the three planning horizons.
- More than 143,000 wildlife acres will be conserved (a 3.5 percent decrease in overall environmental land use with a forecasted 10-fold increase in launch activity).
- A transportation corridor improvement program will be provided.
- The plan identifies nontraditional market segments, including tourism, R&D and academia ongoing collaborative efforts involving utility systems and statewide transportation improvements.

Advanced Technology Development Center (ATDC)

The ATDC will allow for full-scale demonstration, testing and qualification of new Spaceport Technologies in an environment closely approximating an actual launch facility.

- KSC partnered with the 45th Space Wing and Florida Air National Guard to support the ATDC, which is NASA-led.
- The Center is currently under construction at Launch Complex 20 (LC-20) on Cape Canaveral Air Force Station (CCAFS).
- ATDC will be developed in phases.
- Spaceport Technology projects that show promise in a laboratory environment can be deployed and qualified at the ATDC under "real world" conditions, including high-volume, low-pressure cryogenic flow testing.
- It is currently supporting two major programs—qualification of liquid oxygen (LOX) transfer pumps for the Space Shuttle program, and testing of densified hydrogen and oxygen production units for the Next Generation Launch Technologies.
- LOX pump testing is currently scheduled for mid-2003, with densified propellant testing following in mid-2004.

From left: Inside Orbiter Processing Facility 3, workers installed the Orbiter Docking System in Atlantis' payload bay in preparation for the Mission STS-71 launch, June 27, 1995 and the first Mir docking; Shannon Lucid (right front) became the first female astronaut on the Mir Space Station and spent 188 days in space until her return aboard Atlantis on Mission STS-79.

Partnerships (continued)

Aquatic Research Program

The Aquatic Research Program will demonstrate and test the new technology in KSC's unique aquatic environment.

- KSC partnered with Jet Propulsion Laboratory's (JPL) Sensor Web Project.
- The Center installed 14 "Smart Pods" at designated locations within the culvert south of Launch Pad 39A.
- Sensors on each pod record light intensity, water temperature, air temperature, air humidity, water turbidity, and water salinity (at different depths).
- Data will be collected every five minutes and transmitted to a computer for display and archival.
- The program provides KSC with a virtual presence within the ecosystem to gain a better understanding of the long-term trends.
- Workload required for collecting ecological data will be minimized.

The Link Project

The Link Project is a collaboration supporting the development of new technologies for remote environments on Earth and on other planetary bodies. The National Oceanic and Atmospheric Administration (NOAA) is examining the potential for interactions at KSC because there are many ongoing aquatic research programs of national significance at the Center.

- KSC and NOAA are Link Project partners.
- NOAA supports KSC aquatic ecologists and engineers to participate in submarine and remotely operated vehicle operations at Cape Canaveral marine reserves, and deployment and testing of newly developed NASA-KSC undersea acoustic monitoring systems.
- NASA and NOAA are partnering on a joint research project utilizing the SRB recovery vessel Liberty Star for mapping the Oculina Bank off Cape Canaveral's coast. Two expeditions will be performed.
- The first of two expeditions occured Oct. 15–23, 2002, to survey the coral reef using multi-beam sonar to provide detailed habitat mapping and characterization.
- Survey results will be used to guide the second expedition in spring 2003, when the reef fish spawn, again using NASA's ship, plus their underwater robot and an acoustic hydrophone system for listening to fish and vessel noise.

Energy Management Activities

In addition to moving KSC toward its energy reduction goals and saving on utility costs, this effort installs cutting-edge technologies in Shuttle managed facilities. These systems intend to be proven energy efficient, cost-effective and technically reliable.

- Florida Power and Light partnered with KSC for this $3.2 million project.
- Each year the initiative will result in more than $400,000 in expected annual savings on KSC retrofits and aging Shuttle facilities redesigns.

Advanced Power Supply Development

The quality of electrical power has never been more critical to NASA than it is today. This is not only due to widespread use of sensitive electronic equipment but also to the increased dependency on this equipment's continuous and trouble-free operation. The most significant threat to power quality comes from the power supply itself. The power

From left: A Delta II expendable launch vehicle (ELV) lifted off from Launch Complex 17A at CCAFS, Nov. 7, 1996, carrying the Mars Global Surveyor; the first Microgravity Science Laboratory was moved for installation into the payload canister for transport to Columbia prior to launch on Mission STS-83, April 4, 1997; workers checked the Cassini spacecraft in the Payload Hazardous Servicing Facility prior to launch aboard a Titan IVB/Centaur ELV, Oct.15,1997.

supply can inject large amounts of distortion into the power distribution system, which reduces efficiency.

- KSC, University of Central Florida and Electrodynamics Inc. are project partners.
- They are developing a state-of-the-art power supply that improves energy efficiency and electrical power quality.
- It is a Small Business Technology Transfer (STTR) project.
- The project has demonstrated potential for academia and industry partnerships to design a power unit that is more efficient, more reliable, and less costly to produce than any commercially available unit.
- It has completed successful commercial packaging and unit testing.
- Prototype performance criteria, established by the KSC Shuttle Processing Directorate, shows the commercial prototype has met or exceeded original specifications while providing a more cost-efficient product.
- The unit is patented and undergoing commercialization.
- It is likely to become a mass-produced, off-the-shelf item.
- There has been significant attention from some of the nation's largest power supply manufacturers.

Sensors and Monitors

KSC has collaborated with other NASA Centers to develop state-of-the-art sensor and monitoring technology.

- KSC partnered with JPL on a NASA Electronic Parts and Packaging Program, which evaluates commercial electronic nose instruments that detect vapors.
- KSC is partnering with Glenn Research Center (GRC), Johnson Space Center (JSC), Case Western Reserve University and Makel Engineering to develop a Microsystems-based Hydrazine Detection System for the Station and EVA application.
- KSC along with JSC and JPL will be partnering to develop an instrument for monitoring ammonia, hypergolic fuel and oxidizer, in the Shuttle and ISS airlock.

