Oct. 27, 2000 Vol. 39, No. 21

Spaceport News

America's gateway to the universe. Leading the world in preparing and launching missions to Earth and beyond.

http://www-pao.ksc.nasa.gov/kscpao/snews/snewstoc.htm John F. Kennedy Space Center

100 missions launched!

Inside

Discovery, carrying the STS-92 astronauts and payload, ascends on the 100th Shuttle mission launch.

Discovery roars off to Space Station

Kennedy Space Center and the world watched the blazing beginning of the 100th Shuttle mission launch as Discovery lifted off on STS-92 at 7:17 p.m. EDT on Oct. 11.

Viewers murmured and cheered as the Shuttle rose and left a plume colored orange and yellow by the setting sun. The Solid Rocket Boosters glittered like twin stars after they separated from Discovery and dropped toward the Atlantic Ocean.

The flawless launch followed three scrubbed attempts. Weather and technical issues stalled the mission's beginning for six days, building anticipation for the historical liftoff.

STS-92 begins the core of International Space Station construction on orbit and opens the door for the arrival of the first resident crew, Expedition One, expected to launch from Russia in late October. Discovery will deliver an exterior framework called the Z1 Truss and a third mating adapter, which the astronauts will attach.

With the 100th Shuttle mission launch, the Space Shuttle has launched about 3 million pounds of cargo and 596 passengers into space. More than 850 payloads will have flown, and the Shuttle will have deployed more than 60 payloads and retrieved more than two dozen.

The Shuttle has supported two space stations; made three maintenance flights to the Hubble Space Telescope; launched planetary missions to study Jupiter, Venus and the Sun; and conducted hundreds of studies of the effects of weightlessness on materials, plants, animals and human beings.

Although flying for two decades, the Shuttle still has more than three-quarters of its design lifetime available.

X-15 led to development of Space Shuttle

In 1954, shortly after the first test launch of the Redstone rocket on Aug. 20, 1953, *Colliers Magazine* carried articles written by a committee of aerospace experts, including rocket science pioneer Wernher von Braun, concerning the possibility of a reusable Earth-to-orbit space transportation system.

Today, we call that reusable system the Space Shuttle.

It took less than a decade for the discussion to take form.

The U.S. Air Force devised one of the first American concepts for a shuttlecraft in 1962. It was an extension of Air Force Project 1226, the X-15 project. From 1959 to 1968, 199 X-15 flights were made.

The X-15 was originally tested by the Air Force as a 50-foot single-seat rocket aircraft launched from under the wing of a converted B-52 bomber. It could fly at speeds up to Mach 6.7 or 4,534 mph, a record reached in 1967. That record stood until the return of the Space Shuttle Columbia from its first mission in 1981.

The X-15 reached an altitude of 67 miles in 1963. Fifty miles was considered the threshold of space.

Among the dozen X-15 pilots were Neil Armstrong, who became the first man to walk on the Moon, and Joe Engle, commander for Space Shuttle missions STS-2 in 1981 and STS 51-I in 1985.

In an extension of the X-15's initial configuration, the Air Force shuttlecraft concept – which was never fully realized – was to bolt an X-15, modified with a slender delta-wing, to the back of an XB-70A Valkyrie aircraft and launch it at supersonic speeds. Although the proposal never made it past wind-tunnel studies, the idea of a reusable shuttle vehicle was far from dead.

Other experimental shuttle prototypes to emerge before the Space Shuttle fleet was built included the X-20, or Dyna-Soar.

Under development from 1960 to 1963, it was a design for a small single-seat suborbital or orbital shuttlecraft to be launched by a Titan rocket. The Dyna-Soar program was cancelled in 1963, before the vehicle was ever flown, in favor of model testing via the ASSET program.

> *"The key to the future exploration and use of space is the reusable Earth-to-orbit transport system."*
>
> **WERNHER VON BRAUN**
> ROCKET SCIENCE PIONEER

ASSET (Aerothermodynamic/elastic Structural Systems Environmental Tests) was the name of six small gliders designed by the McDonnell Aircraft Corp. for the Air Force. The gliders were used primarily to test issues of aerodynamics and thermal protection. The successful project demonstrated between 1963 and 1965 that winged reentry vehicles could safely traverse the upper atmosphere.

PRIME (Precision Recovery Including Maneuvering Entry) was the name for three Air Force launches made between 1966 and 1967. The launches explored the problems of maneuvering reentry at near-orbital speeds. After the third PRIME launch, the vehicle was found to be in satisfactory condition to be launched again, further demonstrating the reusability of reentry spacecraft.

Other projects conducted during the 1960s, which provided data important to the design of the Space Shuttle orbiter, included the M2 and HL-10, both lifting bodies used to test vehicle handling at transonic speeds.

With the announcement of the cancellation of the last three Apollo lunar landing missions in 1970, NASA made development of a reusable Space Shuttle – which would offer routine, repetitive, affordable flights to and from Earth orbit – its top-priority program, over the Space Station.

Support for the Shuttle from the Department of Defense and the space industrial community provided leverage for this priority shift and helped secure Congressional approval for the funding needed.

Among the dozen U.S. Air Force X-15 pilots was Joe Engle, pictured at left with an X-15. Engle served as commander for Space Shuttle missions STS-2 in 1981 and STS 51-I in 1985.

An X-15 lands on a lakebed in 1961. The X-15 was a 50-foot single-seat rocket aircraft launched from under the wing of a converted B-52 bomber. The vehicle, a precursor to the Shuttle, brushed the threshold of space.

In 1972, NASA authorized Rockwell International's Space Division to proceed with the development of the Space Shuttle.

The collection of research data continued in the 1970s with the X-24 project, which featured manned lifting bodies testing vehicle handling at transonic speeds.

In particular, the X-24B flew 36 times between 1973 and 1975 with some simulated shuttle landings on concrete runways at Edwards Air Force Base, Calif. One of the X-24B pilots was Dick Scobee who was pilot of STS 41-C and commander of the ill-fated STS 51-L.

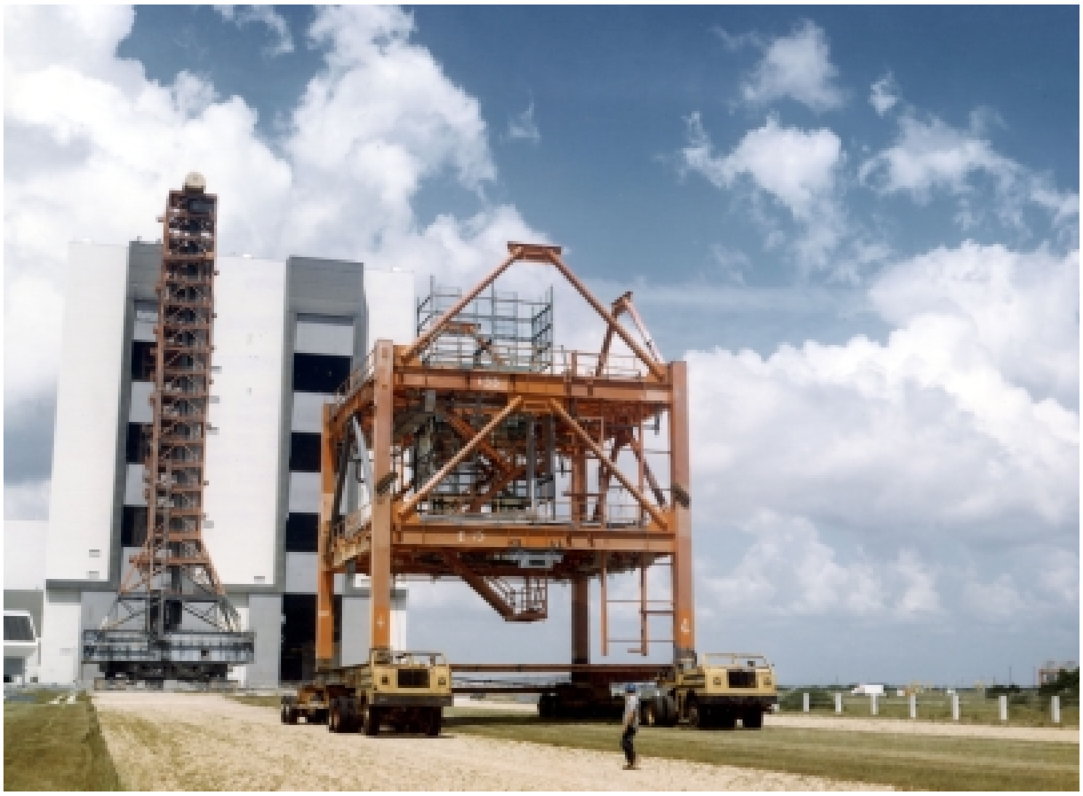
Even now, as the Space Shuttle completes its 100th flight and assembly of the International Space Station escalates, Wernher von Braun's words from 1972 still ring true: "The key to future exploration and use of space is the reusable Earth-to-orbit transport system."

To learn more about the X-15 and other early space vehicles, visit the Air Force Space and Missile Museum at Cape Canaveral Air Force Station. The museum features a variety of educational displays and docent tours.

Kennedy Space Center Visitor Complex offers a special-interest bus tour called "Cape Canaveral: Then and Now." The guided tour features a stop at the museum and other points of interest to early space program history buffs.

Copies of *Hypersonics Before the Shuttle: A Concise History of the X-15 Research Airplane* (NASA SP-2000-4518) by Dennis R. Jenkins is available by sending a self-addressed 9-by-12-inch envelope with postage for 15 ounces (typically $3.20 within the U.S.) to the NASA History Office, Code ZH, Washington, DC 20546.

