



Kennedy Space Center

Annual Report FY 1999

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ON THE COVER: *Faces of Kennedy Space Center*

Front: Clockwise from left, a futuristic spaceport by illustrator Pat Rawlings; the International Space Station on orbit; Delta and Atlas expendable launch vehicles; the signing of a partnership agreement among Kennedy Space Center, Cape Canaveral Air Force Station and government agencies; Shuttle processing; astronaut preparation; research; payload processing; and outreach to the community

Back: Views of launch and landing of the Space Shuttle at Kennedy Space Center, including the Shuttle rising with its signature plume above the Merritt Island National Wildlife Refuge

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KSC: Center of Excellence for Launch and Payload Processing

Within NASA's network of space and research centers, Kennedy Space Center is the Center of Excellence for Launch and Payload Processing Systems, Lead Center for Acquisition and Management of Expendable Launch Vehicle Services, and Lead Center for Payload Carriers, Payload Processing, and Support.

Strategic Goals

All work at KSC supports one or more of the Center's strategic goals or the cross-cutting guiding principles. This Annual Report for FY 1999 will touch on all four goals and four guiding principles.

- GOAL 1:** Assure that safe, sound, and efficient practices and processes are in place for private/commercialized launch site processing.
- GOAL 2:** Increase the use of operational expertise to contribute to the design and development of new payloads and launch vehicles.
- GOAL 3:** Use operational expertise in partnership with other entities (NASA centers, other government agencies, industry, and academia) to develop new technologies for future space initiatives.
- GOAL 4:** Enhance core capabilities (people, facilities, equipment, and systems) to meet NASA objectives and customer needs for safer, better, faster, cheaper development and operation of space systems.

Guiding Principles:

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

KSC's goals and guiding principles reflect NASA's vision, missions and values. The mission of the National Aeronautics and Space Administration is

- to advance and communicate scientific knowledge and understanding of the Earth, the solar system, and the universe;
- to advance human exploration, use, and development of space; and
- to research, develop, verify, and transfer advanced aeronautics, space, and related technologies

Introduction

Kennedy Space Center Director Roy Bridges, Jr., shared his concept of KSC's future as a Spaceport Technology Center during a televised address to the KSC team on July 27, 1999.

"As part of the Cape Canaveral Spaceport, KSC works to strengthen the partnership between KSC and the USAF 45th Space Wing as well as with industry and the State of Florida. The initial Spaceport Technology Center emphasis will be on technology development as the Center forges a more recognized role in what has long been part of its function," Bridges said. "That's what this vision is all about."

As a Spaceport Technology Center, KSC will make use of its knowledge and experience in three primary areas, called "pillars." These pillars are launch and launch vehicle processing systems; payload and payload carrier processing systems; and landing and recovery systems. These three systems are essential parts of a complete space transportation "system of systems."

By continuing to develop new spaceport technologies, KSC reduces costs over program life cycles. KSC's advanced technologies benefit current and future spaceports on Earth, the moon, Mars, and beyond.

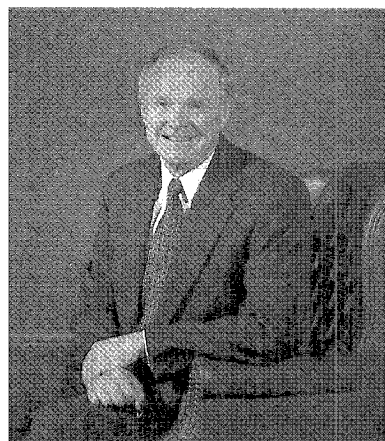
In particular, KSC is placing increased emphasis on technology development in:

- process engineering,
- command, control, and monitor systems,
- materials evaluation,
- range systems, and
- fluids and fluid systems

Current initiatives bringing the Spaceport Technology Center concept to life include:

- the construction of the Reusable Launch Vehicle hangar complex,
- development of the Checkout and Launch Control System,
- successful Integrated Vehicle Health Management experiments,
- umbilical design and testing,
- flame trench hydrogen entrapment and disposal testing,
- root cause analysis system development, and
- Mars sensor technology development

To better support the Spaceport Technology Center vision and sustain the Center's excellence, the Center Director announced a plan to reorganize KSC's management structure. A KSC 2000 Team was formed to study the old management structure and help create a reorganization plan with the Executive Management Team. The reorganization plan is scheduled to be put into effect during FY 2000.



As Center Director, Roy Bridges, Jr., told employees in a July address, KSC already engages in technology design, development, testing, and application.

The spaceport already has

- *developed more than 30 KSC payloads or flight experiments since 1989,*
- *made 345 current customer partnership agreements,*
- *begun developing 156 technologies with commercial potential,*
- *won 12 proposals in the last 12 months,*
- *obtained 27 KSC patents since 1984, and*
- *granted 25 licenses on KSC patents since 1996.*

STRATEGIC GOAL 1:

Space Shuttle Operations

NASA completed transferring 305 tasks to the Space Flight Operations Contract (SFOC) with United Space Alliance during the fiscal year. The three-year transition enabled NASA to reduce its Shuttle operations workforce by 55 percent.

The NASA KSC team changed their role from oversight and approval of many daily operations activities to a role of insight and greater reliance on quantitative measures of contract performance.

This transition requires NASA to rely on quantitative measures of contractor performance in lieu of direct observation. To facilitate the data collection, data validation, data accessibility, and metric automation, NASA has developed the insight system. The insight system provides access to databases on dissimilar computers with various operating systems and database formats. Operators can link databases and build metrics through a single interface and application.

NASA KSC also developed a world-class surveillance methodology for measuring contractor and civil service performance. The methodology includes documenting the respective responsibilities of contractor and civil service and the rationale for each.

A metric standard has been developed and implemented across the center, enabling management to view current and past performance and identify error types and sources. The surveillance methodology also includes a logic diagram to identify NASA KSC's critical tasks, those tasks requiring oversight.

Through the world-class implementation, NASA is measuring performance at several levels, including contract, directorate, and Center. The surveillance methodology and KSC's implementation program enable KSC to gauge support of our customers and our progress toward meeting the tactical and strategic goals of NASA and KSC.

Space Shuttle

KSC safely and successfully launched four Space Shuttles during FY 1999. Those vehicles carried a total of 25 astronauts into space and traveled more than 13.8 million miles before landing at KSC's Shuttle Landing Facility. Those four landings bring the consecutive landings total at the Center to 19.

The first mission of FY 1999 drew overwhelming public attention as John Glenn, one of the original seven Mercury astronauts, returned to space aboard Discovery. Glenn's presence drew extensive media coverage. KSC issued a record 2,700 media credentials and hundreds of thousands of people watched the launch in Brevard County. President and Mrs. Clinton were on hand to witness the historic moment. Clinton complimented KSC workers during his postlaunch address in the Launch Control Center.

John Glenn, astronaut, suiting up at KSC before his historic STS-95 mission

STS-96 astronauts and their families after landing

The next Shuttle flight, STS-88, was equally historic and marked the first NASA mission to the International Space Station. The six-person crew aboard Endeavour ferried the U.S.-built, 12.8-ton Unity connecting module to the Russian Zarya module and completed a flawless docking. The crew became the first astronauts to enter the Station. They prepared the way for future construction efforts on what will eventually be a 1 million-pound orbiting laboratory.

That flight was followed by the STS-96 mission, which continued the process of assembling the Station. During a spacewalk, two astronauts attached a pair of cranes to be used in future construction activities.

The last flight of the fiscal year, STS-93, marked a first as veteran astronaut Eileen Collins became the first woman to command a Shuttle. Collins expertly handled the role of guiding Columbia through the mission.

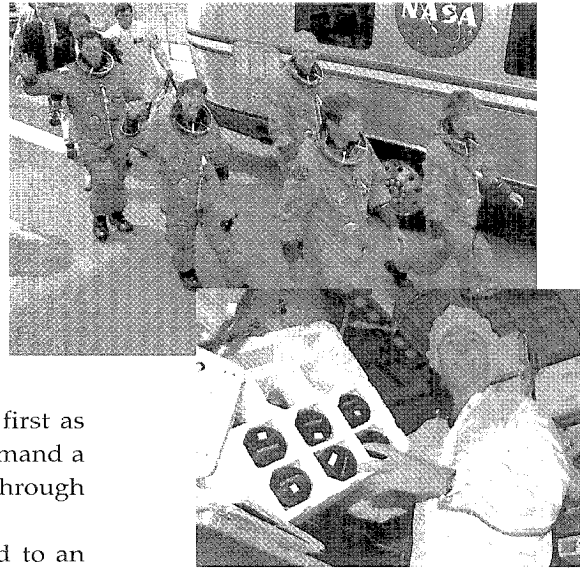
An electrical short during the launch of STS-93 led to an inspection of the Shuttle fleet and the replacement and repair of damaged wiring. Wiring repairs on Endeavour delayed the launch of STS-99, a fifth mission planned for FY 1999, until early FY 2000.

Payload Customers

The KSC payloads team supported the processing of the Spacehab module on STS-95. More than 80 important scientific experiments took place in the pressurized Spacehab module during STS-95. The team also supported the processing of the ISS Unity node on STS-88 as well as the Spacehab module on STS-96, which ferried 3,567 pounds of equipment and supplies to the ISS.

The Chandra X-ray Observatory, the largest payload ever to be released from an orbiter, was processed by the team and became the third of NASA's four great orbiting observatories. The KSC payloads team also supported the needs of Space Shuttle customers through processing and integration of 10 secondary payloads in the Shuttle cargo bay, as well as 17 mid-deck payloads during FY 1999.

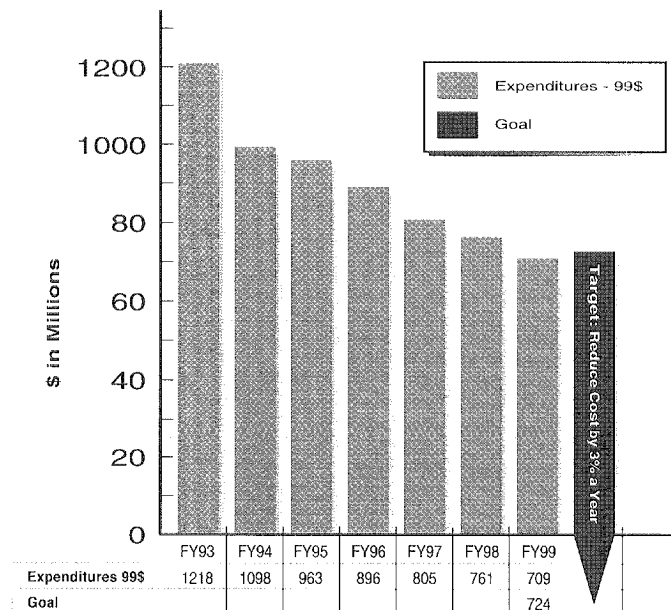
NASA and the world continued to reap rewards from many of the Center's past launch successes. Hubble Space Telescope, Cassini, Mars Global Surveyor, Deep Space 1, Lunar Prospector – and even the Lunar Laser Ranging Experiment left on the moon 30 years ago as part of the Apollo 11 mission – yielded valuable information that reflected on the lasting importance of KSC's processing and launching record.

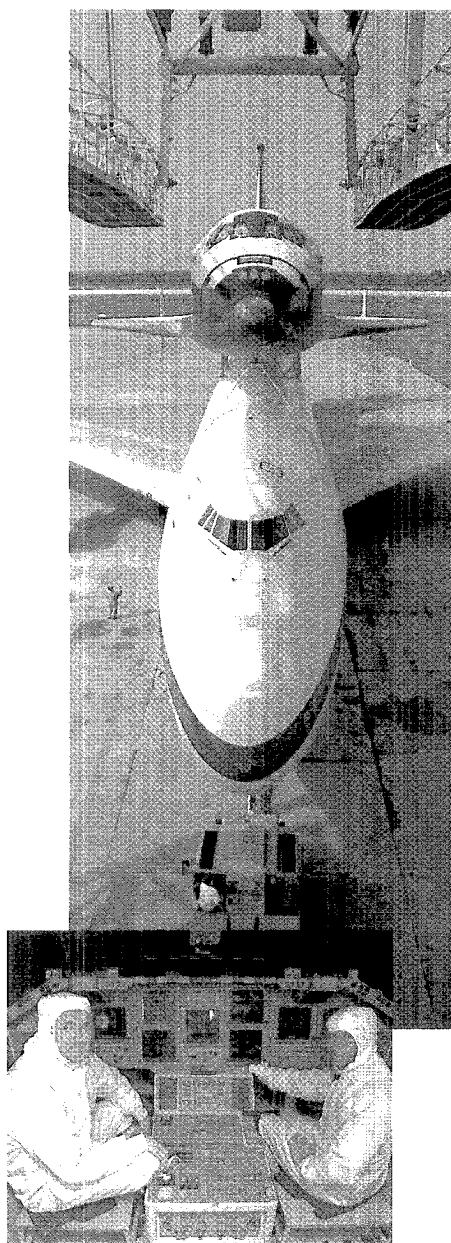


Top: Commander Eileen Collins leads the STS-93 crew walkout.