Cryogenic and Life Sciences Education Grants

Three education grants were awarded in two technical areas of research—cryogenics and life sciences. Each grant is approximately $100,000 and lasts for one year.

- In the cryogenics area, University of Central Florida and Southern University (Baton Rouge, LA) will work independently to investigate cryogenic switch technology.
- In the life sciences area, *Ohio State University* will be teaming with KSC to develop an autonomous harvester for plants in space, and with others to look at technology for harvesting food on longer duration Space Shuttle missions. This project may also have technology transfer potential for production agriculture such as citrus producers interested in automating some of their harvesting activity.

From left: Mission Specialist Kay Hire, the first KSC employee selected as an astronaut, participated in Mission STS-90 prelaunch activities; launch of Mission STS-90 aboard Columbia was April 17, 1998. It was a 17-day Neurolab mission focused on microgravity's effects on the nervous system; Payload Specialist John Glenn Jr. prepared for his return to flight on Mission STS-95 that launched aboard Discovery on Oct. 19, 1998.

Partnerships (continued)

Aerospace Technician Instructional Program

In June, a Space Act Agreement was formed to support Brevard's aerospace technician instructional program.

- The program's partners are Brevard Community College's Spaceport Center, USA, Boeing and Wyle Labs.
- BCC received a $3 million National Science Foundation grant and is working in conjunction with the Community Colleges for Innovative Technology Transfer consortium.
- A two-year associate of science degree in aerospace technology is offered.
- There are plans to develop certification requirements for aerospace technicians.

Many academic partnerships are the result of KSC's relationship with the state of Florida. These partnerships are formally defined in Memoranda of Understanding, such as the one shown here being signed by Center Director Roy Bridges and Florida's Lt. Gov. Frank Brogan (inset).

From left: The Mars Climate Orbiter was mated to the third stage of a Delta II ELV inside the Spacecraft Assembly and Encapsulation Facility-2 prior to launch on Nov. 24, 1998; during Mission STS-88, the first International Space Station assembly mission, the crew joined the U.S. Unity node to the Russian Zarya module in Endeavour's payload bay; NASA's Mars Polar Lander, the second of two Mars Surveyors, was launched on a Delta II ELV from CCAFS Launch Complex 17A, Jan. 3, 1999.

Cape Canaveral Spaceport leaders gather after the master plan signing ceremony at Port Canaveral Terminal 10. From left are Canaveral National Seashore Superintendent Robert Newkirk, Canaveral Port Authority Executive Director Malcolm "Mac" McLouth, KSC Director Roy Bridges Jr., U.S. Rep. Dave Weldon, 45th Space Wing Commander Gregory Pavlovich, U.S. Fish & Wildlife Services Refuge Manager Ron Hight, Naval Ordnance Test Unit Commanding Officer William Borger, and Florida Space Authority Executive Director Ed Gormel. The plan represents interagency cooperation between the leadership group's agencies and the U.S. Fish and Wildlife Service, the National Park Service and U.S. Navy. Joining them in developing a vision of the Spaceport's future have been aerospace educators, researchers, and businesses, along with representatives from local, state and national government.

Master Plan Signing Ceremony

Outreach to the World

Visitors from all over the world come to tour KSC's Visitor Complex. Guests see launches of the Space Shuttle and new space vehicles many times each year. KSC's traveling exhibits and speakers bureau reach many thousands at a variety of venues.

The Kennedy Space Center Visitor Complex

Kennedy Space Center Visitor Complex hosted nearly 1.5 million visitors in FY2002. So that visitors can be served and informed about NASA's missions and programs - past, present and future - many enhancements were completed and more were planned.

- The Rocket Garden was redesigned to enhance its informational value, landscaping, comfort, and safety. The new exhibits, lighting, seating areas, and landscaping were well received, especially the new water fountain.
- A new security policy was designed to protect our visitors as well as KSC assets.
- The new International Space Station IMAX 3D film premiered and is now the Visitor Complex's most popular IMAX presentation.
- The expansion of the Apollo/Saturn V Center souvenir shop was completed.

KSC 40th Anniversary Events

To mark its 40th Anniversary, KSC began a yearlong celebration on July 1, 2002. Several events, special publications and Webcasts helped to mark the official activation of the Launch Operations Center at Cape Canaveral in 1962 and commencement of independent operation under Dr. Kurt Debus. This recognition included:

- A lecture series at KSC and the KSC Visitor Complex that featured Carey McCleskey on Dr. Debus, Dennis Jenkins on Shuttle Development, and other speakers on topics such as the Bumper launch. The series was also viewed on KSC Webcast.
- A special color edition of *Spaceport News* was published and distributed in July.
- A "Post Card" exhibit at KSC Visitor Complex featured space spinoffs.
- A special feature "This Month in KSC's History" was displayed on KSC's Web page.
- A collection of 220 historical photographs was featured on KSC's Multimedia Gallery.
- The Visitor Complex hosted a barbecue picnic in September with several astronauts in attendance, including Scott Carpenter, Bob Crippen and Brian Duffy.

External Exhibits

This program, primarily composed of KSC volunteer staffers and organizers, reached more than 200,000 people at a variety of events in Florida and nationwide. Major events were a National Society of Black Engineers Conference; LaRaza Hispanic Leadership Conference; Federally Employed Women's National Training Program; Farnborough Air Show in England; the Sun and Fun Airshow, and the Air & Sea Show in Florida.

Speakers Bureau

KSC speakers and even a robot were part of programs at about 500 events. They reached close to a half million people in Florida, across the U.S., and internationally at events in South Africa, Argentina and Puerto Rico. Major events included Explorathon at Jacksonville's Museum of Science and History, which hosted 10,000 students; and the Virginia State Fair where "Andros," the robot from KSC's Hazardous Robotics Program, was seen by more than 300,000 during the week-long event.