— Kay Grinter



As part of Shuttle program modifications to Apollo era facilities, a launch umbilical tower, above, is detached from the Mobile Launcher to be transported, at left, to Launch Pad 39A.

Shuttle program uses early structures

"Reusable" is one of the driving concepts of the Space Shuttle program, and the facilities and hardware at Kennedy Space Center turned out to be that, too – reusable.

Originally built to support Saturn V launches during the Apollo program, planners were directed to take full advantage of existing structures and to schedule new construction only when a unique need made it a requirement.

Only two new facilities were needed: hangars to provide convenient access to the Shuttle orbiters during processing and a landing strip since the new vehicle would land on solid ground, rather than splash down in the ocean.

Two connected hangars, called the Orbiter Processing Facility (OPF), were constructed to provide a cleanroom-like environment in which the orbiters could be processed. A third OPF bay was built in 1991 by modifying the Orbiter Modification and Refurbishment Facility.

The Shuttle Landing Facility was built for end-of-mission landings. It is still one of the world's largest runways at 15,000-feet long and 300-feet wide with 1,000-foot overruns.

All of the other necessary Space Shuttle support facilities were created by modifying existing facilities and hardware.

Two of the four firing rooms in the Launch Control Center were equipped with the consoles, computers and associated equipment known as the launch processing system.

Especially developed for the Shuttle program, this system was so sophisticated that only about one-fifth of the manpower required to conduct the checkout and launch for an Apollo mission was needed for a Space Shuttle mission.

And with the new system, the final countdown for the Shuttle was compressed from the 28 hours needed for an Apollo launch to two and one-half hours.

John T. Conway, director of Information Systems, of which the Launch Processing System Division was a part when STS-1 launched, recalls: "The big challenge was that this was the first time KSC was entrusted by NASA with the entire responsibility for the development of a critical launch checkout system. Previously, in the Apollo and Skylab programs, much of the checkout equipment was heritage Marshall and JSC.

"The first Shuttle launch attempt required us to operate all of the firing room consoles continuously for a period of almost 48 hours without any of them going down."

And for the first time ever – none went down!

"It was a high point of my career and my greatest sigh of relief over any success," Conway said. "Our success was 100 percent attributable to the dedication and ability of the hundreds of people who served on the STS-1 launch team."

Other major structures that were modified:

In the Vehicle Assembly Building (VAB), changes were made in two of the four high bays to equip them for the assembly of Shuttle vehicles. Work platforms had to be reshaped to fit the Shuttle configuration. The other two high bays were modified to prepare them for processing the solid rocket motors and external tanks.

All the structures on the surface of the Apollo launch pads at Complex 39 were removed with the exception of the six fixed pedestals at each pad. The pedestals that hold the Modified Launchers, renamed Mobile Launcher Platforms for the Shuttle program, also held the Mobile Launchers for the Apollo-Saturn vehicles.

The most obvious change to the Mobile Launchers was the absence of each launcher's 380-foot tall umbilical tower complete with nine swing arms and large crane. The upper portions of the towers were dismantled and installed at the pads to serve as fixed service structures. A new Rotating Service Structure was built at each pad to provide environmentally controlled conditions for inserting vertically handled payloads in the orbiter payload bay.

Another change in the Mobile Launcher Platforms was the replacement of one large hole at the center of each platform with three smaller openings to accommodate the liftoff flames and hot exhaust gases emitted from the orbiter's main engines and twin solid rocket boosters.

Other structures and buildings modified included Hangar AF on Cape Canaveral Air Force Station that now serves as the solid rocket booster disassembly facility where booster segments are cleaned.

The Hypergolic Maintenance Facility was modified to process orbiter components.

The Operations and Checkout Building, designed for the assembly and checkout of Apollo spacecraft modules, was converted to process horizontal Shuttle payloads.

The Shuttle program reaped tremendous cost savings by reusing these facilites and proved the ingenuity of KSC team members in successfully altering them to serve modern demands.

— Kay Grinter

Historical Shuttle mission highlights

STS-1
Columbia, the first operational orbiter in the Shuttle program, launched April 12, 1981, with two astronauts. Systems performed successfully on this first Space Transportation System (STS) flight.
STS-2
Columbia launched Nov. 12, 1981. The mission included first tests of the remote manipulator system. The first Shuttle payload was the Office of Space and Terrestrial Applications-1 (OSTA-1).
STS-4
The June 27, 1982, launch of Columbia was the final STS research and development flight.
STS-5
Columbia launched Nov. 11, 1982, with the first expanded crew of four.
STS-6
The first flight of Challenger, launched April 4, 1983. The payload included the first Tracking and Data Relay Satellite (TDRS-1). First spacewalk of the Shuttle program performed by Donald Peterson and Story Musgrave.
STS-7
Sally Ride became the first American woman to fly in space, when Challenger launched June 18, 1983. First crew of five.
STS-8
Guion Bluford Jr. became the first African-American to fly in space. Challenger launched Aug. 30, 1983.
STS-9
Columbia launched on Nov. 28, 1983, with the first crew of six.
STS-41-B
First untethered space walks by Bruce McCandless and Robert Stewart. Challenger launched Feb. 3, 1984. First end-of-mission landing at KSC.
STS-41-D
First flight of the orbiter Discovery, launched on Aug. 30, 1984.
STS-41-G
Astronaut Kathryn Sullivan became the first American woman to walk in space. Challenger launched Oct. 5, 1984.
STS-51-C
First dedicated Department of Defense mission. Discovery launched Jan. 24, 1985.
STS-51-D
First crew of seven, launched April 12, 1985, aboard Discovery.

Columbia heads skyward on on STS-1, the first Space Shuttle mission, which was launched on April 12, 1981.

STS-51-B
First operational flight for Spacelab (Spacelab-3) orbital laboratory series developed by European Space Agency (ESA). Challenger launched April 29, 1985.
STS-51-F
Center Director Roy Bridges served as pilot aboard Challenger, launched on July 29, 1985.
STS-51-J
First flight of orbiter Atlantis, launched Oct. 3, 1985.
STS-51-L
Challenger launched Jan. 28, 1986. Explosion 73 seconds after liftoff claimed crew and vehicle.
STS-26
Return to flight. Discovery launched Sept. 29, 1988.
STS-30
Magellan/Venus radar mapper spacecraft launched on Atlantis May 4, 1989.
STS-34
Galileo/Jupiter spacecraft launched on Atlantis Oct. 18, 1989.
STS-31
Hubble Space Telescope launched aboard Discovery April 29, 1990.
STS-41
ESA-built Ulysses spacecraft, designed to explore polar regions of the sun, launched aboard Discovery Oct. 6, 1990.
STS-49
First flight of orbiter Endeavour, launched May 7, 1992. Four spacewalks – a record at the time – to capture and redeploy Intelsat satellite, which had been stranded in an unusable orbit.
STS-50
First flight of U.S. Microgravity Laboratory-1, featuring pressurized Spacelab module. Launched June 25, 1992, on Columbia.
STS-47
Endeavour launched on Sept. 12, 1992. Mae Jemison became the first African-American woman to fly in space; Mark Lee and Jan Davis first married couple in space.
STS-57
First flight of SPACEHAB. Endeavour launched June 21, 1993.
STS-61
First Hubble servicing mission; included record-setting five back-to-back space walks. Endeavour launched Dec. 2, 1993.
STS-60
Sergei Krikalev became the first Russian cosmonaut to fly on Shuttle. Discovery launched Feb. 3, 1994.
STS-63
Eileen Collins became the first female Shuttle pilot. First approach and flyaround by Shuttle with Russian Space Station Mir. Discovery launched Feb. 3, 1995.
STS-71
Atlantis launched June 27, 1995, marking the 100th U.S. human space launch conducted from Cape Canaveral. First docking with Mir.
STS-76
Launch of Atlantis on March 22, 1996, included transfer of Shannon Lucid to Mir. The first American woman to live aboard the station, she set a U.S. and world record.
STS-80
Columbia launched Nov. 19, 1996, on what would become longest Shuttle flight of 17 days, 15 hours, 54 minutes and 28 seconds.
STS-82
Second Hubble Telescope servicing mission, launched aboard Discovery Feb. 11, 1997.
STS-90
Columbia launched April 17, 1998, carrying Neurolab. The crew included Kay Hire, the first KSC employee to be chosen as an astronaut candidate.
STS-91
Final Shuttle-Mir docking. Discovery launched June 2, 1998.
STS-95
Discovery launched Oct. 29, 1998. The crew included John Glenn, returning to space more than 36 years after he became the first American to orbit the Earth.
STS-88
Endeavour launched Dec. 4, 1998, on first flight for assembly of International Space Station (ISS), mating the Unity connecting module with the Russian Zarya control module. Astronaut Jerry Ross made his seventh spacewalk setting a new record.
STS-96
Discovery launched May 27, 1999, on the second assembly flight and first docking to the ISS.
STS-93
The Chandra X-ray Observatory was launched aboard Columbia July 23, 1999. The mission was the first to be commanded by a woman, Eileen Collins.
STS-106
Atlantis launched on Sept. 8, 2000, to prepare the Space Station for its first long-term resident crew.

— Anita Barrett

Challenger accident changed program

Crew who gave so much always remembered

The STS-51-L crew from left to right: Payload Specialists Christa Corrigan McAuliffe and Gregory Jarvis, Mission Specialist Judith Resnick, Commander Francis "Dick" Scobee, Mission Specialist Ronald McNair, Pilot Michael Smith and Mission Specialist Ellison Onizuka.

It was a bright, cold January morning, and we felt like our hearts had just been ripped from our chests and slammed to the ground.