Above Right: Mission Specialist Stephen Robinson reviews an STS-95 payload in the Spacehab module.

Space Shuttle Program Budget





Above: Columbia atop a Boeing 747 Shuttle Carrier Aircraft at KSC before being ferried to Palmdale, Calif., for maintenance.

Above Left: STS-101 Commander James Halsell Jr. (left) and STS-98 Commander Ken Cockrell check out the new "glass cockpit" in Atlantis.

Space Shuttle Upgrades

Atlantis returned from a scheduled 10-month maintenance period in Palmdale, Calif., with enhanced features that made it the most modern of the four Shuttles. Technicians installed a Multifunction Electronic Display System (MEDS), or "glass cockpit," in Atlantis. Outdated cockpit displays were replaced with 11 full-color flat panel screens.

Columbia departed for California for maintenance as FY 1999 came to a close. The oldest of the four Space Shuttles was scheduled to receive more than 100 modifications, including the installation of a "glass cockpit."

New technologies needed for future modifications of the Shuttle fleet were demonstrated by two experiments flown during missions in FY 1999. The Integrated Vehicle Health Monitoring (IVHM) experiments on STS-95 and STS-96 showed new sensor technology can prevent failures and reduce ground processing time. In addition, the IVHM trial demonstrated the effectiveness of a real-time Space Shuttle Main Engine vibration monitoring system.

The viability of using fiber optic technology was tested on STS-95. The results of the successful experiment will be used in making standardized payload connections in the Shuttle Payload Bay, simplifying interfaces and reducing Shuttle processing times. A middeck experiment with wireless sensors is planned for STS-101 in FY 2000.

Shuttle teams continued to explore ways of improving the Thermal Protection System (TPS) for orbiters. Tests on new rewaterproofing agents promise a reduction in the evacuations of the processing bay and a subsequent lessening of the impact on long-term processing. Also, a three-dimensional imaging inspection concept now under development could further refine the current damage inspection, documentation and repair process.

The launch of STS-88 marked the first use of improved software that will automatically replenish liquid hydrogen and oxygen in the event of a Launch Processing System console failure. The software enhances KSC's ability to respond to a short launch window. Similarly, a technique to power the flight vehicle through the Command Decoder was developed, eliminating the need for data processing personnel in the control room and providing faster responses.

Development of the Checkout and Launch Control System (CLCS) continued. CLCS is a modern network that will replace a launch processing system used since the 1970s. Workers completed facility upgrades for Operations Control Room 1, installing a full complement of Shuttle System Engineering consoles. The consoles will house the new computers used for the checkout and launch of Shuttles after applications software is completed and tested.

The facility designed to house the CLCS Integrated Development Environments, to be used for software development and

testing, was also completed. As part of the same project, the Hypergol Maintenance Facility (HMF) software passed a system test in September, marking a significant step toward full operation early in 2000.

Equipment for the CLCS Shuttle Avionics Integration Laboratory (SAIL) at Johnson Space Center was installed, with the lab completing a hardware verification test late in FY 99. KSC created an Independent Assessment Team to conduct a thorough review of a wide variety of CLCS processes, and as a result of the analysis, the team made changes and implemented new processes.

The Central Data System within the Control, Checkout, and Monitoring Subsystem was replaced with a new Shuttle Data Center. The Y2K-compliant upgrade of the real-time data system allows operators to access needed information from a web server.

A Differential GPS (Global Positioning System) landing aid was installed at the Shuttle Landing Facility. The system has not yet been certified by the Federal Aviation Administration, but has been used by the Shuttle Training Aircraft since August 1999. The system acts as an enhanced training aid for astronauts learning to land the training aircraft at the SLF.

Launch Support Equipment Upgrades funded the start of nine "smart investment" projects designed to upgrade Shuttle ground support equipment systems. One of the systems to be enhanced is the Payload Ground Handling Mechanism (PGHM) control. KSC teams, working with United Space Alliance and Dynacs, Inc., are developing new technology modifications to the control systems in an attempt to increase efficiency and safety. The PGHM is used at both launch pads to install or remove Shuttle payloads from the orbiter payload bay and payload transport canister. The current design uses pneumatics and human power, but proposed upgrades would use automation and eliminate dangerous manual drive systems.

Other automation projects in development also offer promise of greater efficiency in Shuttle processing. Those projects include the automated stacking of solid rocket motor segments and the inspection of orbiter midbodies and windows.

Other "smart investment" projects include a new solution and control system for oxidizer scrubbers that produces liquid fertilizer instead of hazardous waste, an off-the-shelf infrared camera for enhanced hydrogen fire detection and vehicle umbilical monitoring, and several upgrades to the Mobile Launch Platform winch system.

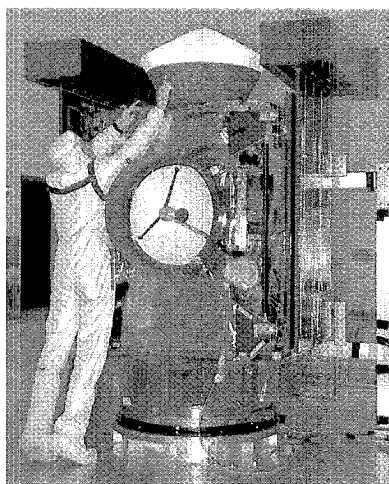
Expendable Launch Vehicle Program Consolidation

At the start of FY 1999, Kennedy Space Center assumed lead center responsibility for NASA's acquisition and management of Expendable Launch Vehicle (ELV) Launch Services, integrating separate programs previously managed by Goddard Space Flight Center and Glenn Research Center.



Launch Complex 39 Pad A underwent an eight-month "down period" for improvements during FY 1999. Upgrades included:

- replacement of metal lines that carry oxidizer to the pad,
- replacement of tower walls containing electrical connections to the Mobile Launch Platform,
- removal and repainting of more than 100 panels (each weighing approximately 16 tons) forming the Crawler Transporter path on the pad surface,
- replacement of the elevators in the Fixed Service Structure, and
- repair of walls, modification of a ceiling and additions of pressure-sealing doors to the Payload Changeout Room.



The KSC team launched six missions from the Canaveral Spaceport:

- *Deep Space-1,*
- *Mars 98 Orbiter,*
- *Mars 98 Lander,*
- *Stardust, (shown above)*
- *Submillimeter Wave Astronomy Satellite (SWAS), and*
- *Far Ultraviolet Spectroscopic Explorer (FUSE).*

KSC successfully merged the acquisition and management programs, forming a new organization. Key employees were recruited from the other Centers. In addition, KSC linked certain engineering functions to an existing contract with Boeing to provide the extensive engineering previously performed by contractors at other Centers. Two new functions, mission analysis and engineering integration, were added to the ELV program.

During FY 1999, KSC successfully managed 11 ELV launches, implemented launch service contract changes for seven additional new missions, and secured launch services for three secondary payloads. KSC completed the acquisition of the Small Expendable Launch Vehicle Services II (SELVS II) contract and initiated the Source Evaluation Board for the NASA Launch Services contract for larger launch vehicles.

Technical and business issues inherited with this lead center ELV role also involved establishment of innovative, cost-effective telemetry capabilities for NASA missions to be launched from Kodiak Island, Alaska, and Kwajalein Atoll in the Marshall Islands.

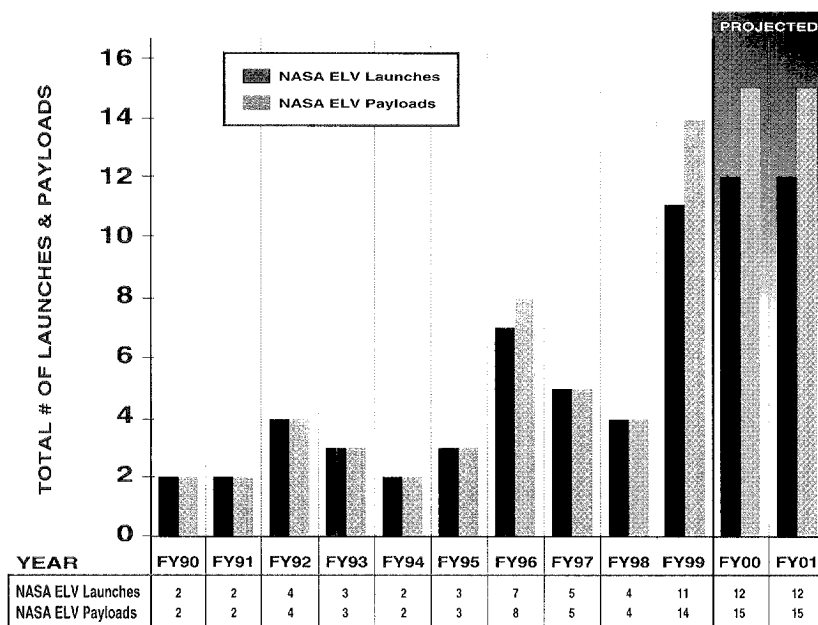
ELV Customers

All of the ELV missions were processed within budget, and the use of telemetry aircraft for the Mars and Stardust missions resulted in savings of \$500,000. The Center's handling of those missions, and others, drew consistent praise from customers at JPL and GSFC.

The five missions launched from Vandenberg Air Force Base in California were

- *Landsat-7,*
- *Orsted/Stellenbosch University Satellite (Orsted/SUNSAT),*
- *Wide-Field Infrared Explorer (WIRE),*
- *Tomographic Experiment Using Radiative Recombinative Ionospheric EUV Radi Sources (TERRIERS), and*
- *Quick Scatterometer (QuikSCAT).*

ELV Launches by FY



The program lent support to the Goddard Space Flight Center-sponsored Wing Glove experiment launch and test on a commercial Pegasus mission. KSC, in partnership with Langley Research Center, also implemented a wind tunnel test program to better assess aerodynamic effects on the performance of the Pegasus launch vehicle.

During FY 99, the ELV program expanded its feedback process to include all phases of the launch campaign and used that customer feedback to drive changes.

KSC took several steps to promote ELV mission planning and early payload design. The newly created Mission Integration Teams were assigned to the day-to-day management of approximately 40 planned missions through completion, while the combining of Launch Site Support Manager and Launch Operations Manager functions into one job brought improved efficiency.

The program established the Advanced Mission Integration Manager to focus attention on missions in the early planning stages and supported the NASA Announcement of Opportunity Process for approximately 25 missions under consideration for future flights.