From left: The Chandra X-ray Observatory was installed inside Columbia's payload bay prior to the Mission STS-93 launch; Eileen Collins, the first female commander of a Space Shuttle mission, prepared for Mission STS-93; Space Shuttle Columbia sat on Launch Pad 39B less than two weeks after Discovery's launch on Mission STS-96. Launch of Mission STS-93 was July 23, 1999.

Protocol

KSC hosted 7,090 official guests during the year including VIPs, education groups, Take our Children to Work guests and Legislative guests. More than 80,000 Shuttle and ELV launch guests were hosted for launch viewing and related activities. The office coordinated several major events including the Community Leader's Breakfast and the Cape Canaveral Spaceport's 50-year Master Plan. More than 350 employees (current and retired) supported these activities.

Community Outreach

The Combined Federal Campaign exceeded its goal, raising more than $300,000, with 35 percent of these funds directed back to the local community. The NASA KSC workforce joined with other organizations at the center to contribute to the September 11 Disaster Relief Fund.

Legislative Affairs Space Industry Day

KSC's Center Director and several NASA KSC representatives attended the annual Space Industry Day in Tallahassee, Fla., to participate in several scheduled programs and activities. These included:

- meetings between KSC Center Director Roy Bridges Jr. and Florida Senate and House leadership on space issues.
- an unprecedented opportunity for more than 160 State Legislators and their staff to interview astronauts on the fourth floor rotunda of the House Chamber.
- space and space industry exhibits positioned on four floors of the State Capitol.
- a space education roundtable hosted at the Capitol with key State education leaders.
- a space-related art contest concluding at the Capitol.

Media Services

KSC's Media Services supported Space Shuttle and ELV launch activities, provided access to the KSC press site, hosted media projects, distributed launch products, provided audio and video coverage, live web broadcasts, and KSC Web Site updates. Accomplishments included:

- accreditation of more than 1,300 world-wide media representatives for four Space Shuttle launches and more than 100 media representatives for six ELV launches.
- hosting more than 140 media projects that resulted in printed news articles, TV/film documentaries, internet and other news medium projects reaching millions with NASA's message.
- Completing more than 38,700 products including printed material, visual and audio images, posters, news releases, mission products and Spaceport News issues.
- a new Web Studio debut, three launch-related web broadcasts, four launch events with live coverage that included both narrative and downloadable video clips.

Four space pioneers pose for a photo in the Rocket Garden at the KSC Visitor Complex during a celebration of the 40th anniversary of American spaceflight, Feb. 24, 2002. From left are Gordon Cooper, Wally Schirra, Scott Carpenter and John Glenn Jr.

Education

Kennedy Space Center's Education Programs and University Research Division provided meaningful educational and professional development experiences for nearly 150,000 participants in Florida, Georgia, Puerto Rico and the Virgin Islands.

The Division created new programs, partnerships and products and assisted in KSC's evolution to a Spaceport Technology Center. They also integrated programs and strengthened relationships across KSC to pipeline qualified participants into educational, research and career opportunities in the space industry.

New Programs and Partnerships

- With sponsorship from the State Department of Education, the SEE NASA (Student Educational Experience) program used the unique resources and missions of the KSC Spaceport to motivate students from schools selected by the State of Florida to study math and science.
- Educator's Resource Center for K-12 was opened in the U.S. Virgin Islands.
- Three new student program grants were awarded to universities for undergraduate students studying engineering, mathematics and sciences.
- A partnership with the University of Central Florida (UCF) was formed to host the regional competition of the For the Inspiration and Recognition of Science and Technology (FIRST) Program in Orlando.
- The Space Research Lecture Series was created to increase working-level interaction between NASA-sponsored scientists and Florida-based researchers. KSC partnered with the Florida Space Research Institute, the Space Business Round Table, Delaware North Park Services and the Florida Space Grant Consortium to create the program. The events are held quarterly and feature world-class scientists whose experiments launch from the Spaceport, and whose space research and technology advancements are of interest to NASA and the Spaceport.

Research and Development (R&D)

KSC hosted the Minority University Presidents Conference, which provided an opportunity for more than 100 university presidents to hear about NASA research and educational opportunities. This activity has led to new partnerships with some of these universities within the NASA family.

Through strategic planning, innovative staffing and extensive internal and external partnerships, KSC's R&D area created new programs and issued competitive grants to strengthen relationships with academia R&D communities in Florida and also nationally. These partnerships have increased the amount of financial and intellectual resources available to solve the Spaceport's technology challenges.

From left: Discovery was suspended by an overhead crane in the VAB prior to stacking with the external tank and solid rocket boosters for Mission STS-92, the Shuttle program's 100th flight; Mission STS-92 launched on Oct.11, 2000 and delivered the Z-1 Truss to the ISS; a view of the ISS from Endeavour during Mission STS-97 showed the Unity module, newly-installed P6 Integrated Truss Structure and Solar Array Wing-3, that provided power to the Station.

For Inspiration and Recognition of Science and Technology (FIRST) robotics regional competition brought many students to the Center, including FIRST World Champions, the Pink Team, shown here.

Below left: Students from Greensboro Elementary School participate in SEE NASA (Student Education Experience-NASA). The participants from Tallahassee are shown here constructing paper rockets and learning how real rockets work.

Below right: Astronaut Story Musgrave visits with students at the KSC Visitor Complex as one portion of National Space Day events on May 2.

Economic Impact

The work done at the Kennedy Space Center not only helps the nation achieve its objectives in outer space, it also enlarges and enhances the nearby economy. These economic effects are broad and substantial. The money spent on space exploration directly supports employment and production at Kennedy Space Center and generates additional jobs, earnings and output elsewhere in Florida through the purchase of goods and services from firms in the private sector. KSC enhances the productivity of the region's workers, raising their wages and standard of living.