Looking skyward, a long white cloud hung over the Atlantic. The billowing plume of booster exhaust, forked at the top, was dissipating in the air.

Life at KSC had changed forever.

Losing the crew was the worst part of the accident. Machines and hardware can be replaced. (And it was. Endeavour was built four years later to replace Challenger.)

But the seven members of the STS-51-L flight now exist as memories.

For the workers at KSC who trained them, worked beside them, and watched them with awe from the hallways and sidewalks, personal memories are the key links to them that remain.

Fourteen years have passed since the Challenger accident, and the Shuttle program has not only recovered, it has excelled.

Seventy-five safe and successful Shuttle missions have launched since that morning on Jan. 28, 1986.

Following the accident, NASA conducted an exhaustive review to fully understand the causes of the tragedy. Then NASA very methodically made extensive changes to several critical systems in an effort to promote safety.

On June 6, 1986, the Presidential Commission of the Space Shuttle Challenger Accident (a.k.a. the Rogers Commission, named after it's chairman, William P. Rogers) submitted its report to President Ronald Reagan. One week later, President Reagan directed NASA Administrator James C. Fletcher to implement those recommendations as soon as possible.

President Reagan wrote: *"… the men and women of NASA and the tasks they so ably perform are essential to the nation if we are to retain our leadership in the pursuit of technology and scientific progress. Despite misfortunes and setbacks, we are determined to press on in our space program. Again, Jim, we turn to you for leadership. You and the NASA team have our support and our blessings to do what has to be done to make our space program safe, reliable, and a source of pride to our nation and of benefit to all mankind…"*

Ultimately, the Rogers Commission made nine recommendations for restructuring the Shuttle program and safely returning to flight.

Some of the technical changes include

- The Solid Rocket Motors and addition of an extra O-ring to the joints between the rocket segments were redesigned;
- Heaters were added to the booster joints;
- Extensive landing safety improvements were made, including upgrades to the orbiter's tires and brakes;
- Nose wheel steering and a drag chute system were added;
- A launch abort and crew escape system were added.

In addition, the Space Shuttle program was reorganized to ensure all necessary information was available to managers at all levels and the flight rate was thoroughly examined.

The Rogers Commission also recommended that experienced astronauts be placed in senior positions within the program structure.

Immediately following the accident, all Shuttle program documentation was reviewed and previous waivers to flight rules or launch criteria were revoked. Re-establishment required detailed analysis by both contractor and civil service personnel at all levels of management.

In addition to the formal open communication system, a system was set up to allow for anonymous reporting of safety concerns.

Finally, after 32 months of intense redesign efforts, numerous booster test firings in Utah, and program management restructuring, the nation again embraced its human space flight program. Shuttle Discovery on mission STS-26 launched from KSC on Sept. 29, 1988, marking our return to space once again.

KSC employees still here must be gratified to have completed 75 Shuttle missions that safely returned their astronaut crews to Earth since the Challenger tragedy.

— Bruce Buckingham

STS-51-L Crew

Commander Francis R. "Dick" Scobee
Aerospace engineer and U.S. Air Force pilot on his second Shuttle flight. Born May 19, 1939, in Cle Elum, Wash.

Pilot Michael J. Smith
Commander, U.S. Navy, on his first Space Shuttle flight. Born April 19, 1945, in Beaufort, N.C.

Mission Specialist Judith A. Resnik
Ph.D., electrical engineer on her second Space Shuttle flight. Born April 5, 1949, in Akron, Ohio.

Mission Specialist Ellison S. Onizuka
Lt. Col., U.S. Air Force, aerospace flight test engineer on his second Shuttle mission. Born June 24, 1946, in Kealakekua, Kona, Hawaii.

Mission Specialist Ronald E. McNair
Ph.D., physicist on his second Space Shuttle Flight. Born Oct. 21, 1950, in Lake City, S.C.

Payload Specialist Christa Corrigan McAuliffe
High school teacher and America's first private citizen to fly aboard the Shuttle. Born Sept. 2, 1948, in Boston.

Payload Specialist Gregory B. Jarvis
Electrical engineer on his first Shuttle mission. Born Aug. 24, 1944, in Detroit.

Visionaries and heroes set the pace

As we look back over nearly 20 years of the Shuttle program here at Kennedy Space Center, it is clear our successes are embodied by thousands of people coming together with tireless dedication coupled with a true love of the space program.

Although there are many people that fall into the categories of visionaries and heroes, we have selected two – one retired and one currently employed – who are indicative of the determination and devotion to the Shuttle program so often exhibited.

Each time the Shuttle lifts off to complete a mission, there are numerous managers and directors who have worked behind the scenes to make it a success.

Bob Sieck, one among their number, joined NASA at KSC in 1964 as a Gemini spacecraft systems engineer and has held many of those key positions while supporting the Shuttle program.

In 1978, he became the chief Shuttle project engineer for STS-1, the first Shuttle flight. Sieck, continuing to lead the historic Shuttle program into the future, was instrumental in the transition and modifications of all launch facilities, including the Vehicle Assembly Building, from the early Apollo days to a building that would sustain the new Space Shuttle activities.

Throughout his career at KSC, Sieck was launch director for 11 missions while serving as director of launch and landing operations.

He returned for STS-26 and was launch director for all subsequent Shuttle missions through STS-63, totaling 52 Space Shuttle launches.

Now retired, Sieck explained that the Shuttle program had always been meaningful to him because he was actively involved in every launch.

"I felt comfortable with my responsibilities and assignments as a launch director because of the great confidence I had in the mission team," said Sieck. "I reflect more now as a spectator. I still have the same feelings as if I was in the Launch Control Center with a headset on. I can't stay away, it is in my blood."

Above, in a firing room in the Launch Control Center, Bob Sieck, then KSC Director of Shuttle Operations, is applauded by NASA Administrator Daniel Goldin and U.S. Secretary of State Madeleine Albright for receiving the Distinguished Service Medal. At left, astronaut Kay Hire, formerly a KSC employee, is welcomed back to KSC by Center Director Roy Bridges. Bridges greeted Hire as she arrived to prepare for the launch of STS-90, the Neurolab mission.

A visionary and hero of the Shuttle program from a younger generation is astronaut Kay Hire. Hire holds a unique place in our history as the first KSC employee to be selected to the Astronaut Corps.

Most astronauts are plucked from a background in the military, or are selected because of their knowledge in a particular payload or scientific experiment. Hire's education in engineering, management and space technology and specialized background in Space Shuttle systems made her a perfect choice for becoming an astronaut.

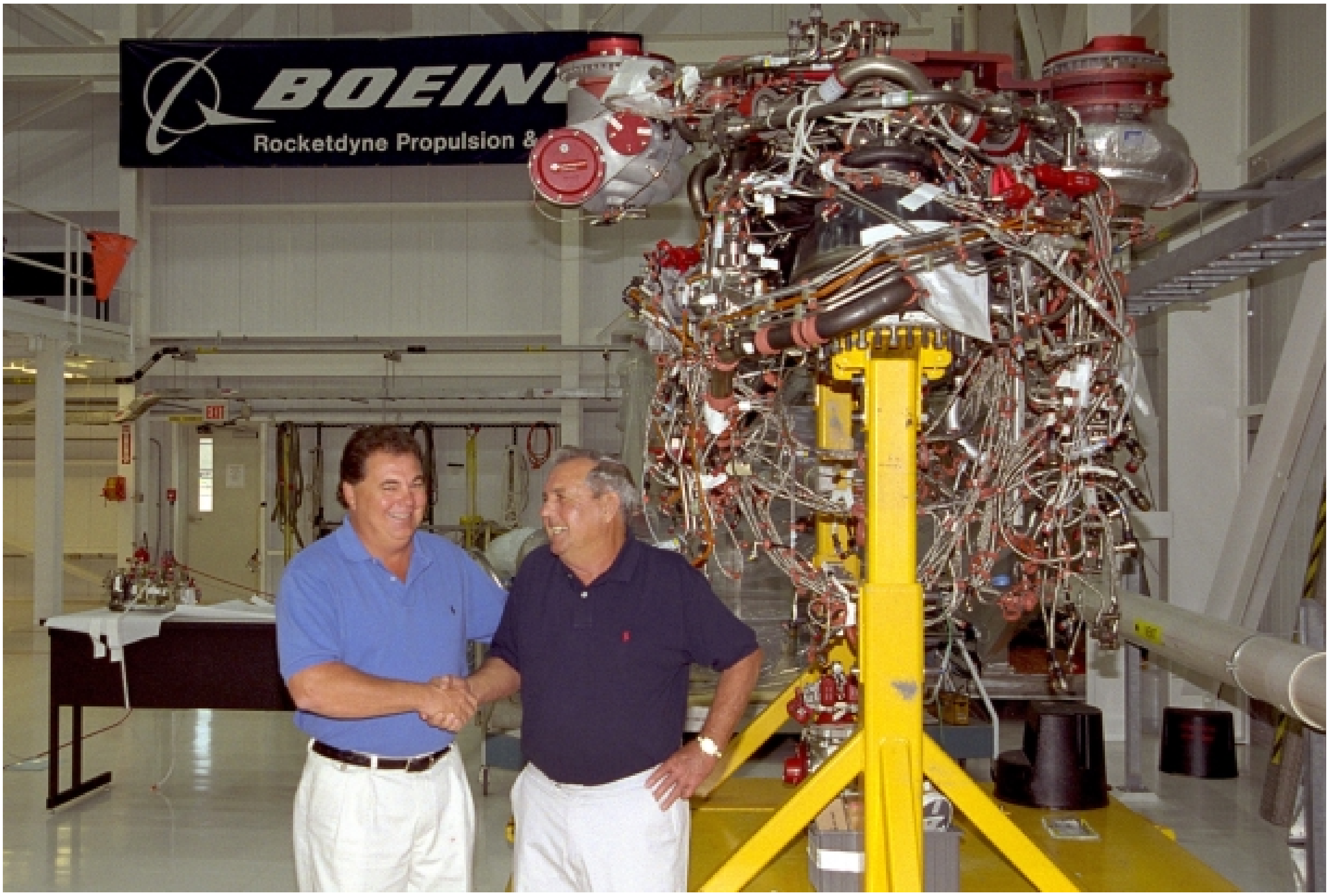
Hire's pursuit to fly as an astronaut grew continually as did her knowledge and expertise about the Shuttle program. After a year of training and evaluation, her dream became a reality.