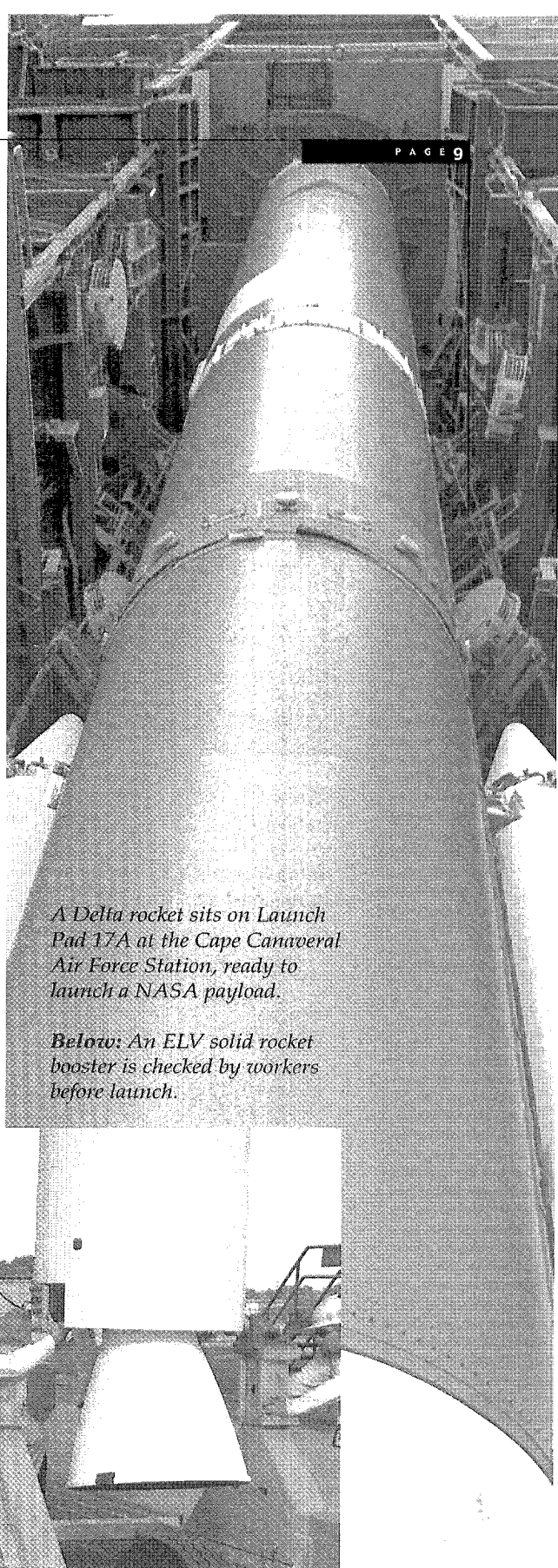
In addition, KSC provided critical launch service data to organizations that were preparing proposals for the Lightweight Synthetic Aperture Radar (LightSAR), Medium Class Explorers (MIDEX), and Discovery Announcements of Opportunity.

Planners also successfully resolved an Earth Science Enterprise launch manifest problem by combining manifests for the Cloudsat and Picasso missions, saving the Agency approximately \$20 million.

Payload Carriers Program

At KSC, unique payload carriers met customer needs with KSC safely and successfully processing hardware for 10 customers, including the Chandra X-ray Observatory, five Hitchhiker missions with 12 experiments including four ejectable satellites, five Getaway Special payloads and three Space Experiment Module Payloads on four Space Shuttle missions.

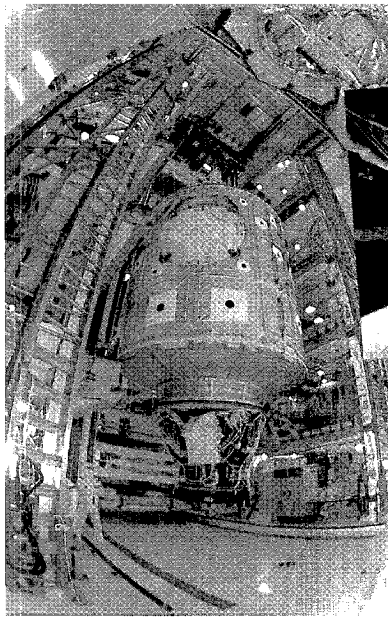
The Center also completed and closed out the Spacelab Program with the distribution of more than \$450 million worth of assets to other NASA programs and to other agencies. That process included the agreement to use a Spacelab pallet in support of the Ranger Telerobotic Shuttle Experiment (RTSX). Further, the program developed and presented proposals to support transportation of International Space Station experiments and logistics items on cross-bay and sidewall carriers.



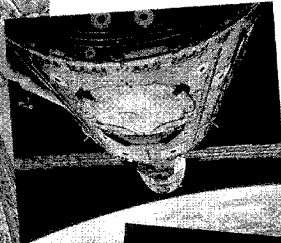
A Delta rocket sits on Launch Pad 17A at the Cape Canaveral Air Force Station, ready to launch a NASA payload.

Below: An ELV solid rocket booster is checked by workers before launch.

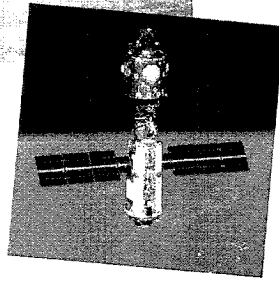
International Space Station



Above: Processing of the Node-Unity at KSC



Above insets: On-orbit views of Unity joined with Russia's Zarya



With the successful launch of the first U.S. built Space Station element, the Node-Unity, KSC made the first of many planned contributions to the assembly of the International Space Station (ISS).

KSC established and operated its first Engineering Support Room (ESR) to monitor the activation of the flight hardware during Space Station assembly operations. The ESR had a successful debut with the flights of STS-88 and STS-96 as team members coordinated on-orbit activities with flight controllers at Johnson Space Center's Mission Evaluation Room.

In addition to the launch site support provided to STS-88, KSC flight hardware processing teams supported the delivery of multiple elements to the Launch Site and began final Integrated and Acceptance Testing for the U.S. Laboratory Module, Z1/S0/S1 Truss Segments, two Italian-built Multi-Purpose Logistics Modules, and the Canadian-built Space Station Remote Manipulator System.

Workers also continued to play an active role in remote acceptance test activities, providing expertise to contractors in the United States and Canada. KSC engineers made more than 350 trips, including 12 international ones, to assure that ISS objectives were being achieved.

While the successes of the first missions to the ISS gained worldwide attention, KSC teams were making sure that components destined for future flights would work when assembled on-orbit. The Multiple Element Integration Test (MEIT), a complex series of integrated interface tests was used to verify ISS systems would work together.

In the case of Leonardo, also known as the Multi-Purpose Logistics Module, test results led to a design modification. In all, processing teams completed the MEIT requirements for three configurations of ISS systems and began work on three others.



At right: STS-88 crew training at KSC learn about a special tool used for spacewalks.

At right, inset: STS-96 Mission Specialist Julie Payette during the Crew Equipment Interface Test at KSC



STRATEGIC GOAL 2:

Future Vehicles

KSC's extensive involvement with all phases of future vehicle development signaled significant progress for the Spaceport Technology Center.

KSC forged multiple-center partnerships in the development of a NASA Space Transportation Architecture Study. The Center provided highly capable team members, who made significant contributions to the study.

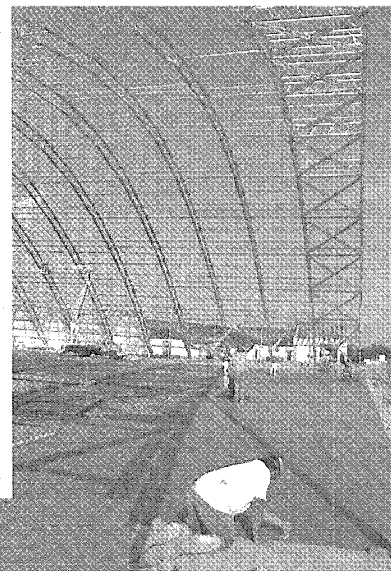
Looking toward the time when new vehicles are launched from KSC, work on a multi-purpose hangar, part of the \$8 million Reusable Launch Vehicle (RLV) Support Complex, began during the summer.

Located near the Shuttle Landing Facility, the complex will include facilities for ground support equipment and administrative and technical support. It will accommodate a variety of vehicles – the Space Shuttle, X-34 RLV technology demonstrator and L-1011 carrier aircraft for Pegasus and X-34, as well as other RLV and X-vehicle programs. The facility, funded by the Spaceport Florida Authority, NASA and KSC, is scheduled to begin operations in 2000.

As part of continuing efforts to secure future flight programs, KSC assisted the Spaceport Florida Authority with a proposal in response to VentureStar's request for qualifications. The Center provided the technical data to support the proposal and performed extensive reviews of the document. KSC also assisted the State of Florida's VentureStar "capture" team. As a result of these efforts, KSC was selected as a finalist in Reusable Launch Vehicle site selection.

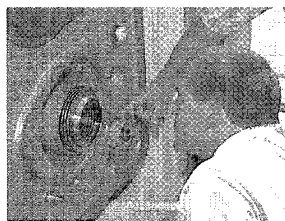
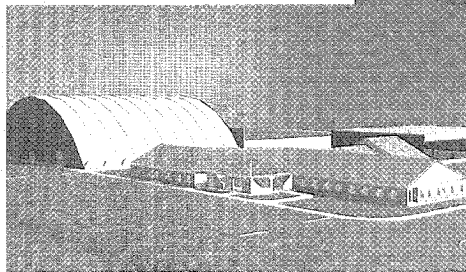
The KSC team made a crucial contribution to the X-33 program by designing, fabricating, and testing its umbilical system – the method of fueling the vehicle. KSC delivered the finished products to Lockheed Martin in July. The X-33, under construction in California, is a half-scale prototype of VentureStar.

KSC employees were part of the X-34 East Coast team in drawing up a flight schedule for the vehicle that includes at least six trips from Beaufort, S.C., to KSC. Those efforts helped resolve questions of range safety, airspace management, ground safety, landing aids, and environmental analysis and communication. The Center's representatives are working with the program to define the requirements needed to fly the X-34 from KSC, with environmental preparations under way.



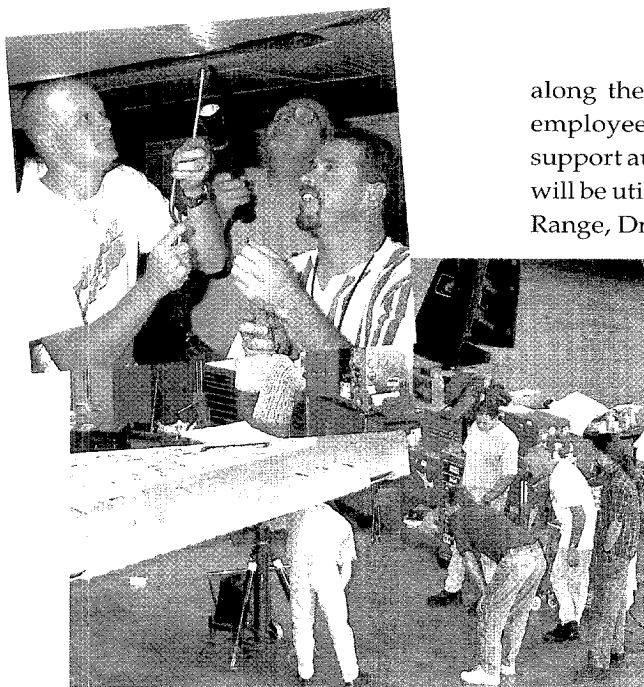
At left: an artist's conception of the new Reusable Launch Vehicle Support Complex.

Above: under construction



Testing of the X-33 umbilical system at KSC





Above and below: KSC technicians work on the wiring of a modified X-34 at Dryden Flight Research Center, Calif.

As part of that process, KSC identified alternate landing sites along the East Coast, visiting four of the most promising sites. KSC employees also designed and built Differential GPS Base Stations to support autonomous landings of the X-34. This Flight Support Equipment will be utilized for the entire flight program including White Sands Missile Range, Dryden Flight Research Center, and KSC.

The Center initiated two projects to promote the use of the X-34 vehicle for testing of Shuttle upgrades. Upgrade teams developed an Integrated Vehicle Health Monitoring experiment that will fly in the second vehicle being built.

In further support of future vehicle development, KSC collaborated with Lockheed Martin Corporation to develop and evaluate its proposal for the X-37 project. The X-38 project at JSC provided another opportunity for a partnership. KSC manufactured thermal protection tiles for the vehicle.

KSC made use of its processing experience to perform testing in support of the Linear Aerospike SR-71 Experiment (LASRE). In particular, the Center performed a "helium signature" test to help identify propellant leaks and to assess safety for flight tests. This project was eventually cancelled,

in part as a result of identified safety concerns.

KSC made use of its expertise in other ways to foster the continued development of future vehicles. The Center:

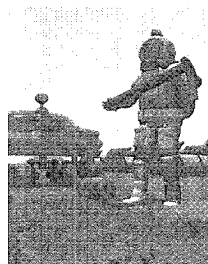
- collaborated with both Lockheed-Martin Astronautics and Boeing on a Future X-Flight Demonstrator and experiments;
- provided expertise to Orbital Sciences, Corp., and Marshall Space Flight Center in the areas of thermal protection systems, landing operations, and ground safety;
- participated with Marshall on Magnum Heavy Lift launch vehicle studies;
- worked in concert with Johnson Space Center on the MARS Design Reference Mission 3.0;
- began a preliminary design study for the VentureStar Crew Module and Space Station Logistics Carrier;
- provided guidance to the Bantam-X and Advanced Space Transportation programs in the areas of launch processing and operations; and
- developed processing studies in support of Magnum vehicle designs.