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, and university research. In meeting 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 such spending recirculates NASA's initial demand among Florida's businesses and households, multiplying the direct impact on the economy.

KSC annually conducts an Economic Impact Study to measure NASA's effect on the economy at the local (Brevard County) and regional (Central Florida) levels. In FY 2000 and 2001, the study was conducted by the University of Florida's Bureau of Economic and Business Research. The FY 2002 report is being conducted by the University of Central Florida, and was not completed in time for this publication; however, estimates are provided in the following tables.

	Brevard County			Central Florida		
	2002*	2001	2000	2002*	2001	2000
	Millions of FY 2002 Dollars					
Procurement	1,425	1,332	1,166	1,447	1,352	1,219
Final Demand	974	910	849	1,112	1,039	1,001
Output	1,471	1,394	1,305	2,019	1,914	1,839
Earnings	633	606	562	826	790	749

* Estimated

Procurement: Cost of goods and services paid out by NASA and Visitors' Center to vendors/suppliers within the study area
Final Demand: Value of goods, services and labor produced and performed within the study area
Output of Goods and Services: Total economic impact of NASA spending by region
Earnings: Salaries of direct workforce and salaries of jobs created by NASA acquisition

From left: Ed Gormel (left) executive director of Spaceport Florida Authority and KSC Director Roy Bridges Jr. signed the Space Experiment Research & Processing Laboratory agreement at the groundbreaking for Space Commerce Way, Feb. 8, 2001; the Delta II rocket carried the 2001 Mars Odyssey spacecraft into the clear blue sky from CCAFS Launch Complex 17-A, April 7, 2001; Mission Specialist Susan Helms, the first female ISS resident, worked in the U.S. Destiny Lab after arriving aboard Discovery on Mission STS-102.

Workforce Diversity

The Kennedy Space Center 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. It is able to help the nation achieve its objectives in Space due primarily in part to the dedication of its workforce. The KSC workforce not only includes civil service employees, but a large number of contractor employees who together are essential in making KSC's vision a success.

People, both NASA and contractor support personnel, are essential to the success of KSC. To accomplish the various missions expected of the Space Center, these individuals fulfill a multitude of tasks. At the end of each year, the Center takes a "snapshot" of its workforce. This picture includes all federal and 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 September 30, 2002, the KSC workforce was as follows:

On-Duty Full Time Civil Servants	**1,791**
On-Duty Other-than-Full Time Servants	**57**
Total Civil Servants	**1,848**

Civil Servant Skill Mix

Science & Engineering	59.5%
Administrative	24.3%
Technical	8.9%
Clerical	7.3%

On-Site Contractor Employees	**10,429**
Off-Site Contractor Employees	**324**
Total Contractor Employees	**10,753**
Total Construction Employees	**263**
Total Tenants	**1,180**
TOTAL KSC POPULATION	**14,044**

From left: Canadian astronaut Chris Hadfield stood on one Canadian-built robotic arm to work on the Station's new Canadarm2, during Mission STS-100 aboard Endeavour, that launched April 19, 2001;in Kodiak, Alaska, technicians prepared one of four Kodiak Star spacecraft, NASA's Starshine 3, for launch; a Lockheed Martin Athena I launch vehicle lifted off the launch pad at Kodiak Launch Complex, Sept. 29, 2001.



Procurement Report

Industry partners at a glance.

The companies listed below were KSC's top business contractors for fiscal year 2002. The following briefly describes their work for the Center.

Space Gateway Support

Space Gateway Support (SGS), a joint venture (with Northrop Grumman, ICF Kaiser and Wackenhut), provides base operations support for Kennedy Space Center, Cape Canaveral Air Force Station and Patrick Air Force Base, including roads and grounds maintenance, facilities maintenance, custodial, fire, security, calibrations, and propellants handling. They held one contract valued at $1 billion over the life of the contract.

United Space Alliance, LLC

United Space Alliance (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 $65 million in fiscal year 2002 on the SFOC contract. USA performs at KSC, JSC, Marshall Space Flight Center, Stennis Space Center, Dryden Flight Research Center, White Sands, and worldwide Trans Atlantic Landing sites; and the SFOC has a total award value of $12.7 billion.

The Boeing Company

The Boeing Company, which acquired McDonnell Douglas in 1997 and assumed all contracts and obligations, including the Payload Ground Operations Contract, held five separate contracts at KSC during fiscal year 2002 valued at $3.5 billion. The companies conducted feasibility studies & advanced planning for use of Delta III and Delta IV launch vehicles; launched medium class expendable launch vehicles with government payload into assigned orbits; medium-light expendable launch vehicle services; operated the joint sponsored research agreement for the vision spaceport project; and provided payload processing services.

Delta Launch Services Incorporated

Delta Launch Services Incorporated, 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 Pueblo, Colorado. Launches will occur from CCAFS, Fla., and from the west coast, VAFB, Calif.

Lockheed Martin Corporation

Lockheed Martin held a total of six contracts during fiscal year 2002 worth a total award value of $889 million. Lockheed performs Expendable Launch Vehicle (ELV) services for GOES I, J, and K; Atlas and Centaur feasibility studies; Intermediate ELV Services for Terra; Athena launch services for the VCL Mission; NASA Launch Services; and Joint Sponsored Research for the Vision Spaceport Project.

Dynacs Engineering Company Inc.

The Dynacs Engineering Company Inc. provides engineering support services that range in scope from technical manpower in support of a variety of sites, facilities, and Government laboratories to engineering and management of complex research, development, and technology projects.

Orbital Sciences Corporation

Orbital Sciences provides Small Expendable Launch Vehicle services for the agency.