She flew as a mission specialist aboard STS-90 in 1998, marking her inaugural flight. STS-90 landed at KSC having covered more than 6.3 million miles.

Many who work here at KSC say it is a point of pride to know that Hire, one of their own, has taken part in an opportunity of a lifetime, space travel.

"I reflect often on my time at the Kennedy Space Center and the people that influenced my career," said Hire. "I feel very fortunate to have had the perspective of working at KSC before becoming an astronaut. I know the people, experiences and knowledge I gained from my time here contributed to my success."

— Jessica Rye



From left, son and father, Don and Gene Ewers, worked together in the Shuttle main engine shop at KSC until 1988 when Gene Ewers retired.

Father, son take pride in main engine work

As you walk throughout the halls at Kennedy Space Center, you can almost hear the historic conversations of previous employees echoing from the walls.

Many employees represent the second and even third generation of KSC workers. They are the children who grew up in the space program, wanted to carry on the family legacy, and couldn't imagine doing anything else for a living.

While all of these families are too numerous to mention, each has a unique story to tell. The Ewers family, Gene the father and Don the son, are prime examples of families who have spent their entire careers in the world of "rocket science."

Gene moved his family to Brevard County in 1967 from NSTL, now Stennis Space Center, in Bay St. Louis, Miss., to continue work on the Apollo program. Don, just nine years old at the time of the move, was raised in and around the Apollo and Shuttle programs. At an early age he set his sights on following in his dad's footsteps and becoming an aerospace worker.

"It was important for me to keep the tradition going," said Don of his decision to take a job working with Rocketdyne in 1977, also at NSTL. "Growing up so close to the early space programs, I couldn't help but want to be a part of it. It was in my blood."

In 1979, Gene found himself in a position where he needed to transfer another technician from NSTL to work on the main engines.

Although he tried to stay out of the decision to transfer his son, many of the KSC technicians, who had worked with Don in Mississippi, recommended that he approach Don about a possible relocation to Florida.

In 1980, Don returned to Florida to serve as a technician on his father's crew in the engine shop.

"It was exciting to have so many firsts that I could share with my son," said Gene. "I remember watching STS-1 lift off the pad. I was standing there with my son and the team that worked so hard to get those engines ready and was so proud that my son and I were part of it."

"As Dad and I stood in front of the VAB watching STS-1, the excitement was overwhelming," said Don. "The team was so thrilled that the engines were actually going into space, after the long years of testing on the stands in Mississippi. We were all yelling and jumping up and down. It was one of the greatest experiences of my life."

The father and son pair worked together in the engine shop until 1988, when Gene retired.

Gene says he still watches each and every Shuttle flight, on the television until main engine start, and then he goes outside to watch the launch.

"I continue to be very proud of the work the engine team does at Rocketdyne," said Gene. "I hope the team members who are still there feel as if I had a part in helping to set the stage for what has been a critical part of a very successful Shuttle program."

Don, now a manager and father of two teenagers, says his children are leaning toward the engineering field, but he is not putting any pressure on them to continue the family tradition here at KSC.

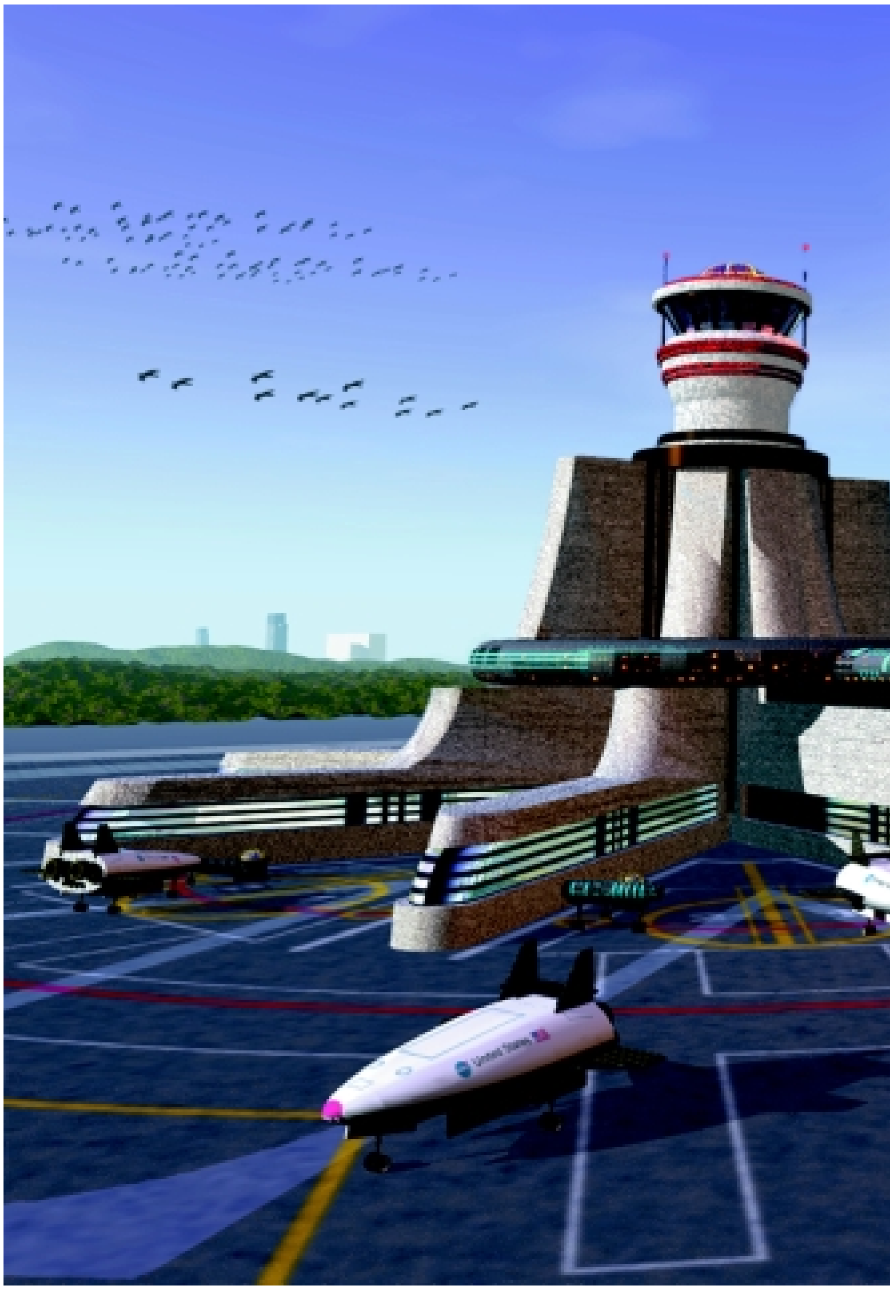
"But if they do," he says, "I hope they enjoy the experience as much as Dad and I have."

As the second generation of Shuttle workers begins to have college-age children, KSC can be proud that it is a special place to work, and even more special to share with the whole family.

— Jessica Rye

Spaceport Technology Center strategy to drive KSC's growth

A new er



Kennedy Space Center leaders are not content just to let the Center continue its course of excellence in processing payloads, launching Shuttles and managing Expendable Launch Vehicles launch services.

Instead they are determined to ensure that KSC leads the way in this new century as the Spaceport Technology Center for NASA and the international aerospace community.

Center Director Roy Bridges and his senior managers are creating a management structure and processes at KSC to strategically foster the development and sharing of new spaceport technologies.

In addition, leaders at KSC are seeking a higher profile for KSC as an emerging world-class Spaceport Technology Center.

With prospective launch sites being planned across the nation and the world, KSC intends to offer its expertise in efficiently designing and managing those sites. In addition, KSC plans to continue to increase the number of valuable spinoffs derived from the technologies KSC team members develop.

KSC has spawned a growing number of spinoff technologies in recent years and this year is leading the Agency in technology licenses. That lead has created pride in a NASA Center that has not historically been considered a research and development center.

"We've always developed new spaceport technologies to meet our operational challenges, but with more focus we believe we can do even greater things that will not only better KSC, but will also improve the lives of people in this country and around the globe," said Gale Allen, assistant KSC chief technologist.

The Spaceport Technology Center concept encompasses all KSC organizations. Specific technology areas selected to focus limited resources on and generate useful technologies include Fluid System Technologies; Spaceport Structures and Materials; Process Engineering; Command, Control, Monitoring and Range Technology; and Plant and Microbiological Sciences

KSC leaders believe that the Center can achieve greater strides in technology development in all of those areas. Working groups have been formed to look at specific operational needs and to help generate solutions through technology development. The groups will help target funding sources, such as NASA Research Announcements.