While participating in these future vehicle programs, the Center has taken into account environmental concerns and evaluated environmental issues for each proposed future launch vehicle. Requirements for permits and opportunities for cost reduction have been noted.

STRATEGIC GOAL 3:

Exploration Investments

The Center committed a development team to the JPL Mars Sample Return Project. The group, working with a team at Jet Propulsion Lab, undertook a preliminary design for a rocket that would launch from the surface of Mars. The rocket would place samples from the planet into orbit to be collected later.



Toward the end of FY 1999, the team prepared for release of a Request For Proposal seeking bids from contractors. The unprecedented project positions KSC for future exploration endeavors and makes KSC part of the historic first launch planned from another planet.

KSC contributed to many other areas of the future exploration of Mars as well. Engineers performed research and development geared toward the need for a crew to produce fuel and consumable products from the Martian atmosphere (a process known as In-Situ Resource Utilization) and Center employees completed a 5,000-gallon thermal vacuum chamber that simulates Mars' environment, including daily cycles.

The Mars chamber allowed development teams to conduct studies on electrical charging and decay of materials and particles. KSC also assisted JPL in electrometer design and material characteristics for the Mars Environmental Chamber Analysis experiment.

The Center also obtained funding to develop and test inflatable greenhouse structures that could be used for early missions to Mars.

In addition, KSC teams worked on an experimental sounding rocket for potential launch from Mars. Efforts included the development of a miniature propulsion system that potentially will be used with the Mars 2003 lander to demonstrate propellant production on the planet's surface, and the fabrication of various sensors to be used for Mars data acquisition.

KSC worked in partnership with NASA Headquarters and Marshall Space Flight Center to complete a Mars Mission study. The Center also developed an integrated logistics strategy for Mars Surface Operations and co-authored the Mars Operations Concept Document and the Mars Surface Reference Mission with Johnson Space Center.

In addition, teams completed a thermal assessment of three Mars mission architectures for the exploration office at JSC. The assessment included total mission mass, operational scenarios, required hardware, and hardware interfaces for all elements of a manned Mars mission. And KSC initiated the Mars Umbilical Technology Demonstrator project, with one summer faculty fellow and two summer interns giving full-time support.

Team members presented an overview of ongoing KSC exploration activities to:

- faculty at Florida Institute of Technology, the University of Florida, University of Central Florida, Florida State University, and Florida A&M University;
- participants in the Partners in Education and Research Conference;
- representatives of Schwartz Electro-Optics;
- project leads for the New Millennium Program; and
- representatives of Lockheed-Martin.



A technician prepares gaseous nitrogen freezer for flight on STS-95.



The OmniBot project is developing alternative approaches for operations in hazardous environments.

Technology Development

KSC led all centers with 65 software releases during FY 1999, a new Agency record. In addition, KSC received \$140,000 in Space Act Awards, an increase of \$43,000 from the past year. The awards are given in recognition of technology innovation. KSC received 19 board action awards, totaling \$81,400 in prizes for employees. A total of 184 KSC workers involved in 79 new technology projects were recognized.

Intellectual property activities included five new KSC technologies licensed to commercial organizations, four new patents filed, and five new patents issued. A total of 74 new KSC technologies were reported and evaluated.

During FY 1999, the Center held 240 active agreements and technology transfers that were reportable as commercialization partnerships under the Government Performance and Results Act. The total included 145 new agreements and 95 ongoing partnerships, 17 Small Business Innovation Research projects in various stages, two new Small Business Technology Transfer projects, two new Dual Use partnerships, five new Space Act Agreements, 109 new Technology Transfer Agreements, and five new Joint Sponsored Research Agreements.

The Cryogenic Testbed, a partnership with industry, academia, and government, continued to attract the attention of customers. KSC combined a \$750,000 contribution from the State of Florida with additional NASA funds to establish the testbed, which offers state-of-the-art development and testing services for uses of cryogenic (supercold) substances. The testbed encourages local economic growth in the technology sector.

The Center made further use of its cryogenic technology by completing an analysis of commercially available insulation in varying vacuum environments. This work led to the development of a new insulation with superior properties at "soft" vacuum levels. A patent is pending.

KSC, working with the Boeing Evolved Expendable Launch Vehicle (EELV) program, completed the first phase of hydrogen entrapment testing for a proposed launch pad exhaust duct. Boeing also chose KSC to develop a new coupling for a payload environmental control system and to continue providing cryogenic and pneumatic study support.

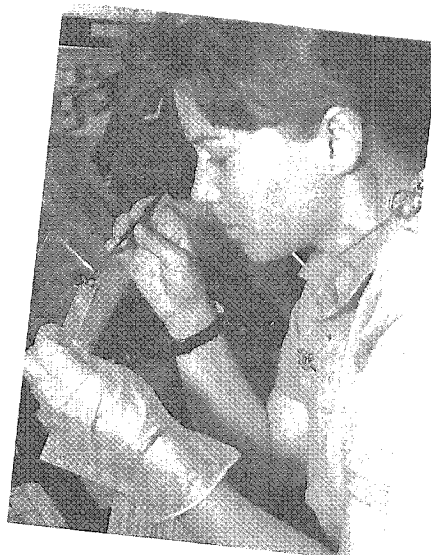
The Center initiated a new collaboration with NASA and industry in the form of the Space Solar Power team. KSC was designated as the source for launch infrastructure assessments and launch processing research and development. In addition, KSC contacted a power plant to coordinate scale-up testing for eventual transfer of a new control technology researched and developed here.

KSC scientists have developed a novel technology for growing potatoes, using a recirculating hydroponic solution that boosts the size of tubers while reducing the size of vines. The process, which

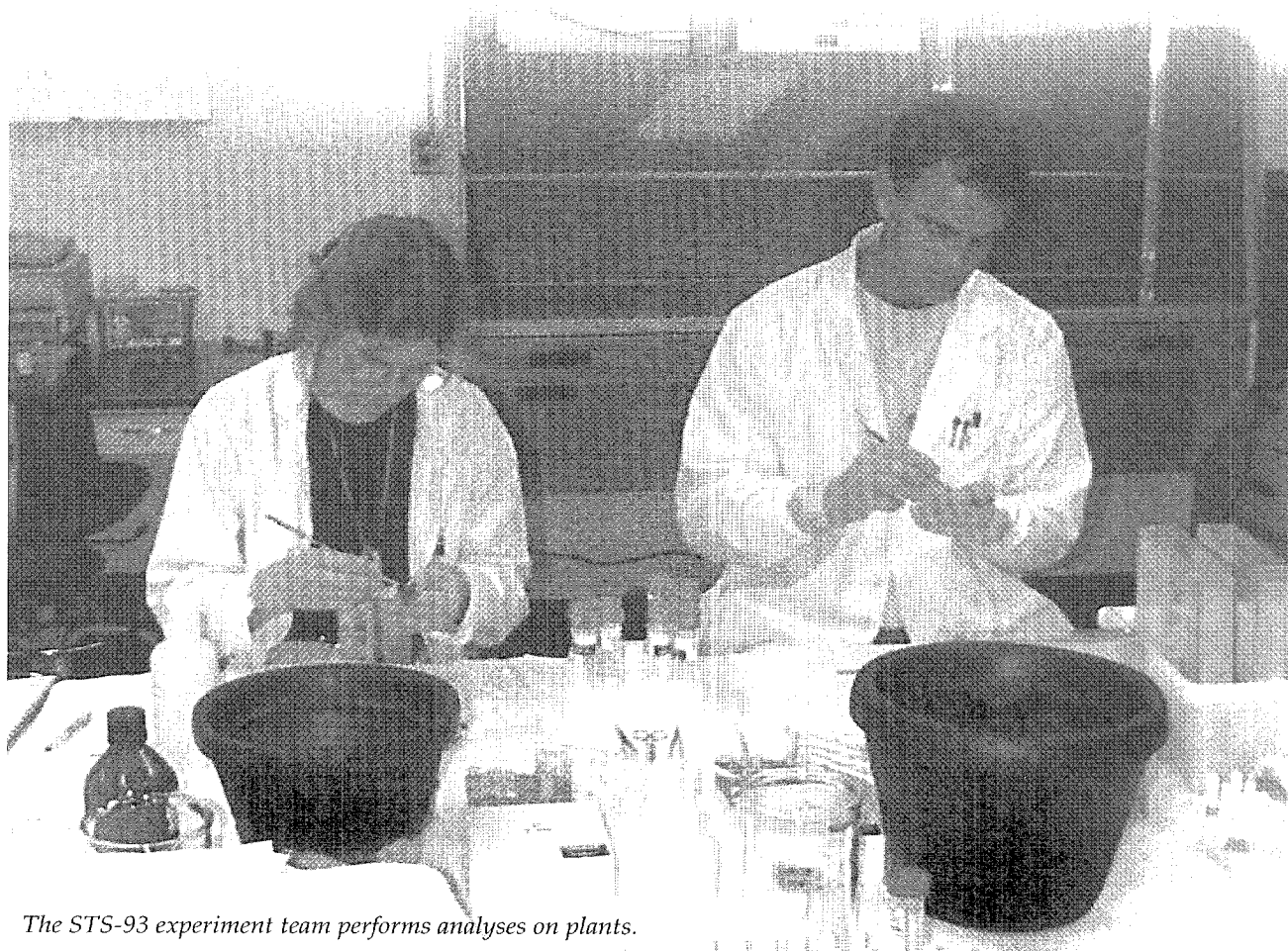
earned a Notice of Allowance on a patent, holds promise for both the potato industry and NASA's Advanced Life Support Program.

KSC scientists, working in conjunction with the University of Central Florida, developed an automated means of monitoring environmental conditions in precisely controlled plant growth chambers. The Advanced Life Support Automated Remote Manipulator (ALSARM) uses a robot arm to gather crucial information while eliminating the contamination caused by human entry to obtain measurements. A second phase in production would give ALSARM the ability to take cuttings from plants and move them to an airlock. The project has potential for use on lunar or Martian bases.

KSC made progress in many other areas related to biology and space flight. Scientists developed a single software package to operate all environmental chambers and participated in developing guidelines for JSC on crop growth experiments. KSC also took part as host of a program hardware evaluation workshop that developed near-, mid-, and long-term plans to accommodate crop production research for Shuttle and International Space Station missions.



Mission Specialist "Cady" Coleman performs a plant experiment during STS-93.



The STS-93 experiment team performs analyses on plants.

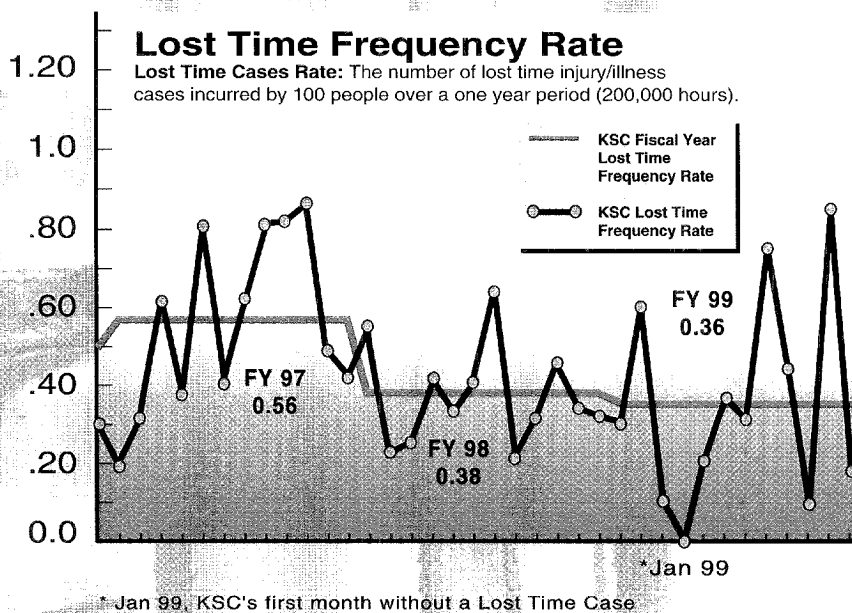
STRATEGIC GOAL 4:

Operations

KSC made considerable progress in pursuit of faster, safer, and less costly processing of orbiters and payloads. Greater efficiency continued to be seen in ground processing labor hours. Mishaps remained at or below the historical average, with a corresponding rise in reported "close calls." Injuries reported to the Occupational Safety and Health Administration averaged 2.58 cases per 200,000 labor hours, lower than the previous four fiscal years.