From left: Space Shuttle Endeavour soared into a twilight sky, Dec. 5, 2001, on Mission STS-108—the first Utilization Flight and the 12th ISS flight; Astronaut Jerry Ross prepared to enter Space Shuttle Atlantis for Mission STS-110's launch, April 8, 2002—Ross made his seventh Shuttle flight and completed his ninth spacewalk, setting a new record in the history of the Shuttle program.

Your Procurement Dollars at Work

During fiscal year 2002, the Center obligated approximately $900 million within the U.S. in support of our mission. As indicated by the chart below, 32 different states received procurement dollars from KSC.

Geographical Distribution by State of FY02 Obligations

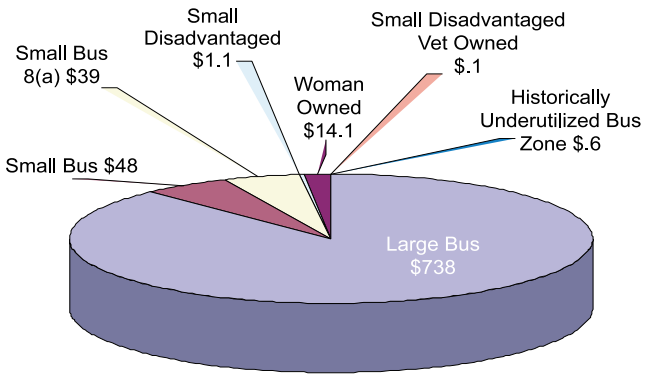
State	Total ($k)
Alabama	$ 1,721
Arizona	$ 24,102
California	$ 149,890
Colorado	$ 1,431
Conneticut	$ 1,269
Florida	$ 688,578
Georgia	$ 1,558
Illinois	$ 133
Kansas	$ 96
Kentucky	$ 334
Louisiana	$ 587
Massachusetts	$ 956
Maryland	$ 3,506
Minnesota	$ 430
Missouri	$ 45
Mississippi	$ 202
Montana	$ 25
North Carolina	$ 497
New Hampshire	$ 142
New Jersey	$ 544
New Mexico	$ 915
New York	$ 369
Ohio	$ 3,160
Oklahoma	$ 1,718
Pennsylvania	$ 7,384
Tennessee	$ 38
Texas	$ 6,850
Utah	$ 435
Virginia	$ 2,439
Washington	$ 431
Wisconsin	$ 510
Total*	**$ 900,570**

* Includes Intragovernmental, Grants, Agreements and BankCard Transactions

Supporting Small Business

Supporting Small Businesses is a NASA priority. In fiscal year 2002, KSC obligated $102.9 million dollars to small businesses, exceeding the goal of $88 million. This was a significant increase over the fiscal year 2001 results of $92.5 million.

DISTRIBUTION OF FY02 OBS BY BUSINESS TYPE (IN MILLIONS)



$840.9 Total Dollar Obligations through Contracts*
$102.9 Total Dollar Obligations Small Business
*Does not include Intragovernmental, Grants, Agreements or BankCard Obligations

Top 20 KSC Business Contractors for FY02

Company	Number of Contracts	Dollars Obligated (in Thousands)
Space Gateway Support	1	310,280
The Boeing Company	5	167,308
Delta Launch Services Incorporated	1	91,981
Lockheed Martin Corporation	6	75,869
Dynacs Engineering Company Incorporated	1	26,865
Orbital Sciences Corporation	1	23,821
O A O Corporation	5	13,462
Air Products & Chemicals Inc.	5	13,227
Dynamac Corporation	6	12,164
Analex Corporation	1	10,146
Boeing Space Operations Company	1	9,264
Air Liquide America Corp	3	9,210
Space Mark Incorporated	1	4,381
Canaveral Construction Company	4	4,241
Geosyntec Consultants Incorporated	3	3,647
All Points Logistics Inc.	4	3,618
Praxair Incorporated	6	3,521
Johnson Controls World Services	1	3,092
H S W Environmental Group	2	2,679
Chrome Electric Incorporated	5	2,386
TOTAL	**62**	**$791,162**

*Note: The JSC-managed Space Flight Operations Contract recorded $671.8 million managed by KSC in fiscal year 2002.

Statement of the Chief Financial Officer

The Fiscal Year (FY)2002 financial statements are prepared to report the financial position and results of NASA's Kennedy Space Center (KSC) operation, pursuant to the requirements of the Chief Financial Officers (CFOs) Act of 1990 and the Government Management Reform Act of 1994 (GMRA).

The statements include the Statement of Financial Position and the Statement of Operations and Changes in Net Position. The statements are prepared from the books and records of NASA, in accordance with the comprehensive basis of accounting prescribed by the Office of Management and Budget (OMB) Bulletin 94-01, "Form and Content of Agency Financial Statements." The statements are different from financial reports used to monitor and control budgetary resources, which are prepared from the same books and records.

The statements should be read with the realization that they are for an agency of the U.S. Government, a sovereign entity. Liabilities not covered by budgetary resources cannot be liquidated without the enactment of an appropriation, and payment of all liabilities, other than for contracts, can be abrogated by the sovereign entity.

These financial statements were prepared in accordance with Federal accounting standards. These standards are evolving through the efforts of the Federal Accounting Standards Advisory Board (FASAB). This board includes members from the Office of Management and Budget (OMB), the General Accounting Office (GAO), and the Department of Treasury (Treasury). Currently, NASA observes the following hierarchy of accounting standards as required by OMB:

- Individual FASAB standards published by OMB, GAO and Treasury;
- OMB guidance on the form and content of financial statements;
- Agency accounting guidance, which represents prevalent practices; and
- Accounting principles published by other authoritative sources.