The Plant and Microbiological Sciences area, unlike the other four technology areas identified, has historically been viewed by the Agency as a "research and development" area at KSC. Scientists and technicians in Life Sciences, as the area has been known, have achieved an international reputation for their work in ecological monitoring, bioregenerative life support, development of life science experiment payloads, and molecular biology.

"We want each of the key spaceport technology areas to become as developed and recognized as Life Sciences," Allen said.

One of the emerging development areas, Process Engineering, is beginning to be viewed as a hallmark technology development area for KSC. Because of the thousands of processes involved in preparing expendable and reusable vehicles, launching payloads, and operating/maintaining complex spaceport equipment and infrastructure, process engineering is a natural focus area for development at KSC, Allen said.

Process engineering provides a systems approach to design, management, and improvement of processes. Current process engineering development projects include a Spaceport Systems Processing Model to collect operational experience and simulate current and future spaceport processes and a Root Cause Analysis software system to help identify systemic root causes of incidents and close-calls. A Process Engineering Technology Center is also being established to support dissemination and development of new process engineering technologies.

The other technology areas are also seen as focused sources for development. The newly opened Cryogenic Test Bed, which is being used by KSC, academia and industry to help develop new cryogenic technologies, is already increasing recognition for the Center in the area of Fluid System Technologies.

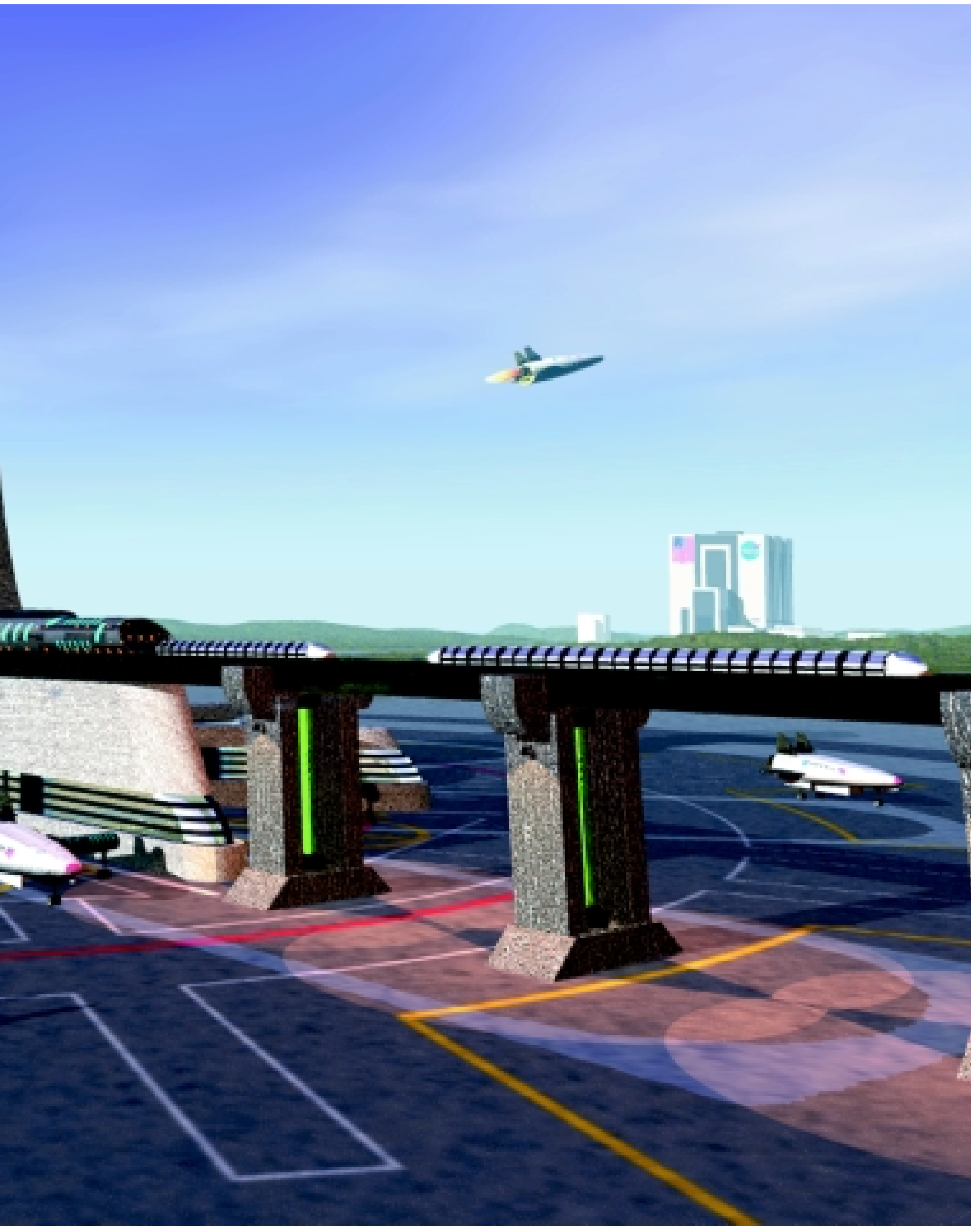
A new electromagnetic physics test bed is being created in the Spaceport Structures and Materials area in addition to the expansion of its corrosion testbed.

The Command, Control, Monitoring and Range Technology Area is pursuing areas including advanced weather instrumentation, decision models, simulations and space-based technologies. These technologies will be integrated together by an command and control, and network architecture that will support the next generation of launch vehicles.

"These are exciting times for KSC. We're reinventing ourselves as the Spaceport Technology Center," Allen said. "Operational excellence will be something we continue to achieve, and that will only be enhanced with our new focus on spaceport systems and technology development."

— Kathy Hagood

a begins



About the illustration

This concept illustration by InDyne Inc. graphic artist Jerry Forney depicts a commercial spaceport terminal at the Cape Canaveral Spaceport. In Forney's vision of the future, passengers and commodies would arrive at the terminal on high-speed Maglev trains. Passengers would be taken to one of 16 departure gates located in the eight spokes of the terminal.

The centrally located launch control tower atop the hub would allow for oversight of all ground and air operations. All fueling and maintenance would take place away from the terminal in a nearby automated processing facility not shown in the illustration.

Suborbital space vehicles at the terminal would be leased by airlines, commercial air delivery systems and entertainment ventures. The high speeds of the vehicles would significantly reduce air travel times. A business trip to Tokyo could become a day trip via such a spaceport.

Creating a vision for our future spaceport

The Cape Canaveral Spaceport will take on exciting new roles in the coming decades. Visions for those roles are being shaped by leaders at Kennedy Space Center, the 45th Space Wing and the Spaceport Florida Authority (SFA).

While familiar vehicles including the Space Shuttle and Expendable Launch Vehicles will continue to be launched, a new generation of space vehicles now in development could also be launched here. Those vehicles would allow the Cape Canaveral Spaceport to expand its capabilities to include a commercial spaceport.

With a commercial spaceport, vehicles faster than the Concorde could transport business travelers, tourists, mail and other cargo around the globe in just a few hours. Such a spaceport would attract travelers and commerce from a wide region here and create and support a teeming local economy.

"The commercial potential is enormous because of the world's growing need for faster international transportation," said Renee Ponik, NASA comprehensive master planner for KSC. "With such a spaceport, you could have a business meeting in Tokyo and be back home in time for dinner."

While such space vehicles are not yet ready for commercial use, the Spaceport and its partners must begin planning to create the infrastructure to support them. That's the only way the Cape Canaveral Spaceport will maintain its position as the world's premiere gateway to space in the future, Ponik said.

To that end, KSC, the 45th Space Wing and SFA have joined forces to help create a comprehensive master plan for the Cape Canaveral Spaceport. ZHA, Inc., a master planning consultant, has been hired to help shape that plan. ZHA helped guide the successful Orlando International Airport.

ZHA also has ties through one of their subcontractors to the Canaveral Port Authority, an important government partner for the Cape Canaveral Spaceport.

Because the Cape Canaveral Spaceport of the future will have such local and regional impact, KSC, the 45th Space Wing and SFA are holding a series of visioning sessions this fall with community and government leaders to help shape the comprehensive master plan now being developed.

The public will also be invited to submit their ideas via a Web site, which can be accessed at **www.yourspaceport.com.**

"We want all our stakeholders to have a say in how we create such a spaceport," Ponik said.

A final 50-year master plan for the Cape Canaveral Spaceport will be developed and unveiled in approximately 21 months. It will then be updated periodically to stay current with advances in technology and changing needs.

Offering a commerical spaceport for international travel is just one new potential role for the Cape Canaveral Spaceport, Ponik said. Farther in the future, the Spaceport could also be used as a takeoff point for cargo for a lunar base. A trip to that lunar base could be just one leg on a journey to planets in our solar system and beyond.

"All this may sound fantastic, but we have to start planning for the future of the Cape Canaveral Spaceport or someone else will take on our role while we fall behind," Ponik said. "Many other states and countries are moving to develop spaceports. We support their efforts, but we want to maintain our role as the No. 1 spaceport in the world."

— Kathy Hagood

Titusville High School students Courtney Cannon and Rebekah Smith practice public relations at the Press Site while participating in KSC's student volunteer service program during the spring.

Summer High School Apprenticeship Research Program student Cameo Hume, who is interested in a career in the medical field, conducts a laboratory analysis during his summer internship.

Future space leaders cultivated

The turn of the century marks an exciting time for the Kennedy Space Center. The continued construction of the International Space Station and future plans for research and development in space will launch a new era in space program education.

NASA's Education Programs and University Research Division is determined be on the cutting edge during the new Millennium, developing the minds of those who will carry the space program torch into the future.

How will they accomplish this?