KSC increased its use of electronic commerce techniques to enhance general efficiency in meeting construction and procurement needs. Specifically, the Center developed several new tools to expedite the procurement cycle and trim customer response time. Among them were

- The use of Indefinite Delivery/Indefinite Quantity orders, which added efficiency to several "mini-construction" projects in the Launch Complex 39 and Industrial areas, and
- Increased emphasis on using simplified contracting procedures as a method to collaborate quickly with proven sources.



Processing improvements contributed to financial savings. An integrated solution to "Sticky Event Indicator" problems was developed, resulting in savings of approximately \$70,000 per occurrence. The elimination of a step in the orbiter changeout process saved the Agency \$30,000 per flight.

The reconfiguration of a UHF circuit to Houston will enable KSC to support potential Shuttle landings at Dryden Flight Research Center with fewer employees having to travel to California.

The development of the NASA/KSC Asset Delivery and Accountability Guidelines document led to improvements in shipping and receipt processes and property management in the ISS program. The new guidelines dramatically trimmed receipt processing time and reduced the mislabeling of shipping documentation by 25 percent.

KSC also developed the initial Sustaining Engineering Plan, which defines the terms of support throughout the life of the International Space Station Program.

Facilities and Major Systems

To better protect orbiters against threatening weather, a new construction project was begun during the fall of 1999. Operation "Safe Haven" will create a third stacking area inside the Vehicle Assembly Building, allowing for storage of another orbiter without disruption to the assembly of Shuttle stacks. In addition, workers will restore the Apollo-era crawlerway, offering greater flexibility in rolling an orbiter back from the pad and into the building during hurricane season.

Four resource areas have been installed at KSC to meet the Agency's Collaborative Engineering Environment (CEE) and Intelligent Synthesis Environment (ISE) project goals. Areas include "Level 2" rooms that provide audio and video conferencing and data integration capabilities, and "Level 3" rooms that can share virtual technology with similarly equipped facilities. KSC conducted a presentation of the Virtual Shuttle Processing application for the NASA Administrator and his staff using these technologies, and engineering teams now work interactively with others at Jet Propulsion Laboratory, Johnson Space Center, Marshall Space Flight Center, and other NASA sites.

KSC constructed a 14,110-square-foot NASA Technical Records Center in the Industrial Area, replacing a facility lost in the conversion of Launch Complex 37 to commercial use. The Center coordinated contractor responsibility for the work, resulting in a larger and more accessible records center at no cost to NASA.

The Space Shuttle Main Engine Processing Facility became fully operational in FY 1999. The state-of-the-art building, adjacent to the Orbiter Processing Facility, has contributed to improved efficiency of engine operations and has significantly reduced safety risks by moving main engine processing out of the VAB.

The Joint Communications Control Center (JCCC) began operating during FY 99 as a function of the JBOSC arrangement. The facility, located at KSC, monitors more than 98,000 devices (including fire alarms and smoke and motion detectors) at both KSC and Cape Canaveral Air Force Station.

The Applied Chemistry Laboratory was completed. Efforts continue on a plan for the physical consolidation of all development laboratories into a single location, the KSC Development Labs Complex. The plan combines all laboratory activities, develops a comprehensive organizational plan, sets priorities for lab activities, and establishes a five-year plan that includes goals and activities.

Plans for a new Space Experiment Research and Processing Laboratory are being developed. Representatives met with the Spaceport Florida Authority and Florida's State University System to advance the project with a collaborative approach. The new laboratory will be part of a Space Commerce Park of 400 acres set aside for development. This park will open an entire new future for research and development as the International Space Station is completed and commercial uses of the laboratory grow.



Above: KSC executives gather for the opening of a Collaborative Engineering Environment room.

Above right: Grand opening of the Technical Records Center

KSC upgraded its outdated communication systems by installing a new telephone switch and single line capability.

Forty NASA-owned trailers, which were aging and vulnerable to weather, were removed from the Center as part of KSC's commitment to safety.



Former Apollo astronauts Neil Armstrong, left, and Gene Cernan share memories during an Apollo 11 commemorative event.

Special events held for the public in recognition of KSC's role in space history:

- The Apollo 11 moon launch, made on July 16, 1969, was commemorated by special events held at the Visitor Complex during July. Highlights included public and press briefings by Apollo astronauts and their attendance at the celebration picnic.
- The kick-off of a year-long celebration commemorating 50 years of launches from the Space Coast was held on Cape Canaveral Air Force Station in August. The first Bumper rocket was launched from Cape Canaveral on July 24, 1950.

Upgrades included the renovation of existing facilities and the installation of these new attractions:

- International Space Station theme ticket plaza, (at right)
- Universe Theater and "Quest For Life" movie,
- Robot Scouts presentation, and
- Merritt Island Wildlife Refuge ecosystem exhibit.

Enabling Processes

Having achieved ISO 9001 certification in the previous year, KSC maintained 100 percent of that certification. Auditors from Det Norske Veritas toured the Center and did not find one example of non-compliance with ISO 9001 standards in the second audit.

The Center took decisive steps toward ensuring that all systems and processes would work successfully in the year 2000. NASA and contractor teams inventoried more than 9,700 items (approximately 7,500 from the Space Shuttle program), and all items or components not Y2K compliant were replaced or discarded. One item, which required new components, had not been certified by the end of FY 1999. A policy in place requires all information technology purchases to meet Year 2000 standards.

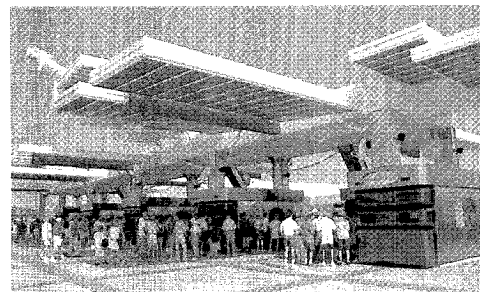
KSC developed its requirements for near-term hiring, highlighting "climate indicators" for the workforce. This strengthened the Center's hiring position by showing the negative effect of prolonged downsizing on the workforce. The result was an Agency agreement for new KSC hires. Business teams also defined the requirements for external recruitment, workforce reduction goals and core competencies, setting up a basis for improved management decision making. It was a major breakthrough to see new engineers come into the NASA KSC workforce in 1999.

The Center established a Leadership Excellence Achievement Program (LEAP) to help supervisors and leads improve their leadership skills. To kick off the program, employees were given the Covey "Seven Habits" course. Subsequent leadership training emphasized strategic planning and the Spaceport Technology Center concept.

In its role as lead center for propellant acquisitions, KSC engineered dual-source contracts for liquid oxygen and liquid nitrogen to serve the needs of Stennis Space Center and Michoud Assembly Facility. The contracts will save the Agency approximately \$10 million over five years compared to previous contract prices. An additional \$2.6 million in savings resulted from obtaining excess Department of Defense solvent for the Shuttle Program.

Outreach To The World

KSC's Web site continued to serve as a valuable portal for people from across the world, with more than 200 million "hits" during FY 1999. That represented an increase of



approximately 25 percent from the previous year. The site has been ranked at various times among the top 100 and top 500 sites on the World Wide Web.

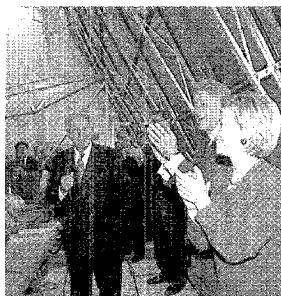
The KSC Visitor Complex drew about 2.8 million visitors during the fiscal year, an increase of about 7 percent. KSC, partnering with Delaware North Parks Services, reinvested \$21 million from Visitor Center sales to enhance the destination.

In addition, the Visitor Complex acquired 18 new tour buses with access for the disabled and added a tour package for blind visitors.



KSC hosted 31,785 VIPs at the four Shuttle launches (including launch attempts) during FY 1999. VIPs included President Clinton, his wife Hillary, and daughter Chelsea. In addition, 150 tours were given to nearly 560 VIPs and more than 3,000 other visitors. More than 400 tours were conducted for members of the media.

The four Shuttle launches in FY 1999 drew a total of 101,000 onsite visitors and more than 3,900 members of the press. The launch of STS-95, featuring original Mercury astronaut John Glenn, accounted for 45,000 onsite visitors and 2,700 media representatives by itself. KSC officials subsequently assisted Brevard County leaders in the planning and execution of a "Heroes Return Parade" and a reception in Cocoa Beach that drew thousands.



As far as taking the KSC show on the road, the KSC Centerwide Display team was out every month of the year at local or national events, including the inauguration of Florida's new Governor, Jeb Bush. KSC's education exhibit at the inauguration provided thousands of Floridians information about NASA's programs.

As in past years, members of the KSC team took an active role in planning and participating in the 36th Space Congress, sponsored by the Canaveral Council of Technical Societies. Panel sessions and paper presentations addressed how the global efforts of the science, commerce, military, and education communities are contributing to the understanding of space and the well-being of people around the world.

KSC also worked with the 45th Space Wing, the Spaceport Florida Authority, Florida Institute of Technology, and industry to organize the 4th Annual Florida Space Launch Symposium. The symposium, which drew about 200 contractor, military, and civilian launch managers, educators, and federal and state policy directors, was held in February. The event focused on the present state of affairs in the commercial launch business, with particular emphasis on Cape Canaveral Air Force Station and the Eastern Range.



Mrs. Lalitha Chandrasekhar, wife of the astronomer for whom the Chandra X-Ray Observatory is named, visited KSC for the launch of the STS-93 Chandra mission.

KSC engineers and scientists presented technical papers as far away as Australia, as close by as Orlando, and at many city civic events, universities, and industry conferences. Other outreach activities:

- Team members made a presentation on IVHM activities and chaired a Ground Operations Working Group at an Advanced Sensing Systems Workshop held at JPL;
- KSC conceived and produced a major conference, "Partners in Education and Research," which helped more than 200 students and teachers to better understand KSC's current and future endeavors and the technologies of greatest interest;
- Teams organized and participated in two sessions of an American Institute of Aeronautics and Astronautics conference held at Marshall Space Flight Center; and
- KSC contributed to a Federal Aviation Administration/Commercial Space Transportation conference that resulted in a request by the FAA for a Spaceport Technology Seminar.



Scenes from Expo '98, which drew 1,300 government and business leaders

Outreach To Business

Expo '98 featured 216 exhibitors from across the Southeast and drew approximately 1,300 people to Port Canaveral. Sponsored by NASA, the 45th Space Wing, and Canaveral Port Authority, the event allows businesses to display their products and services for NASA and Patrick Air Force Base while learning what the government and prime contractors plan to purchase over the next few years.



KSC continued its efforts to accommodate the needs of small businesses as all 145 contract clauses were reviewed and updated. The KSC Procurement Office established aggressive socio-economic goals, as it does each year. KSC, as always, was committed to seeking out small disadvantaged and women-owned small businesses in its daily procurement activities. KSC was one of only five Centers to meet its socioeconomic goals. More than \$84 million was awarded in contracts to small, small disadvantaged, and woman-owned businesses during FY '99. Of that \$84 million, \$50 million was awarded to Small Disadvantaged Businesses and \$13 million to Women-Owned Small Businesses.

Two contractors received awards from NASA Headquarters based on their work at KSC. Dynacs won the NASA and KSC Small Disadvantaged Business of the Year Award for outstanding research and development, design engineering, laboratory operations, and maintenance and support services. Dynamac won the NASA and KSC Women-Owned Small Business of the Year Award for its outstanding Life Sciences Support contract performance.

In addition, contractor RUSH Construction won NASA's Special Recognition Award for constructing Launch Control Facility No. 4 on time and within budget on a highly aggressive schedule.



Outreach To Students and Teachers

The Space Life Sciences Training Program provided an opportunity for 24 college students from across the United States to work and study at the Center during the summer with KSC researchers serving as mentors.