NASA Headquarters, which receives funding through annual Congressional appropriations, authorizes and funds KSC operations. KSC's total operation expenses for FY 2002 by appropriation were:

Appropriation	**Amount** (In thousands)
Mission Support	$ 32,967
Human Space Flight	718,219
Science, Aeronautics and Technology	244,740
Construction of Facilities	(105)
Total Expenses	**$ 995,821**

The 2002 Annual Report and Financial Statements were the result of the work of a dedicated team of professionals at KSC.

N.A. Carroll, Chief Financial Officer

Financial Statement

Statement of Financial Position As of
September 30, 2002 (In Thousands)

	2002	2001
Assets:		
Intragovernmental Assets:		
Fund Balance With Treasury (Note 2)	$ 497,696	$ 466,673
Accounts Receivable, Net (Note 3)	16,324	17,282
Governmental Assets:		
Accounts Receivable, Net (Note 3)	922	1,555
Advances and Prepayments	40	58
Property, Plant and Equipment (Note 4)	2,093,073	2,073,077
Other Assets (Note 5)	131,821	113,140
Total Assets	$ 2,739,876	$ 2,671,785
Liabilities:		
Liabilities Covered by Budgetary Resources:		
Intragovernmental Liabilities:		
Accounts Payable	$ 12,891	$ 15,072
Other Liabilities (Note 6)	650	358
Governmental Liabilities:		
Accounts Payable	213,070	243,720
Other Liabilities (Note 6)	12,975	12,450
Total	$ 239,586	$ 271,600
Liabilities not Covered by Budgetary Resources:		
Intragovernmental Liabilities:		
Other Liabilities (Note 6)	$ 385	$ 385
Governmental Liabilities:		
Other Liabilities (Note 6)	14,261	14,286
Total	$ 14,646	$ 14,671
Total Liabilities	$ 254,232	$ 286,271
Net Position (Note 7):		
Unexpended Appropriations	$ 275,391	$ 213,962
Invested Capital	2,224,894	2,186,217
Cumulative Results of Operations	5	5
Future Funding Requirements	(14,646)	(14,670)
Total Net Position	$ 2,485,644	$ 2,385,514
Total Liabilities and Net Position	$ 2,739,876	$ 2,671,785

The accompanying notes are an integral part of these statements.

Financial Statement

Statements of Operations and Changes in Net Position
For the Year Ended September 30, 2002 (In Thousands)

Revenues and Financing Sources:		2002		2001
Appropriated Capital Used	$	854,169	$	902,405
Revenues from Sales of Goods and Services:				
To the Public		7,645		4,939
Intragovernmental		134,007		155,985
Other Revenues and Financing Sources (Note 8)		357		719
Less: Receipts Transferred to Treasury		(357)		(719)
Total Revenues and Financing Sources	$	995,821	$	1,063,329
Expenses:				
Program or Operating Expenses by Appropriation:				
Mission Support	$	30,792	$	283,586
Human Space Flight		600,241		361,968
Science, Aeronautics and Technology		223,241		256,789
Construction of Facilities		(105)		362
Reimbursable Expenses		141,652		160,925
Total Expenses	$	995,821	$	1,063,630
Total Revenues and Financing Sources In Excess of Expenses	$	0	$	(301)
Nonoperating Changes:				
Unexpended Appropriations (Note 7)	$	61,429	$	9,520
Invested Capital (Note 7)		38,677		35,149
Cumulative Results from Operations (note 7)		0		(301)
Future Funding Requirements (Note 7)		24		(513)
Total Nonoperating Changes	$	100,130	$	43,855
Change in Net Position	$	100,130	$	43,855
Net Position, Beginning Balance		2,385,514		2,341,659
Net Position, Ending Balance	$	2,485,644	$	2,385,514

The accompanying notes are an integral part of these statements.

Financial Statements

Notes to the Financial Statements
For the Year Ended September 30, 2002

1. Summary of Accounting Policies and Operations

Basis of Presentation

These financial statements were prepared to report the financial position and results of operations of John F. Kennedy Space Center (KSC), pursuant to the requirements of the Chief Financial Officers Act of 1990. The statements were prepared from the books and records of KSC, in accordance with the comprehensive basis of accounting specified in OMB Bulletin 94-01.

Reporting Entity

KSC is one of nine NASA field centers established to aid NASA in its mission to provide for aeronautical and space activities. Financial management of its operations is the responsibility of Center officials at all organizational levels. KSC's accounting system is one of ten distinct operations located at nine NASA Centers and Headquarters. Although KSC, like the other Centers, is independent and has its own Deputy Chief Financial Officer for Finance, it operates under Agencywide financial management regulations. KSC provides payroll accounting for approximately 1,791 civilian employees and processes approximately 6,873 non payroll related accounting transactions monthly. This data provides the basic information necessary to meet internal and external financial reporting requirements and provides both funds control and accountability.

Four appropriations require individual treatment in the KSC accounting and control system.

(1) The Human Space Flight (HSF) appropriation supports human space flight research and development activities for space flight, spacecraft control, and communications actions. This includes research, development, operations, services, maintenance, and construction of facilities, which encompasses the repair, rehabilitation, and modification of real and personal property.

(2) The Science Aeronautics and Technology (SAT) appropriation provides for the conduct and support of science, aeronautics and technology. This includes research, development, operations, services, maintenance and construction of facilities, which encompasses the repair, rehabilitation, and modification of real and personal property.

(3) The Mission Support (MS) appropriation provides for safety, reliability and quality assurance activities supporting Agency programs, space communication services for NASA programs, salaries, and related expenses in support of research in NASA Field Centers, and construction of facilities, which encompasses the repair, rehabilitation and modification of real and personal property.

(4) The Construction of Facilities (CFO) appropriation, which was restructured and replaced in the 1995 budget, includes the construction of new facilities and the repair, rehabilitation and modification of facilities.

In addition to the basic operating programs described above, KSC expenditures in FY 2002 included $142 million of reimbursable activity.