By providing hands-on learning opportunities that remove the ever-present fear of the unknown and making the concepts of science, mathematics and technology easier to grasp.

As NASA's launch, processing and primary landing site, KSC is uniquely qualified to provide a wide range of educational programs for students, teachers and the community as a whole.

Many of the educational programs offered here are national in scope while others are unique to KSC and can only be found at The Center for Space Education.

The K-12 Education Programs Office helps develop the natural interest of students from kindergarten through high school in science, mathematics and technology.

Taking simplified concepts and turning them into fun, interactive activities provide for an educational experience that can't be beat.

> "Our unique world-class facilities provide the perfect setting for educational opportunities to promote an interest in the space program and to encourage careers that will help sustain space exploration into the coming centuries."
>
> **JOANN MORGAN**
> DIRECTOR
> EXTERNAL RELATIONS AND BUSINESS DEVELOPMENT

"Our goal is to expose students to as many exciting learning opportunities as possible," said Pam Biegert, deputy of the Education Programs and University Research Division. "When you see a child's face light up and they say 'Oh, that's what that means!' you realize the true impact of our programs."

The long-running Summer High School Apprenticeship Research Program (SHARP) is a great example.

SHARP exposes students to their first work experience in the fields of science and engineering by providing them with an opportunity to work alongside KSC engineers during the summer months.

Participants in the SHARP program work on mission-related projects and learn communication skills and the value of teamwork, making the dreams they thought unattainable realities.

Workshops are also provided to educators through the KSC Education Program.

These training opportunities provide updated information and experiences to teachers so that they can better teach space-related technologies in the classroom.

Teachers, however, are not the only ones who reap huge benefits from these workshops.

Informal educators like librarians also participate so that they can field frequently asked questions when students are researching specific topics of interest.

This past summer, KSC piloted a new NASA program in which 50 librarians from Brevard, Orange and Volusia County attended weeklong workshops that exposed them to KSC. The program included hands-on activities, lectures and field experiences.

KSC also gains valuable resources through several on-site programs like the Summer Faculty Fellowship Program.

The faculty involved brings a fresh perspective to problems due to their on-going educational research efforts.

These highly qualified, university faculty members work throughout the summer side by side with KSC engineers and scientists on issues related to the space program each year.

KSC also sponsors numerous programs for students with disabilities as well as programs with groups such as Historically Black Colleges and Universities and Other Minority Universities.

These programs offer summer internships that provide work experience in the fields of mathematics, science, engineering and business administration.

"NASA has made a significant commitment to education programs at the Kennedy Space Center," summarized JoAnn Morgan, director, External Relations and Business Development. "Our unique world-class facilities provide the perfect setting for educational opportunities to promote an interest in the space program and to encourage careers that will help sustain space exploration into the coming centuries."

— Suzanne Sparling

Center builds through partnering

Space program leaders take part in the First Florida Space Summit, which was held in January 2000. Seated in front from left to right are Florida Lt. Gov. Frank Brogan, U.S. Air Force 45th Space Wing Commander Brig. Gen. Donald Pettit, and KSC Director Roy Bridges.

An artist's rendition of the Space Experiment Research and Processing Laboratory, a planned biological and life sciences laboratory, which is being developed through a State and KSC partnership.

Partnerships at the Kennedy Space Center embody the future direction of KSC.

The alliance between NASA and the Spaceport Florida Authority (SFA) is a perfect example. The state government space agency has worked with KSC to make great strides in enhancing the Cape Canaveral Spaceport.

Working with NASA, the Governor's Office, and several state legislators, the SFA made possible the appropriation of state funds that in combination with NASA funds enabled the development of the new Reusable Launch Vehicle Support Complex.

The main hangar of the complex will be used for the X-34 test program and other reusable space vehicles that will use the Shuttle Landing Facility. The hangar can also accommodate other types of aircraft, including the Shuttle.

"The RLV Support Complex positions KSC to support future space transportation systems, both government and commercial," said Eddie Ellegood, director of Spaceport Florida's Policy & Program Development.

Another KSC partnership involves the future Space Experiment Research and Processing Laboratory (SERPL) magnet facility for a planned Space Station Commerce Park. NASA and the SFA teamed to develop the concepts that will accommodate commercial, government and international space research and technology development programs.

This collaborative effort also includes the State's Office of Tourism, Trade and Economic Development; Department of Management Services; Florida Space Research Institute; University of Florida; University of Central Florida; Enterprise Florida; TRDA; and contractors like Dynamac, Bionetics, Space Gateway Support and Delaware North Parks Services.

Plans for the 400-acre park on Center include building the SERPL to support life sciences and biological flight experiment processing and research for the International Space Station.

The SERPL will be used to combine post-flight research here at KSC with biological research that will be undertaken onsite by local universities. NASA currently is designing the facility.

The State of Florida has appropriated $14 million for the project and is working to appropriate the remaining funding necessary for construction. Once it is completed, the State-owned SERPL will be available for lease by NASA's Life Sciences Support Contractor.

"NASA is trying to develop our own Spaceport technology and research capabilities here at KSC," stated Jan Heuser, chief of NASA's Spaceport Technology Business Development Office. She also serves as program manager for the SERPL effort.

Another KSC partnership that has taken root is the Joint Performance Management Office (JPMO), which manages the Joint Base Operations and Support Contract (J-BOSC).

This two-year-old partnering effort between NASA and the U.S. Air Force's 45th Space Wing focuses on building a unified Cape Canaveral Spaceport by generating efficiencies and reducing costs to support the nation's launch requirements.

"The partnership reflected in the JPMO provided a significant step in the merging of two cultures," commented Susan Kroskey, acting executive director of the JPMO. "One of the significant achievements on the J-BOSC has been the establishment of a one-stop shopping phone number. Any questions or problems with base support services can be handled by calling 476-HELP."

Another key KSC cooperative relationship is with Delaware North Parks Services. The consessionaire has managed and operated NASA's Kennedy Space Center Visitor Complex for five years. Educating people about the space program and developing interest in it is the prime objective of Delaware North.

"An aggressive, five-year, $130 million growth and expansion plan has played a crucial role in helping DNPS fulfill its mission – to tell the NASA story and inspire people to support space exploration," said President and Chief Operations Officer, Rick Abramson.

Expansions to the KSC Visitor Complex have included the construction of the Launch Complex 39 Observation Gantry and the International Space Station Center.

KSC wants to work together with its partners to take on bold new challenges for the new millennium. With the support of government, educators, subcontractors and the local community, NASA will continue the realization of a dream that was born more than 40 years ago.

— Suzanne Sparling

Above, Barry Slack, at left, the NASA biomedical electronics technician who created the medevac oxygen system kit, works with Greg Lowdermilk, a pararescueman with Patrick Air Force Base. At right is the oxidizer farm at Launch Pad 39A where the nitrogen oxide scrubber has been installed.

Program tech spinoffs benefit public

How would our lives be affected if there were no kidney dialysis, infrared thermometers, artificial hearts, infrared cameras, laser surgery, as well as water purification, cordless power tools, and physical therapy and exercise machines?

All of these, and more, grew from NASA's space program as technology spinoffs, many of them based on developments here at Kennedy Space Center.

Home

Have you ever wished you had a larger refrigerator to store that large holiday turkey or ham but realize your kitchen has no space for a larger appliance? A NASA spinoff may just solve that situation by allowing the same size refrigerator to provide more space.

The development of a superinsulation blanket based on a substance known as *aerogel* means manufacturers can use the product to create thinner refrigerator walls for greater volume.

What does NASA have to do with refrigerators? NASA needed an aerogel-based cryogenic insulation system with extremely low thermal conductivity that is flexible, durable and easy to use. The result was a blanket composed of aerogel-based composites and radiation shield layers that can be produced as a blanket, sheet or clam shell unit. Potential space applications include the Reusable Launch Vehicle, Space Shuttle upgrades, interplanetary propulsion and life support equipment.

Besides refrigeration, other potential commercial markets are ovens, shipping containers and skylights. Auto manufacturers can use it in firewalls, floorboards, exhaust systems and head liners, especially for race cars.

Medicine

A recent KSC medical spinoff is a cancer detection device known as a DNAnalyzer. To help decipher the medical mystery of why and how microgravity affects the immune system, NASA sought development of a machine that could separate and examine cells rapidly.

NASA found the existing device too large to place on the Space Station and partnered with the American Cancer Society on the Space Station In-Flight Cytometry Project to develop a more compact flow cytometer.

The cancer-fighting benefits of flow cytometry include the ability to evaluate cancer cells very early and to determine several important features, such as the sensitivity of the cancer cells to different chemotherapy drugs, the ability of the cells to grow, and their capacity for spreading. The DNAnalyzer allows better understanding of the nature of a patient's tumor, thereby enabling better treatment.

Other potential uses of the technology involve early detection of leukemia, sensitivity studies prior to chemotherapy, antibody analysis and detection of pathogenic organisms.

Another medical spinoff is being evaluated by the military but may also have commercial potential. It is the medevac oxygen system, known as MOS, which can provide a therapeutic oxygen supply to up to four patients at once when they are being flown aboard aircraft during a long-haul medevac scenario.

The system was developed to enable a C-130 astronaut medevac team to treat a Space Shuttle crew in the event of an emergency. Previously, medevac teams aboard U.S. military aircraft at the Space Shuttle Transatlantic Abort Landing sites were equipped to handle only three patients. Shuttle crews are normally larger.

The newly designed MOS can supply up to four patients, and systems can be "daisy chained." The system is packed and stored in a durable, waterproof case divided and padded to prevent damage during storage and transport.