KSC managed 13 new or existing education and research grants totaling \$1 million in funding.

KSC completed and published Mathematics Explorations 1 curriculum guides with Capital Community Technical College and the National Science Foundation. These guides offer examples of math applications in the space program for the use of college instructors teaching first- and second-year students.

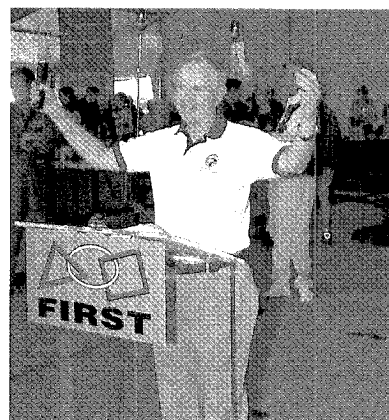
The Exploration Station, located in the Center for Space Education at the Visitor Complex, accommodated more than 173,000 students, teachers and other people, while the Educators Resource Center hosted nearly 9,000 teachers during FY 1999. Another 1,150 teachers benefited from 35 educator workshops. In addition, the Center conducted 40 student/educator tours involving nearly 1,400 people.

KSC initiated an interactive webcast series. The 11 webcasts during FY 1999 provided thousands of faculty and students with access to information regarding ongoing projects. The series also gave participants the ability to interact with engineers and senior management.

The "landing to launch" series of Real Media webcasts highlight the processing of the orbiter from the time it lands at the Shuttle Landing Facility through the moment of launch. This Internet-based program allows students to tour the facilities at KSC and to have their questions answered live by NASA experts. The last landing-to-launch webcast had 20,000 viewers participate worldwide.

The Virtual Science Mentor Program connects Kennedy Space Center scientists and engineers to schools throughout the State of Florida. Volunteers from KSC use desktop video conferencing technology to mentor, advise, and assist their students in developing experiments, to assist teachers in achieving the Florida Sunshine State Standards of Education, and to encourage students to realize the importance of science and mathematics in the space industry. The VSM program presently encompasses about 5,800 students in 7 counties and 58 classrooms.

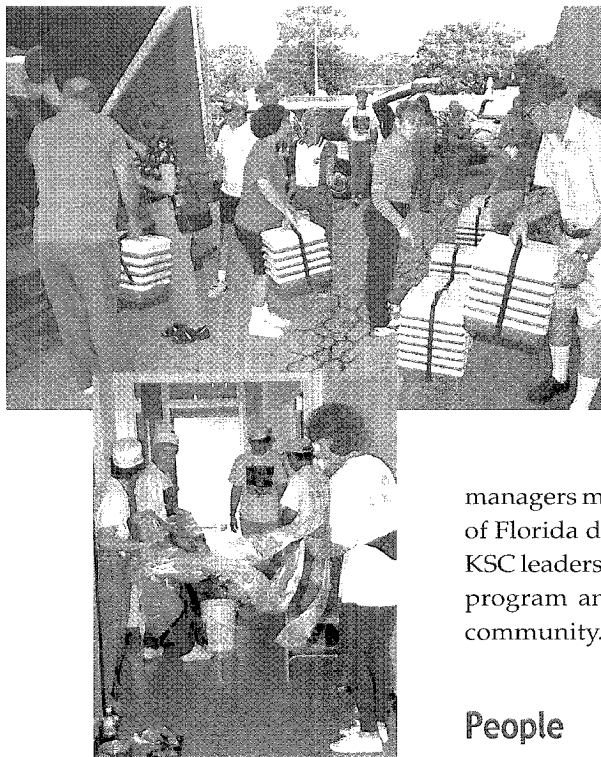
For the sixth consecutive year, KSC donated excess computer software to schools. The Center has contributed software valued at more than \$1 million during the program's six years. Computer hardware donations also continued with a new initiative. Workers volunteered their time to inspect and clean the computers, making upgrades when necessary, before the 81 working units (valued at about \$90,000) were given to schools in Brevard County.



Center Director Roy Bridges enthuses about the FIRST tournament.



KSC hosted the Southeast Regional competition of the FIRST (For Inspiration and Recognition of Science and Technology) tournament. The competition involved 27 teams of high school students who built robots according to precise specifications and then unleashed their creations to battle each other in various tasks. The Center's involvement went well beyond hosting the event. Engineers served as mentors for local teams, and Deputy Director for Launch and Payload Processing Loren Shriver was one of the judges.



KSC workers participate in Days of Caring.

Other Outreach To The Community

Through projects including the Days of Caring, 24 percent of civil service employees took part in public outreach activities.

KSC's contributions through the 1998 Combined Federal Campaign exceeded its goal by nine percent, with more than \$229,000 given by civil service employees.

Efforts to encourage alternative fuel use included participation in Space Coast Clean Cities, a Department of Energy program that recognizes community efforts to reduce vehicle emissions and to reduce dependence on oil imports.

KSC Director Roy D. Bridges, Jr., and other KSC senior managers met with community leaders from Brevard County and the State of Florida during the annual Community Leaders Breakfast in June. The KSC leadership presented projections for future plans of the Center's space program and the economic impact these plans may have in the local community.

People

J. Chris Fairey was promoted to Director of Safety and Mission Assurance in January, 1999. He is responsible for planning, managing, directing, and implementing safety, reliability, maintainability, and quality assurance for the Shuttle, International Space Station, Expendable Launch Vehicle, and institutional programs. Mr. Fairey has worked at KSC since 1969.



J. Chris Fairey



Richard E. Arbuthnot

Richard E. Arbuthnot was named director of the Administration Office in July after serving as acting director. Arbuthnot provides executive leadership and centralized management of civil service human resources programs, workforce management, and planning, and industry relations.

David King became Director of Shuttle Processing in December. King is responsible for the management and oversight of all activities involving Shuttle processing and launch operations at KSC. King began his career with NASA in 1983.



David King

Joseph Gordon came onboard in December 1998 as the new Director of Public Affairs. He is responsible for leading the Center's public affairs efforts. He came to KSC from the Department of Defense.



Joseph Gordon

Also in December, Jan Heuser was named program manager for the Space Experiments Research and Processing Laboratory Project. The project is the first phase of a proposed research industrial park in which KSC will team with Spaceport Florida Authority to serve as host of governmental, commercial, state, and international organizations involved in space-related research. Heuser previously served as associate director of Installation Operations.

An abundance of awards were given to recognize and encourage outstanding performance during FY 1999. Honors included 1,452 Performance Awards, 1,111 Time-Off Awards, 276 On-The-Spot Awards, 269 Certificates of Appreciation, 149 Employees of the Month and 104 Superior Accomplishment Awards. Other awards included 26 NASA Group Achievement Awards, 24 Exceptional Service Medals, 16 Employee of the Year awards, and 16 Exceptional Achievement Medals.

Bill Helms, chief of KSC's Instrumentation Development Laboratory, received a \$10,000 Space Act Award for the role he played in the development of the Space Shuttle Hazardous Gas Detection System.

As part of a continual improvement program, the Center Director bestowed 245 Gold Quality Dollars on employees, while department leaders presented 21 Silver Quality Dollars in recognition of accomplishments. In addition, 78 continual improvement teams were recognized at the 10th Annual KSC Continual Improvement Reception. The use of the KSC Opportunity for Improvement system also increased during FY 1999.

Beyond recognizing excellence, the Center seeks to develop its employees through continuing education and fellowships. The Kennedy Graduate Fellowship Program, begun during Fall Semester 1999, offers NASA civil service employees the opportunity to apply for fellowships for full- and part-time doctoral and master's degree programs. Fellowships are given to selected candidates in programs that support the center's strategic plan and goals. Sponsorship for undergraduate degrees, also begun during the Fall Semester, is available through the Kennedy Undergraduate Studies Program.

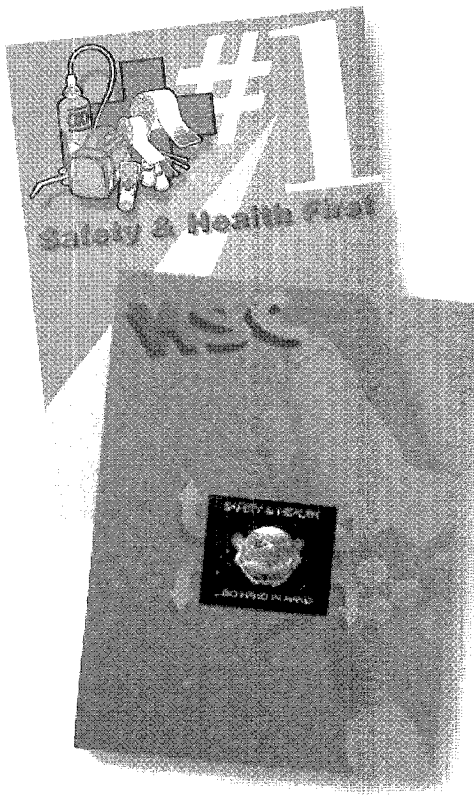
NASA's Co-op Program is used to develop the skills of future leaders. The program, which includes about 50 to 60 students at any one time, is a primary source for filling permanent jobs in the KSC workforce. Graduating engineering students in the program are hired to meet critical skills needs when positions for which they are qualified become open.

Winners of top awards:

- **Director's Award -**
Michael Sumner
- **Exceptional Engineering Achievement Medal -**
Dale E. Lueck
- **Distinguished Service Medals -**
P. Thomas Breakfield and Robert Sieck
- **Small Disadvantaged Business Award -**
Janice Pirkle
- **Secretary of the Year -**
Anita S. Gross
- **Strategic Leadership Award -**
Miguel Rodriguez



Silver Quality Dollar Award winners



Guiding Principles

"Safety and Health First"

"Safety First" continues to be our most important guiding principle. Protecting the public and our workforce as we launch and process payloads is paramount.

On June 17, 1999, Kennedy Space Center and the 45th Space Wing celebrated the second joint NASA/Air Force Safety and Health Day. It was the first time that "health" was included in a safety day event, producing the theme "Safety and Health Go Hand in Hand." Approximately 17,000 NASA, contractor, and Air Force employees ceased all non-essential work and dedicated an entire day to safety and health. Televised events included a poignant testimonial on living through an aircraft disaster by commercial airline pilot Dennis Fitch and a panel session with NASA and Air Force senior managers, who answered employee questions.

Activities also included more than 150 vendor displays across the Center and at Air Force locations, as well as local seminars and training, which focused on workplace safety. At a technical paper session held the next day, timely and informative topics were presented for government and contractor safety and health professionals. Employee feedback on the activities was overwhelmingly positive.

The emphasis on safety extended well beyond one designated day. For example, the newsletter "Safety on the Line" is now posted in 300 locations on KSC and CCAFS. A related home page receives 1,500 to 2,000 hits per issue.

During the first year of managing the ELV program, KSC established Safety and Mission Assurance Flight Assurance capability partnerships with other NASA centers and government offices. The Center also hosted a Safety and Mission Assurance directors meeting and a conference on Quality in the Space and Defense Industry.

A threat to safety in the form of weather emerged late in FY 1999 in the form of Hurricane Floyd. When the Category 5 storm was on a course for Cape Canaveral, managers promptly decided to close the Center for two days and arranged for the protection of facilities and equipment. Eventually the storm shifted northward, and damage at KSC proved relatively minor. A "rideout team" of 105 workers who volunteered to stay at KSC throughout the threat later received commendations from NASA Administrator Daniel S. Goldin.

KSC's ongoing preparations for all safety threats included a rescue training session at the Shuttle Landing Facility. Simulating a Shuttle crash landing (an unlikely occurrence), personnel rehearsed rescue procedures and communications. The simulation, involving an airlift by helicopter, provided valuable training for employees across several departments.

As part of the "safety culture shift," civil service employees were taught how to conduct safety area walkdowns. Safety training also



Above left: Center Director Roy Bridges conducts one of many safety area walkdowns.

focused on hazard recognition. The development of two courses, "Human Factors for Leaders" and "Human Factors for Investigators," promoted safety by placing emphasis on the role of human elements in daily processes. In addition, a safety and health element was included in the performance plan of every supervisor and manager.