Financial Statements

Basis of Accounting

KSC accounts are maintained on an accrual basis (i.e., expense and revenue are recorded in the accounts in the period in which they are incurred or earned). Expenses are classified in the accounts according to the appropriation that financed the activity. These expenses are coded in accordance with the Agencywide coding structure, which sets forth a uniform classification of financial activity that is used for planning, budgeting, accounting and reporting. The expenses are further categorized in the General Ledger as operating expenses or capitalized expenses.

Funds with the U.S. Treasury and Cash

KSC's cash receipts and disbursements are processed by the U.S. Treasury. The funds with the U.S. Treasury include appropriated funds, trust funds and deposit funds for advances received for reimbursable services. Balances are not held outside the U.S. Treasury.

Advances

KSC funds its University Contracts and Grants program through the use of predetermined payment schedules where letters of credit are not used; recipients are required to schedule drawdowns to coincide with actual, immediate cash requirements, in accordance with OMB Circular A-125 and Department of Treasury regulations. Quarterly financial reporting of cash transactions is provided on Federal Cash Transactions Reports (SF 272's). Detailed monitoring and accountability records are maintained; monitoring includes audits by the Defense Contract Audit Agency (DCAA) and NASA's Office of the Inspector General (OIG).

Accounts Receivable

The largest portion of accounts receivable is due from other Federal agencies and includes research and development of satellites as well as launch services. Nongovernmental customers are required to provide advance payments, which are credited to the appropriate appropriation. Advances are then used to offset services as performed. In unusual cases, exceptions and waivers to this general rule have been granted under the Space Act, allowing customers to postpone advance payments.

Financial Statements

Property, Plant, and Equipment

KSC-owned Property, Plant, and Equipment may be held by the Center or its contractors. Under the provisions of the Federal Acquisition Regulation (FAR), contractors are responsible for control over and accountability for such property in their possession.

Under the User Charge Act and OMB Circular A-25, Property, Plant, and Equipment (PP&E) may be depreciated while in prior years a “use” charge was applied to commercial reimbursable customers, which included a factor for depreciation of facilities and equipment. KSC is permitted to charge depreciation under the “full cost” concept to non-government reimbursable customers. Depreciation is not included in cost at the Center level, but is calculated and reflected in the Agency-level financial statements.

All internal use software, whether it is commercial off-the-shelf, contractor-developed, or internally developed, which meets the capitalization criteria, is subject to the provisions of SFFAS Number 11 and its cost shall be capitalized when accepted. When such software is integrated into and necessary to operate general PP&E, rather than perform an application, it is considered part of the PP&E of which it is an integral part and capitalized and depreciated accordingly. In these cases, the aggregate cost of the PP&E and software is used to determine whether the item meets the dollar threshold for capitalization.

Equipment with a unit cost of $100,000 or more and a useful life of 2 years or more, not intended for sale in the ordinary course of operations and has been acquired or constructed with the intention of being used, or being available for use by the Agency is capitalized. Capitalized cost includes unit cost, transportation, installation, and handling and storage costs.

Real property such as land, buildings, and other structures and facilities, is capitalized when the asset value is $100,000 or more. The capitalized value represents the total cost to NASA, including both acquisition and preparation costs. Land values are recorded at original acquisition cost and do not reflect current value nor include the cost of improvements. Buildings are also valued at acquisition cost, including the cost of capital improvements and fixed equipment required for functional use of the facility. Other structures include the acquisition cost of capital improvements.

Government-owned/contractor-held property includes KSC materials, plant equipment, Agency-peculiar property, special tooling and special test equipment. Contractors are directed to annually report all plant equipment costs for the fiscal year. Plant equipment costing $100,000 or more and having a useful life of two years will be capitalized. Contractors electronically report property changes during the fiscal year, as of September 30, on a NASA Form 1018, Report of Government-owned/Contractor-held Property. The electronic submission does not have digital signature, and is validated by Department of Defense (DOD) or NASA Property Administrator (NASA PA), Industrial Property Management Specialist (IPMS) and Deputy Chief Financial Officer (DCFO).

Financial Statements

Contractor-held, Agency-peculiar property includes flight pallets, mission peculiar experiment support structures, spacelab, transfer tunnel, and similar components unique to NASA space programs and held by NASA prime contractors or their first-tier subcontractors who are responsible for building, refurbishing and launching the hardware. Contractor reporting is stipulated in the NASA Federal Acquisition Regulation Supplement, NFS Part 1845. These items are priced in accordance with guidance set forth in this NASA supplement. The unit acquisition cost shall include all costs incurred to bring the property to a form and location suitable for its intended use per NFS Part 1845.7101.3.

Other Assets

Other assets include Government-owned/Contractor-held materials.

Liabilities

Accounts payable includes amounts recorded for receipt of goods or services furnished to the Center, based on receiving reports and billings rendered. Additionally, KSC accrues cost and recognizes liability based on information that is provided monthly by contractors on cost and performance reports (NASA Form 533, Contractor Financial Management Report). KSC relies on independent audits by the DCAA to ensure the reliability of reported costs and estimates. To provide further assurance, financial managers are required to test the accuracy of cost accruals generated from the NF 533's, and NASA Headquarters independently analyzes the validity of KSC's data.

Revenues and Other Financing Sources

KSC receives the majority of its funding through multi-year appropriations. These include three-year appropriations for construction activities, two-year appropriations for operational and space flight activities, and a single year appropriation for civil service payroll and travel. In addition to appropriated funds, the Center performs services for other Federal agencies and the public and receives reimbursable funding authority.