Vehicles and More

A biodegradable, non-toxic lubricant was originally developed to replace the Space Shuttle Crawler's standard lubricant. The lubricant is known as The X-1R Crawler Track Lubricant (CTL).

The first commercial product, X-1R Concentrate Friction Eliminator, was developed for the NASCAR racing circuit, to protect engines and transmissions from heat and wear damage.

Newer retail product lines have targeted the sports market, providing lubricants for gun cleaning, skates, air tools, fishing reels, bicycles, and an air conditioning retrofit kit. These spinoff products are sold in retail stores nationwide.

KSC recently found a way to eliminate the hazardous waste stream that is captured in a scrubber when the toxic oxidizer is transferred from storage tanks into rockets and vice versa.

This new nitrogen oxide scrubber captures nitrogen tetroxide in water where hydrogen peroxide oxidizes the resulting nitrous acid into nitric acid. The nitric acid is neutralized with potassium hydroxide to form the product potassium nitrate – a primary fertilizer material, with fewer impurities than commercially available fertilizers.

Whether you walk into your home, drive your car, visit the doctor or go to the gym, you will likely come in contact with a product developed from NASA technology.

For more details about these spinoffs and others, go to the Web site: **http://www-pao.ksc.nasa.gov/kscpao/educate/docs.htm** and click on "NASA Spinoffs."

Also, you can keep abreast of the latest technology developments by going to **http://nasatechnology.nasa.gov/portal_main.cfm** (NASA Technology Portal) and **http://technology.nasa.gov/** (TechTracS)

— *Anita Barrett*

MILA station tracks Space Shuttle

MILA Space Flight Tracking and Data Network Station workers at KSC use state-of-the-art automation technology in preparing to track the Shuttle.

The MILA (Merritt Island) Space Flight Tracking and Data Network Station – the only source of tracking data for the first seven minutes of each Space Shuttle launch – continues to evolve and upgrade its technology since its early role in the space program.

MILA has a long history. The station began in 1966 as one of the 17 ground stations of the Manned Space Flight Network to provide earth orbital support to the Apollo program. It also supported data acquisition for virtually all low Earth-orbiting satellites.

For STS-1, the Ponce De Leon Inlet Tracking Annex (PDL) was added to MILA's support capability. Located on the coast at New Smyrna Beach approximately 30 miles north of Kennedy Space Center, it provides a different "look angle" than does MILA.

Unlike with the Saturn V in the Apollo program, this became necessary with the Space Shuttle program because the highly radio-reflective solid rocket booster plume strongly attenuates S-band radio signals.

Staffed by personnel from MILA, the PDL facility furnishes all communications with the Space Shuttle during the second minute of flight.

With the addition of the Tracking and Data Relay Satellite (TDRS) constellation, beginning after STS-6, the role the MILA Tracking Station began to change. Now with all low Earth-orbiting satellites as well as the Space Shuttle tracked by the TDRS network once in orbit, MILA and the 17 ground stations around the world became unnecessary for this roll.

All of the ground stations of the Space Flight Tracking and Data Network were phased out, yet MILA still remains. It is as essential today for the 100th Space Shuttle launch as it was for STS-1. It is the only source of launch data until the TDRS-East satellite begins tracking the Space Shuttle about seven minutes into flight.

The most dramatic change for MILA since STS-1 is new technology. A planned transition to automation is allowing the development of a new computerized work station that significantly reduces cost. Also, analog recorders and data tapes have given way to new digital systems.

Three 30-foot domestic satellite antennas have been phased out in favor of a single fiber optic system. This increased available bandwidth eliminating periodic solar interruptions. Also, energy consumption at MILA has been reduced by one-third.

"All of this has allowed a more business-oriented approach in the operation of MILA," said Tony Ippolito, NASA station director.

During the Apollo program and for STS-1, the station was operated by Bendix Field Engineering, employing 139 people at the height of employment for their contract.

Today the station is part of the NASA-wide Consolidated Space Operations Contract. As part of that, the MILA station is managed by Honeywell Columbia, Md., operated and maintained by technicians from GHG of Houston, Texas, and the logistics requirements handled by BAE of Rockville, Md.

But some things remain the same as they did for STS-1. The same pair of 30-foot diameter S-Band steerable dish antennas still track the ascending Space Shuttle. These antennas also support the landings at KSC, acquiring the orbiter about 13-minutes before its touchdown at the Shuttle Landing Facility. Live on-orbit television is frequently provided from these same antennas.

Located west of the Kennedy Space Center Visitor Complex about a mile south of NASA Causeway, the visual appearance of the station continues now as then to be a field of complex antennas and arrays.

There is also a second UHF helix antenna used for air-to-ground voice communication with the astronauts during launch and landing that can also provide on-orbit communications if necessary. It was brought to KSC from Dakar, Africa, after that station was phased out.

Once the first TDRS satellite was launched, two 10-foot diameter steerable TDRS ground antennas were constructed at MILA, one mounted atop a 140-foot tower.

These continue to serve as a communications interface between spacecraft undergoing testing at KSC payload processing facilities and the payload operations control centers at Johnson Space Center or the Jet Propulsion Laboratory's "Mil-71" ground station co-located at MILA.

— George Diller

Payload team processes it all

The types of primary payloads processed at Kennedy Space Center and carried in the Space Shuttle's payload bay have largely been driven by the history of the program.

Early in the Shuttle program, commercial communications satellites, NASA scientific spacecraft and Department of Defense payloads were bread and butter for the Shuttle fleet.

These were primarily vertical payloads. Typically, each satellite was stacked atop an upper stage booster in KSC's Vertical Processing Facility, then installed into the orbiter's payload bay at the launch pad. Until the Challenger accident in 1986, approximately 25 vertical payloads were deployed.

But in the wake of that accident, the philosophy of what payloads the Shuttle should carry was reassessed. President Ronald Reagan directed that the Shuttle would no longer be used to deliver commercial satellites that could be launched aboard expendable vehicles. The Air Force re-evaluated its reliance on the Shuttle as its sole means for placing strategic payloads into space. Finally, for safety reasons, modification of the Centaur as an upper stage for planetary payloads delivered by the Shuttle was halted.

But a backlog of payloads meant that the second payload phase for the Shuttle program would be transitional.

"After the Department of Defense and commercial payloads left the Shuttle, the pace of KSC payload processing operations really accelerated. We averaged seven or more scientific launches each year from 1992 through 1997," said NASA-KSC payload manager Roelof Schuiling.

Under this transition, many famous payloads were launched, including the Magellan and Galileo spacecraft, the Hubble Space Telescope and the Gamma Ray Observatory.

During the transition, the first of many new horizontally processed payloads, adopting NASA's new payload philosophy, came online. This third phase of payload processing covered more than two dozen Spacelab missions. Those missions were steppingstones to the International Space Station missions.

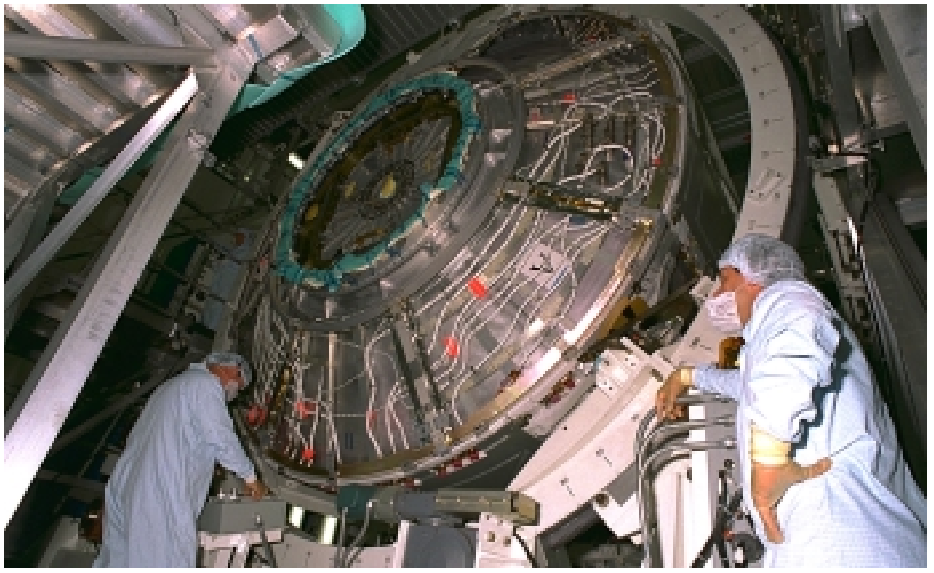
The Spacelab payloads were processed in the Operations and Checkout Building. Hangar L at Cape Canaveral Air Force Station was used to prepare Life Sciences experiments to be carried aboard Spacelab modules and in the orbiter's mid-deck.

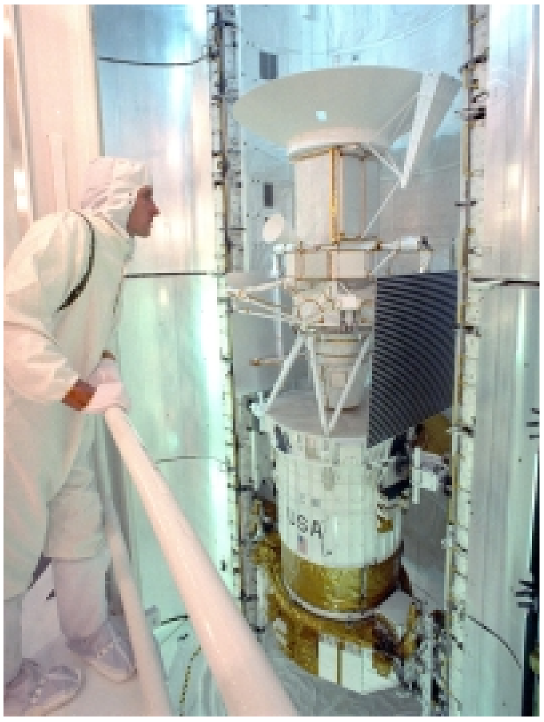
The current phase of payload processing is almost exclusively associated with the elements of the International Space Station. The Space Station Processing Facility was built to support the current era. Dedicated in June 1994, it is second in volume at KSC only to the Vehicle Assembly Building.