KSC research on protecting the health of employees generated notable results. Studies proved the feasibility of a new, highly efficient form of air storage in the suits used by propellant handlers. Plans call for full prototype testing of the ensemble. Similarly, a design has been developed for an advanced, closed-circuit breathing apparatus that offers longer duration and lighter weight than current models. And a prototype of a liquid-cooling garment was developed to reduce the effects of heat during outdoor use. All of these innovations promise significant benefits for workers.

The Fitness Center in the Operations and Checkout building exercise facility was upgraded and expanded, drawing in more employees and increasing the likelihood of a healthier workforce. Other measures designed to improve employee health include the Cardiovascular Disease Risk Factor Intervention Program, an encephalitis health alert, and an industrial ventilation training class. KSC operates NASA's largest occupational health program with the most proactive programs for preventive medicine and environmental health.



KSC FITNESS
Center

"Build Teamwork and Reliance Everywhere"

KSC continued its efforts to join with other NASA centers and government, academia, and business in strategic alliances.

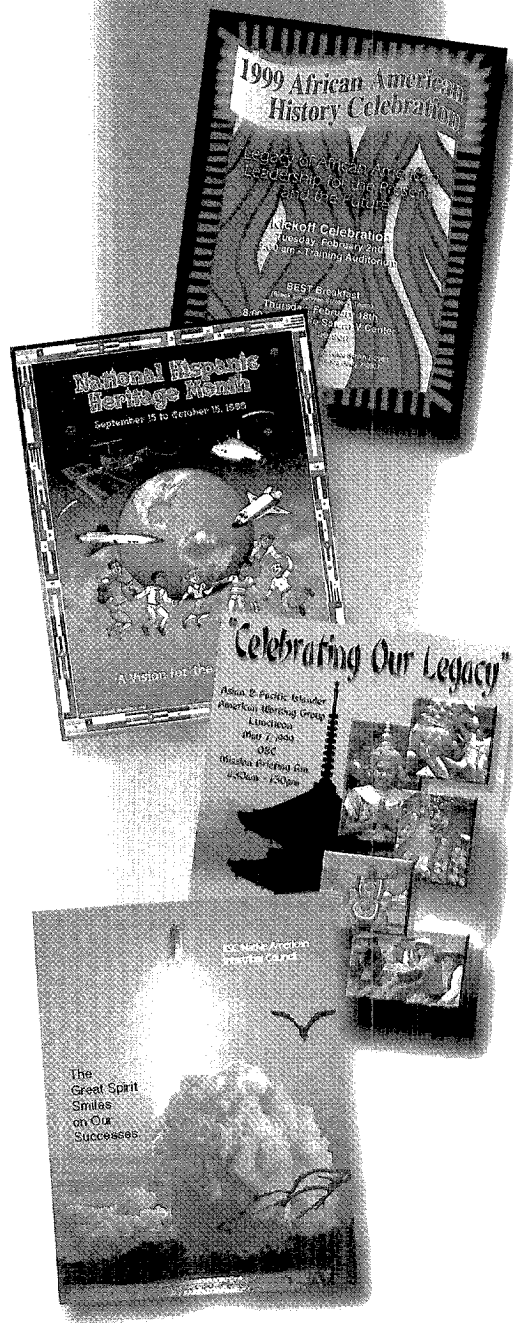
Here at the Cape Canaveral Spaceport, a vibrant new partnership drew national attention. The Joint Base Operations and Support Contract (JBOSC), an operational partnership among KSC, Cape Canaveral Air Force Station, and Patrick Air Force Base, drew much recognition and a Hammer Award by Vice President Al Gore.



The JBOSC acquisition team, composed of NASA and Air Force personnel, received the award for their pioneering achievements in consolidating the base support requirements of KSC, CCAFS, and PAFB into one joint contract, yielding projected savings in excess of \$500 million over 10 years.

KSC's offices of Joint Performance Management and Installation Operations reduced their oversight of JBOSC from 120 employees to 40. Meanwhile, representatives worked to refine the indicators used to assess contractor performance. The metric indicators have brought attention to areas where improved performance is required.

Special events designed to build pride and introduce employees to diversity in the workplace included African-American, Hispanic, Asian-American, and Native American celebrations and programs.





Center Director Roy Bridges stops to pet one of the Canine Companions for Independence dogs at a disability awareness fair.

Customer satisfaction initiatives:

- Approximately 80 percent of payload safety reviews are now conducted by mail or telephone through the streamlining efforts in International Space Station processing.
- KSC developed a draft charter for a new "one-stop shop" to offer a single point of contact for new customers as part of the Spaceport Technology Center concept.
- The Customer Advocacy and Customer Value Plan teams were established to acquire new tools, improve approaches, and deploy modern analysis tools.

In an effort to educate employees, their families and friends about various areas of the Center, an annual Open House is held. More than 36,700 employees and guests attended the KSC Open House on Saturday, Oct. 10, 1999. A featured display on early manned launches was organized at the Complex 14 blockhouse at Cape Canaveral Air Force Station.

Numerous expositions and fairs were held at KSC to inform employees about the resources of various organizations, both on Center and off. They included the Assistive/Accommodative Technology Fair, the third annual Community Services Expo, the Environmental and Energy Awareness Expo, and the 1999 Information Technology Exposition.

Other activities that helped KSC team members get to know each other better included the Eighth Annual Beat The Boss 5K Run And 2-Mile Walk, the 1999 KSC All-American Picnic, and Take Our Daughters to Work Day.

"Satisfy our Customers Anytime, Anywhere"

The Center continued to work on increasing customer satisfaction. To directly measure improvement efforts, KSC, the USAF 45th Space Wing, Spaceport Florida Authority, Enterprise Florida, Boeing, and Lockheed engaged a consulting firm, J.D. Power and Associates, to determine the level of customer satisfaction with the Cape Canaveral Spaceport. The partnership group analyzed the results of the J.D. Power and Associates' study and started plans to close the gap between customer expectations and delivery of products or services.



KSC workers strive to satisfy their customers' needs. Here the obviously happy customer is STS-93 Commander Eileen Collins.

"Environmental Leadership"

KSC continued its excellent overall record during environmental audits and inspections conducted by federal, state, and local regulatory agencies since 1991. This excellent record has drawn many agencies to use the Center as a model, resulting in several tours and training sessions for external organizations.

In one of its most comprehensive environmental projects yet, KSC entered an agreement with four other government agencies to study procedures used to remove contamination from ground water at Launch Complex 34. Another technique developed by workers on ground water treatment has been tested, with a patent application submitted.

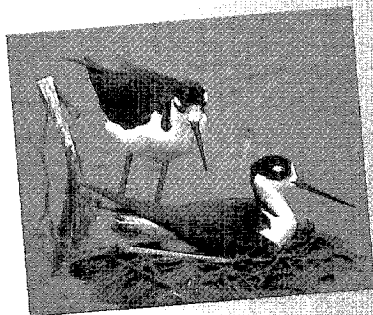
One of many continuing environmental projects resulted in a Federal Energy and Water Management Award. The award recognized the implementation of a rinse water recycling system at the Parachute Refurbishment Facility, where more than 250,000 gallons of water are now saved annually. The teaming effort between operators and regulators produced a solution that benefited both.

Hazardous waste, as a result of Shuttle ground operations, continued to decline. Those operations generated significantly less than the projected amount of hazardous waste during FY 1999. At the same time, improved efficiencies and substitutions of materials allowed KSC to complete its phaseout of the ozone-depleting refrigerant R114 two years ahead of schedule.

NASA and contractor engineers replaced 24,000 pounds of refrigerant at 12 sites during available windows of opportunity while continuing to support routine operations and maintenance tasks. Ozone-depleting chlorofluorocarbons (CFCs) now have been eliminated from all Shuttle ground cooling operations.

KSC also consumed less energy during FY 1999, largely due to energy conservation projects by NASA and its contractors. Efforts to achieve government-mandated energy reductions included improvements to lighting systems in the Vehicle Assembly Building. KSC completed surveys of the environmental effects of exterior lighting at several facilities, with changes at the Solid Rocket Booster Recovery Facility reducing exterior lighting by about half. The Center also completed surveys on sea turtle orientation in relation to lighting.

The Center demonstrated its concern for wildlife in several ways, including continued population studies of scrub jays, manatees, indigo snakes, beach mice, gopher tortoises, and sea turtles at the Merritt Island National Wildlife Refuge, which with KSC shares a boundary. Work continued on a scrub jay risk model.



KSC participates in an environmental agreement with four other government agencies.

KSC completed plans for managing future use of wetlands and scrub land and supported the development of a habitat suitability model for scrub oak environments.

KSC had several other environmental accomplishments:

- In a cooperative effort with NASA, academia, and industry, the second phase in the research and development of a new technology to reduce emissions of a pollutant from stationary combustion sources was completed. The technology has high potential for commercial transfer.
- Scientists used a laser mapping system to develop a high-resolution digital model of KSC lands that can be used for such activities as surface water modeling, threatened and endangered species habitat studies, and controlled burns.
- Environmental Protection Agency investigations of 33 sites were closed.
- An annual study showed that toxic releases during 1998 decreased by 44 percent from the previous year, largely as a result of freon recycling and reuse.
- KSC performed tests of stainless steel alloy samples to replace current material used on ground support equipment and flight hardware in hopes of reducing or eliminating replacement costs resulting from deterioration.

Looking Toward the Future

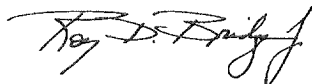
NASA and KSC are looking forward to the workforce revitalization with hiring in critical skill areas after several years of staff reductions. Plans are for NASA's budget to increase over the next five years. The national support for greater investment in technology should benefit NASA and KSC.

At the same time, reorganizing through the KSC 2000 Team will enable KSC to operate in a more streamlined manner. The new structure will focus the emerging Spaceport Technology Center and feature a "one-stop-shopping" philosophy to better serve customers. The new framework will allow the complementary functions of ground operations and technology development to become stronger.

Excellence and safety for Space Shuttle operations, Expendable Launch Vehicle missions, the International Space Station, and new payloads will have emphasis to meet our customers' requirements safely. Concurrently, KSC will continue to build a reputation as a technology resource for future space transportation systems.

New partnerships with industry, academia, and government promise to create dramatic new opportunities for the next decade and beyond. The proposed Space Experiment Research and Processing Laboratory at the new 400-acre Space Station Commerce Park is just one example. The laboratory will support the development of commercial, NASA, and other government experiments to fly aboard the Space Station, and spinoff even more opportunities.

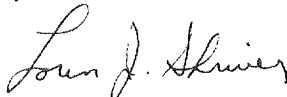
At KSC, our people dramatically demonstrate flexibility and creativity in responding to changing needs. They work at KSC to be a part of a great and growing space program. And no matter how many payloads they process or launches they support, they feel the excitement and share in the accomplishment each time they see and hear a Shuttle or ELV racing skyward.



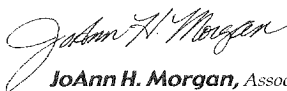
Roy D. Bridges, Jr., Center Director



James Jennings, Deputy Director for Business Operations



Loren J. Shriver, Deputy Director for Launch & Payload Processing



JoAnn H. Morgan, Associate Director for Advanced Development & Shuttle Upgrades



National Aeronautics and Space Administration
John F. Kennedy Space Center
 Kennedy Space Center, FL 32899

Statement of the Chief Financial Officer

The Fiscal Year (FY) 1999 financial statements (unaudited) have been prepared to report the financial position and results of NASA's Kennedy Space Center 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 have been 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 practice; and
- Accounting principles published by other authoritative sources.