Financial Statements

2. Fund Balance with Treasury:
(In Thousands)

Fund Balances:	Obligated	Unobligated Available	Unobligated Restricted	Fund Balance
Appropriated Funds	$ 390,521	$ 101,263	$ 5,026	$ 496,810
Deposit Funds				
Suspense/Clearing Accounts				886
Total Fund Balance with Treasury				$ 497,696

3. Accounts Receivable, Net:
(In Thousands)

	Entity Accounts Receivable	Non-Entity Accounts Receivable	Allowance for Uncollectible Receivables	Net Amount Due
Intragovernmental	$ 16,324	$ -	$ -	$ 16,324
Governmental	1,186	312	(576)	922
Total	$ 17,510	$ 312	$ (576)	$ 17,246

Non-entity accounts receivable represent amounts that will be deposited to miscellaneous receipts when collected.

4. Property, Plant and Equipment:
(In Thousands)

	2002	2001	Change
Government-owned/Government-held:			
Land	$ 73,672	$ 73,672	$ -
Structures, Facilities and Leasehold Improvements	1,433,777	1,416,836	16,941
Equipment	203,839	205,486	(1,647)
Work in Process	11,193	4,705	6,488
Total	$ 1,722,481	$ 1,700,699	$ 21,782
Government-owned/Contractor-held:			
Structures and Facilities	$ 7,567	$ 7,567	$ -
Equipment	61,557	61,602	(45)
Special Tooling	3,048	1,590	1,458
Special Test Equipment	57,874	58,702	(828)
Space Hardware	239,651	242,151	(2,500)
Work in Process	895	766	129
Total	$ 370,592	$ 372,378	$ (1,786)
Total Property, Plant and Equipment	$ 2,093,073	$ 2,073,077	$ 19,996

See Note 1 for further discussion on property, plant and equipment.

Financial Statement

5. Other Assets:
(In Thousands)

	2002	2001	Change
Contractor-held Materials	$ 131,821	$ 113,140	$ 18,681
Total	$ 131,821	$ 113,140	$ 18,681

6. Other Liabilities:
(In Thousands)

Liabilities Covered by Budgetary Resources:

	Current	Non-Current	Total
Intragovernmental Liabilities:			
Liability for Deposit and Suspense Funds	$ 650	$ -	$ 650
Total	$ 650	$ -	$ 650
Governmental Liabilities:			
Liability for Deposit and Suspense Funds	$ 1,631	$ -	$ 1,631
Accrued Funded Payroll and Benefits	11,344	-	11,344
Total	$ 12,975	$ -	$ 12,975

The liability for deposit and suspense funds includes cash advances received from other Government agencies and public reimbursable customers. Also included are funds on deposit with the U. S. Treasury for employees' savings bonds and state tax withholdings.

Liabilities Not Covered by Budgetary Resources:

	Current	Non-Current	Total
Intragovernmental Liabilities:			
Accounts Payable for Closed Appropriations	$ -	$ 385	$ 385
Total	$ -	$ 385	$ 385
Governmental Liabilities:			
Accounts Payable for Closed Appropriations	$ -	$ 825	$ 825
Contingent Liabilities	-	-	-
Unfunded Annual Leave	-	13,436	13,436
Total	$ -	$ 14,261	$ 14,261

See Note 1 for further discussion of liabilities not covered by budgetary resources.

Financial Statement

7. Net Position:

(In Thousands)	2002 Appropriated Funds	2001 Appropriated Funds	Change
Unexpended Appropriations:			
Undelivered	$ 169,102	$ 127,483	$ 41,619
Unobligated:			
Available	101,263	81,957	19,306
Unavailable	5,026	4,522	504
	$ 275,391	$ 213,962	$ 61,429
Invested Capital	$2,224,894	$ 2,186,217	$ 38,677
Cumulative Results	$ 5	$ 5	$ 0
Future Funding Requirements:			
Annual leave	$ (13,436)	$ (13,047)	$ (389)
Closed appropriations	(1,210)	(1,623)	413
Other	-	-	-
	$ (14,646)	$ (14,670)	$ 24
Total	$2,485,644	$ 2,385,514	$ 100,130

8. Other Revenues and Financing Resources:

(In Thousands)	2002	2001
General Fund Proprietary Receipts	$ 357	719
Total	$ 357	$ 719

General Fund Proprietary Receipts represent user fees, gifts, fines or interest penalties.

Space Shuttle Columbia emblazons the pre-dawn clouds as it soared into the sky on its 27th flight into space on mission STS-109, March 1, 2002, from Launch Pad 39A. STS-109 was the fourth Hubble Space Telescope Servicing Mission.

Cover Photos:

Top, from left: The Viking 1 launched aboard a Titan/Centaur rocket from Complex 41 at Cape Canaveral Air Force Station (CCAFS), Aug. 20, 1975, beginning an 11-month journey through space to explore Mars; John H. Glenn Jr. in his Mercury Spacesuit; launch of the Gemini-Titan 3, March 23, 1965, from Complex 19 at CCAFS.

Bottom, small photos from left: Commander Eileen Collins in a T-38 jet trainer at the KSC Shuttle Landing Facility, Feb. 9, 1999; the International Space Station as seen from Space Shuttle Endeavour during Mission STS-111, June 15, 2002; launch of NASA's Mars Polar Lander on a Boeing Delta II, Jan. 3, 1999, from Complex 17B at CCAFS.

Bottom, large photos from left: Engineers inspected and tested a boilerplate Mercury capsule, Jan. 1, 1960; launch of Mission STS-95 aboard Space Shuttle Discovery occurred Oct. 19, 1998, carrying John Glenn on his return to flight after 36 years.

Back Cover:

Upper left: Apollo 11 Moon footprint

Bottom from left: Gordon Cooper prepares for his Mercury-Atlas 9 flight, May 15, 1963; a view of the International Space Station as seen from Space Shuttle Atlantis during Mission STS-112.

FY 2002 Annual Report produced by
InDyne Inc., graphics design and writers.

KENNEDY SPACE CENTER ANNUAL REPORT FY2002