The SSPF's design provides more processing flexibility than any previous payload facility at KSC. All test stands are easily reconfigured. Ground support equipment is easily moved using an air-bearing pallet. The high bay can be configured in any way appropriate for the current payloads in flow.

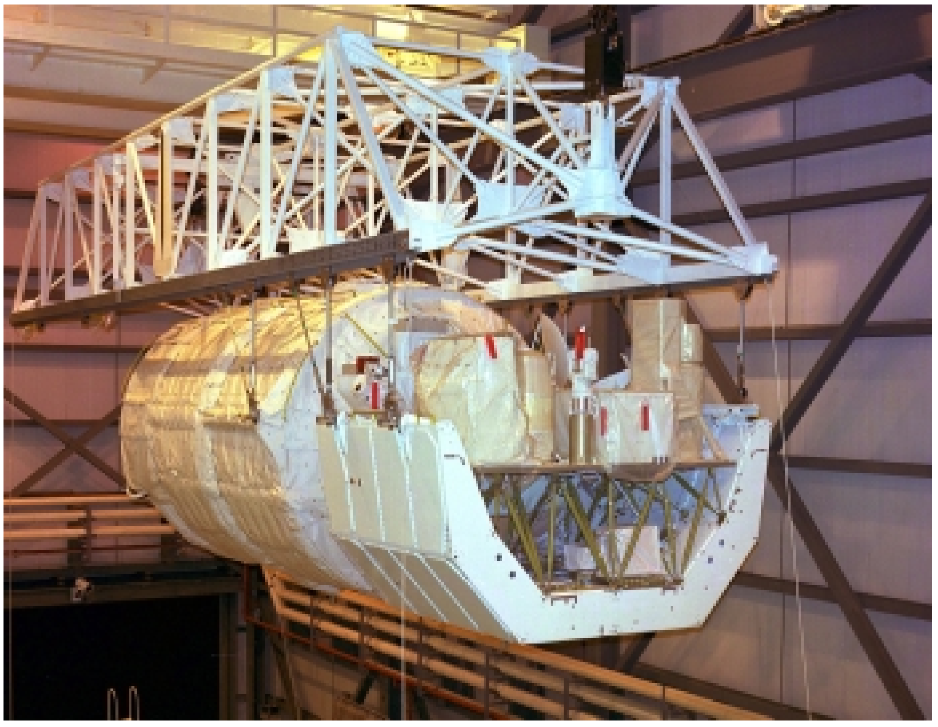
The Operations and Checkout Building has also been reconfigured and pressed into service once again to round out KSC's Space Station processing capability. One of two altitude chambers not used since the Apollo program has been refurbished to allow for a vacuum check of the habitable Space Station modules before they are launched.

— George Diller





Above, technicians attend the rotation of the International Space Station Node Unity during payload processing for STS-88, the first Space Station flight in December 1998. Space Station elements continue to be processed in the new Space Station Processing Faciltiy and the Operations and Checkout Building (O&C). At left, a technician observes the Magellan/Venus radar mapper spacecraft in Atlantis' payload bay during payload processing of STS-30. The mission launched in May 1989. Magellan was a classic example of a vertical payload. Below, the Spacelab 1 module and its attached pallet are hoisted out of the payload canister and over the work stands. The module was to be loaded into the cargo bay of Columbia in August 1983.



A Shuttle team that's out of sight

After 19 years and 100 Shuttle flights, you would think that every possible story on Shuttle-related jobs has already been told. Everyone recognizes launch directors, engineers and technicians, but have you ever heard of an "E Stop" or a "Spectrum Manager"?

A deeper look into KSC's Shuttle team reveals many outstanding workers whose jobs don't always stand out.

Here are the stories of two critical groups that seldom get news page coverage.

Thirteen overhead cranes and five mobile cranes stand ready to support Shuttle operations at KSC with capacities ranging from 8.5 to 325 tons. Without their operators though, the gears remain silent and still. Kennedy's crane operation crew, composed of about 145 workers, is responsible for putting the major pieces of the Space Shuttle together and any other heavy lift operation occurring on center.

"When you're dealing with flight hardware the process must be slow and meticulous," explained Ed Morales, KSC's manager of crane operations. "We treat the solid rocket segments like big sticks of dynamite, realizing that one wrong move could bring the program to a screeching halt."

Whether it's a payload at the launch pad, booster segments in the Rotation Processing and Surge Facility, spacecraft components in the Orbiter Processing Facility, or the 58,000-pound external tank in the Vehicle Assembly Building (VAB), it takes a very skilled operator to complete each task. Mating a single booster segment can take up to 18 hours. The process is so precise that the crane crew refers to it as "micro-inching." Some movements require accuracy to 1/1000th of an inch.

Hovering high above the VAB floor in a crane cab, you might call them crane pilots. Two highly trained operators lift and move the orbiter to complete the Shuttle stack with the solid rocket boosters and external tank already mated and waiting atop the Mobile Launcher Platform.

In the cab they focus on colorful, flat-panel displays similar to the "glass-cockpit" that astronauts use to fly the Shuttle. A ground controller in radio contact with the crane operators guides every movement from the floor, about 459 feet below the crane. Finally, an "E-Stop" observer is ready to operate an emergency switch to halt the operation if needed.

"Second to launch, watching all the pieces come together is probably the most rewarding part of our job," said Morales, a United Space Alliance employee and KSC team member since 1985. "We know that even though we're behind the scenes this bird won't fly without us."

It does not matter if your lifting flight hardware or launching rockets, every task or operation at KSC requires clear and reliable communication.

At left, United Space Alliance (USA) communication engineers, Larry Wages, left, and Phil Adams, bury fiber optic connectors for KSC's complex communication system. Below, USA overhead crane operators Lonnie Watson, left, and Richard Welch work in the bridge cab on the 34th level of the Vehicle Assembly Building.

"It's like the old saying, you don't really worry about the lights until the light switch doesn't work," explains NASA Spaceport Services' Communications Services Branch Chief, Doug England. "We do our best to make sure that communications at KSC work when the 'switch' is thrown. That's a bigger job than you might know."

A laundry list of voice, video and data infrastructure proves that there are far too many communication "switches" that support Shuttle operations at KSC to take them for granted.

About 800 miles of major cables, 243 miles of fiber optics, 3,000 Operational Intercommunication System (OIS) units and their headsets, 3,000 radios, paging systems in every KSC building, more than 200 video cameras, 700 video monitors, 150 film cameras and more than 11,000 computer network connections keep KSC workers linked together.

"The constant change of scenery and a diverse customer base make our job interesting and challenging," said England, a KSC employee since 1983. "One day workers are reaching under floor tiles in the launch control room, the next day they could be supporting flight crew communications at the pad. Since we wear a design hat, planning hat and an operations hat, our team covers most of KSC."

Wireless communication turns the team's focus from the ground to the air. KSC's wireless customers are as diverse as the colors of a rainbow, so the KSC Spectrum Manager, Steve Schindler, must coordinate all devices that transmit via radio waves including equipment used by TV and movie production crews and for spacecraft launch processing.

NASA's Spaceport Services' Communication Services Branch employs only 24 engineers, but with contractor support, KSC has about 375 communication workers supporting operations.

In addition to maintaining current systems, communication engineers must solve daily problems as they arise and implement system upgrades without disrupting critical operations.

"At KSC, something is going on seven days a week and 24 hours a day. Unless Shuttle engineers are connected with each other and the technicians, the process that leads us to launch would never be completed," England said.

KSC's communication team supports every aspect of the Shuttle processing effort through launch and landing. They liken it to providing communication support to a small city, but the citizenry of KSC are unlike any other in America. We have the critical mission of safely launching humans and payloads into space and only if Comm is ready can the Shuttle be made ready.

— Joel Wells

Getting ready

At right, Discovery is lifted to vertical in the Vehicle Assembly Building (VAB) during processing for STS-92, the 100th Space Shuttle Mission Launch. Below, the Shuttle processing crew prepares the orbiter after it rolls over to the VAB from the Orbiter Processing Facility. Farther below, the STS-92 crew poses for a photo in the white room while training for their mission. Standing left to right in the front row are Mission Specialists Peter "Jeff" Wisoff, Michael Lopez-Alegria, Koichi Wakata and Leroy Chiao. In back left to right are Commander Brian Duffy, Pilot Pamela Ann Melroy and Mission Specialist William McArthur Jr.

John F. Kennedy Space Center

Spaceport News

Spaceport News is an official publication of the Kennedy Space Center and is published on alternate Fridays by the Public Affairs Office in the interest of KSC civil service and contractor employees.

Contributions are welcome and should be submitted two weeks before publication to the Media Services Branch, XAE-1. E-mail submissions can be sent to Katharine.Hagood-1@ksc.nasa.gov

Managing editor. . . . . Bruce Buckingham
Editor. . . . . Kathy Hagood

Editorial support provided by InDyne Inc. Writers Group.
NASA at KSC is located on the Internet at *http://www.ksc.nasa.gov*

USGPO: 633-096/00043