NASA Headquarters, which receives its funding through annual Congressional appropriations, authorizes and funds KSC operations. KSC's total operational expenses for FY 1999 by appropriation were

<u>Appropriation</u>	<u>Amount</u> <u>(in thousands)</u>
Mission Support	\$ 291,399
Human Space Flight	445,378
Science, Aeronautics, and Technology	458,765
Construction of Facilities	2,792
Research and Development	2,647
Research and Program Management	3
Space Flight Control and Data Communications	377
Total Expenses	\$ 1,201,361

The 1999 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 STATEMENTS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

JOHN F. KENNEDY SPACE CENTER

ANNUAL REPORT FY 1999

Statement of Financial Position

As of September 30, 1999 (In Thousands)

Financial Notes 1 through 8 on the following pages

<i>Assets:</i>	<u>1999</u>	<u>1998</u>
Intragovernmental Assets:		
Fund Balance With Treasury (Note 2)	\$ 502,299	\$ 257,696
Accounts Receivable, Net (Note 3)	10,345	7,168
Governmental Assets:		
Accounts Receivable, Net (Note 3)	1,630	1,423
Advances, and Prepayments	260	477
Property, Plant, and Equipment (Note 4)	1,996,953	1,806,073
Other Assets (Note 5)	112,684	120,359
<i>Total Assets</i>	<u>\$ 2,624,171</u>	<u>\$ 2,193,196</u>
<i>Liabilities:</i>		
Liabilities Covered by Budgetary Resources:		
Intragovernmental Liabilities:		
Accounts Payable	\$ 16,092	\$ 20,922
Other Liabilities (Note 6)	(143)	425
Governmental Liabilities:		
Accounts Payable	277,390	89,109
Other Liabilities (Note 6)	12,728	12,732
<i>Total</i>	<u>\$ 306,067</u>	<u>\$ 123,188</u>
Liabilities not Covered by Budgetary Resources:		
Intragovernmental Liabilities:		
Other Liabilities (Note 6)	\$ 418	\$ 57
Governmental Liabilities:		
Other Liabilities (Note 6)	15,546	16,853
<i>Total</i>	<u>\$ 15,964</u>	<u>\$ 16,910</u>
<i>Total Liabilities</i>	<u>\$ 322,031</u>	<u>\$ 140,098</u>
<i>Net Position (Note 7):</i>		
Unexpended Appropriations	\$ 208,468	\$ 143,576
Invested Capital	2,109,636	1,926,432
Cumulative Results of Operations	0	0
Future Funding Requirements	(15,964)	(16,910)
<i>Total Net Position</i>	<u>\$ 2,302,140</u>	<u>\$ 2,053,098</u>
<i>Total Liabilities & Net Position</i>	<u>\$ 2,624,171</u>	<u>\$ 2,193,196</u>

The accompanying notes are an integral part of these statements.

FINANCIAL STATEMENTS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

JOHN F. KENNEDY SPACE CENTER

ANNUAL REPORT FY 1999

Statement of Operations and Changes in Net Position

For the Year Ended September 30, 1999 (In Thousands)

Financial Notes 1 through 8 on the following pages

	<u>1999</u>	<u>1998</u>
Revenues and Financing Sources:		
Appropriated Capital Used	\$ 1,061,997	\$ 389,196
Revenues from Sales of Goods and Services:		
To the Public	4,032	4,255
Intragovernmental	135,332	17,044
Other Revenues and Financing Sources (Note 8)	975	491
Less: Receipts Transferred to Treasury	(975)	(491)
Total Revenues and Financing Sources	<u>\$ 1,201,361</u>	<u>\$ 410,495</u>
Expenses:		
Program or Operating Expenses by Appropriation:		
Mission Support	\$ 287,593	\$ 256,223
Human Space Flight	363,057	89,089
Science, Aeronautics, and Technology	405,513	31,392
Construction of Facilities	2,792	12,387
Research and Development	2,647	196
Research and Program Management	3	2
Space Flight Control and Data Communications	376	(93)
Reimbursable Expenses	139,380	21,299
Total Expenses	<u>\$ 1,201,361</u>	<u>\$ 410,495</u>
Total Expenses in Excess of Revenues and Financing Sources	<u>0</u>	<u>0</u>
Nonoperating Changes:		
Unexpended Appropriations (Note 7)	\$ 64,892	\$ 1,611
Invested Capital (Note 7)	183,204	(555,491)
Future Funding Requirements (Note 7)	946	(384)
Change in Net Position	<u>\$ 249,042</u>	<u>\$ (554,264)</u>
Net Position, Beginning Balance	<u>2,053,098</u>	<u>2,607,362</u>
Net Position, Ending Balance	<u>\$ 2,302,140</u>	<u>\$ 2,053,098</u>

The accompanying notes are an integral part of these statements.

FINANCIAL STATEMENTS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

JOHN F. KENNEDY SPACE CENTER

ANNUAL REPORT FY 1999

Notes to the Financial Statements For the Year Ended September 30, 1999

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 aide 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 1,665 civilian employees and processes approximately 6,681 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.

Seven 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 Research and Development (R&D) appropriation, which was restructured and replaced in the 1995 budget, includes research and development of aeronautics and space, space vehicles, space systems effort, related institutional activities, minor construction repair, maintenance, rehabilitation, and modifications.
- (5) The Space Flight, Control, and Data Communications (SFCDC) appropriation, which was restructured and replaced in the 1995 budget, includes production, operations, and support activities for the Space Transportation System, which includes the Space Shuttle and expendable launch vehicles. The appropriation also provides for tracking, telemetry, command, and data acquisition support of all flight projects.
- (6) The Construction of Facilities (CofF) appropriation, which was restructured and replaced in the 1995 budget, includes the construction of new facilities and the repair, rehabilitation, and modification of facilities.
- (7) The Research and Program Management (R&PM) appropriation which was restructured and replaced in the 1995 budget, includes salaries, travel, and related expenses for the civil servants in support of NASA programs.

In addition to the basic operating programs described above, KSC expenditures in FY 1999 included \$139 million of reimbursable activity.

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 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 and NASA's Office of the Inspector General.

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. Nongovernment customers are required to provide advance payments which are placed on deposit with the U.S. Treasury until services are performed. In unusual cases, exceptions and waivers to this general rule have been granted under the Space Act, allowing customers to postpone advance payments.

Notes to the Financial Statements (cont'd.) For the Year Ended September 30, 1999**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 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.

Automated data processing software is costed as an operating expense when acquired rather than capitalized in accordance with GAO Title II guidelines.

Equipment with a unit cost of \$100,000 or more and a useful life of 2 years or more, that will not be consumed in an experiment, 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 or 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, space hardware, special tooling, and special test equipment. Contractors are directed to annually report plant equipment costing \$100,000 or more and having a useful life of 2 years and which will not be consumed in an experiment. Reporting is also required for special test equipment, special tooling, materials, and space hardware which, for the most part, includes items that are in excess of \$100,000; however, reporting on all such items is required and their total value is included in the statement of financial position. Contractors report, as of September 30, on a NASA Form 1018, Report of Government-owned/Contractor-held Property, is certified by the contractor's representative and reviewed by a Government property administrator.

Contractor-held space hardware includes flight pallets, mission peculiar experiment support structures, spacelab, transfer tunnel, igloo assembly 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 required for cost-type contracts exceeding \$500,000 where space hardware costs exceed \$75,000. These items are priced in accordance with guidance set forth in a NASA supplement to the FAR. The valuation policy allows for use of actual or estimated costs, which may be abstracts of data from contractors' records, computations based upon engineering estimates, estimates from NASA contractor financial management reports, formula procedures, latest acquisition/pricing estimates, or other approved methods.

Notes to the Financial Statements (cont'd.) For the Year Ended September 30, 1999**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 3-year appropriations for construction activities, 2-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.

Notes to the Financial Statements (cont'd.) For the Year Ended September 30, 1999**2. Fund Balance with Treasury:**
(In Thousands)

<i>Fund Balances:</i>	<u><i>Obligated</i></u>	<u><i>Unobligated Available</i></u>	<u><i>Unobligated Restricted</i></u>	<u><i>Fund Balance</i></u>
Appropriated Funds	\$ 446,853	\$ 43,101	\$ 12,280	\$ 502,234
Deposit Funds				0
Suspense/Clearing Accounts				65
<i>Total Fund Balance with Treasury</i>				<u><u>\$ 502,299</u></u>

3. Accounts Receivable, Net:
(In Thousands)

	<u><i>Entity Accounts Receivable</i></u>	<u><i>Non-Entity Accounts Receivable</i></u>	<u><i>Allowance for Uncollectible Receivables</i></u>	<u><i>Net Amount Due</i></u>
Intragovernmental	\$ 10,345	\$ 0	\$ 0	\$ 10,345
Governmental	1,308	1,253	(931)	1,630
<i>Total</i>	<u><u>\$ 11,653</u></u>	<u><u>\$ 1,253</u></u>	<u><u>\$ (931)</u></u>	<u><u>\$ 11,975</u></u>

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

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

	<u><i>1999</i></u>	<u><i>1998</i></u>	<u><i>Change</i></u>
Government-owned/Government-held:			
Land	\$ 73,672	\$ 73,672	\$ 0
Structures, Facilities, and Leasehold Improvements	1,383,596	1,399,861	(16,265)
Equipment	218,012	29,386	188,626
Work in Progress	3,585	38,508	(34,923)
<i>Total</i>	<u><u>\$ 1,678,865</u></u>	<u><u>\$ 1,541,427</u></u>	<u><u>\$ (137,438)</u></u>
Government-owned/Contractor-held:			
Structures and Facilities	\$ 7,660	\$ 0	\$ 7,660
Equipment	60,238	50,130	10,108
Special Tooling	980	1,239	(259)
Special Test Equipment	65,412	58,227	7,185
Space Hardware	182,864	154,215	28,649
Work in Process	934	835	99
<i>Total</i>	<u><u>\$ 318,088</u></u>	<u><u>\$ 264,646</u></u>	<u><u>\$ 53,442</u></u>
<i>Total Property, Plant, and Equipment</i>	<u><u>\$ 1,996,953</u></u>	<u><u>\$ 1,806,073</u></u>	<u><u>\$ 190,880</u></u>

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

Notes to the Financial Statements (cont'd.) For the Year Ended September 30, 1999**5. Other Assets:**
(In Thousands)

	<u>1999</u>	<u>1998</u>	<u>Change</u>
Contractor-held Materials:	\$ 112,684	\$ 120,359	\$ (7,675)
Total	\$ 112,684	\$ 120,359	\$ (7,675)

6. Other Liabilities:
(In Thousands)

Liabilities Covered by Budgetary Resources:

	<u>Current</u>	<u>Non-Current</u>	<u>Total</u>
Intragovernmental Liabilities:			
Liability for Deposit and Suspense Funds:	\$ (143)	\$ 0	\$ (143)
Total	\$ (143)	\$ 0	\$ (143)
Governmental Liabilities:			
Liability for Deposit and Suspense Funds:	\$ 3,014	\$ 0	\$ 3,014
Accrued Funded Payroll and Benefits	9,714	0	9,714
Total	\$ 12,728	\$ 0	\$ 12,728

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:

Intragovernmental Liabilities:

	<u>Current</u>	<u>Non-Current</u>	<u>Total</u>
Accounts Payable for Closed Appropriations	\$ 0	\$ 418	\$ 418
Total	\$ 0	\$ 418	\$ 418
Governmental Liabilities:			
Accounts Payable for Closed Appropriations	\$ 0	\$ 2,141	\$ 2,141
Contingent Liabilities	0	1,276	1,276
Unfunded Annual Leave	0	12,129	12,129
Total	\$ 0	\$ 15,546	\$ 15,546

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

Notes to the Financial Statements (cont'd.) For the Year Ended September 30, 1999**7. Net Position:**
(In Thousands)

	1999 <i>Appropriated Funds</i>	1998 <i>Appropriated Funds</i>	<i>Change</i>
Unexpended Appropriations:			
Undelivered	\$ 153,087	\$ 82,105	\$ 70,982
Unobligated:			
Available	43,101	48,869	(5,768)
Unavailable	12,280	12,602	(322)
	<u>\$ 208,468</u>	<u>\$ 143,576</u>	<u>\$ 64,892</u>
Invested Capital	<u>\$ 2,109,636</u>	<u>\$ 1,926,432</u>	<u>\$ 183,204</u>
Cumulative Results	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>
Future Funding Requirements:			
Annual Leave	\$ (12,129)	\$ (12,835)	\$ 706
Closed appropriations	(2,559)	(2,956)	397
Other	(1,276)	(1,119)	(157)
	<u>\$ (15,964)</u>	<u>\$ (16,910)</u>	<u>\$ 946</u>
Total	<u><u>\$ 2,302,140</u></u>	<u><u>\$ 2,053,098</u></u>	<u><u>\$ 249,042</u></u>

Notes to the Financial Statements (cont'd.) For the Year Ended September 30, 1999**8. Other Revenues and Financing Resources:***(In Thousands)*

	<u>1999</u>	<u>1998</u>
General Fund Proprietary Receipts	\$ 975	\$ 491
<i>Total</i>	<u>\$ 975</u>	<u>\$ 491</u>

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



