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STS-1: The boldest test flight in history

The world proudly watched as NASA resumed human space flight on April 12, 1981

By Jim Kennedy
Center Director

Six years passed from the end of NASA's human space flight program Apollo to the roar of Space Shuttle Columbia on its April 12, 1981, maiden flight from KSC's Launch Pad 39A carrying astronauts John Young and Bob Crippen on a two-day Earth-orbital mission.

Twenty-five years ago this month, the world watched as the two brave astronauts completed the monumental first test of the Space Transportation System by landing at Edwards Air Force Base in California. That successful mission verified the combined performance of the orbiter, solid rocket boosters and external tank.

As NASA pushes ahead with the nation's Vision for Space Exploration to extend human presence across the solar system, starting with a return to the moon by the end of the next decade, the agency is pursuing that vision by building on the best of Apollo and shuttle technology.

Kennedy Space Center Director Jim Kennedy

As a young engineer at the Marshall Space Flight Center in Alabama, I was privileged to be a part of the team responsible for the design and development of the solid rocket boosters and will always remember, with much pride, watching the magnificent technology perform beautifully.

The Kennedy Space Center work force enjoyed the unique opportunity to relive that historic mission when Young and Crippen recently returned to our center and spoke about the thrilling challenges of the first shuttle flight. Their enthusiasm for America's space program is as strong as it was the day they learned they would be aboard that first mission.

Today, more than 2,000 employees who worked at Kennedy Space Center during STS-1 still work here.

This issue provides details on NASA's first shuttle mission and the evolution of human space flight, including an interview with Young and Crippen and their look back on "the ultimate test flight," as described by Crippen.

You will also learn about how the shuttle's technology has evolved, the modifications to existing facilities to meet the needs of the space shuttle program, the diversity of the space shuttle crews and spinoffs from shuttle technology.

As we prepare for the next space shuttle launch in July, the work you are performing to safely fly Discovery is as critical as during the time NASA prepared for STS-1.

Thanks for all of your contributions as we continue the amazing journey of space flight together as a team.

SPACE SHUTTLE Columbia lifts off shortly after 7 a.m. on April 12, 1981.

STS-1 PILOT Bob Crippen (left) and Commander John Young returned to KSC on April 6-7 to celebrate the 25th anniversary of the first space shuttle flight.

Space shuttle history boasts mission success

By Kay Grinter
Reference Librarian

ORBITER COLUMBIA – riding piggyback atop a modified 747 Shuttle Carrier Aircraft – returns to Kennedy Space Center April 21, 1981, after a two-day journey from the Dryden Flight Research Center in California. Columbia touched down on the Shuttle Landing Facility two weeks after its return to Earth from the first space shuttle flight.

Where does the history of the Space Shuttle Program begin? In 1969, President Richard Nixon's appointed Space Task Group proposed that, after Apollo, the nation should pursue a broad-based space exploration program to include a space station, a lunar base, Mars exploration and a space shuttle. Practical applications and international cooperation in space were essential to the plan.

The group envisioned a reusable space system to provide low cost per pound to orbit. A reusable space shuttle offered major advantages over conventional rocket systems. Spacecraft built to fly aboard a shuttle vehicle could be designed with more emphasis on their mission capabilities, and less emphasis on their ability to withstand the rigors of existing rocket launches.

And so, NASA marched ahead with the Space Shuttle Program.

Enterprise, the first orbiter off the assembly line, was named after the starship in the popular science-fiction television show "Star Trek." Intended for use only as a test article, the vehicle rolled out of Rockwell's assembly facility in Palmdale, Calif., on Sept. 17, 1976.

From February through October 1977, Enterprise was used in the Approach and Landing Test program based at NASA's Dryden Flight Research Center. The tests successfully demonstrated the orbiter could fly in the atmosphere like a spacecraft but land on a runway like a glider.

SPACE SHUTTLE Enterprise was rolled out to the launch site on May 1, 1980, to make certain shuttle elements were compatible with the Spaceport's launch facilities.

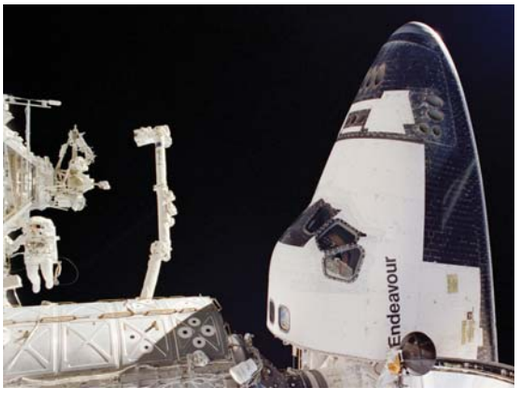
Three and a half years later, on April 12, 1981, the first launch of an operational space shuttle, Columbia from NASA's Kennedy Space Center Launch Complex 39, ushered in the new era.

The shuttle concept represented an entirely new way of space flight. On a standard mission, the vehicle carries up to seven crew members. The first two space shuttle missions, STS-1 and STS-2, only carried a two-person crew.

Between 1981 and 1991, four more orbiters were built: Challenger, Discovery, Atlantis and Endeavour. They carried experiments into space and launched important science instruments such as the Magellan Venus probe, the Hubble Space Telescope and the Chandra X-ray Observatory.

NASA received approval to proceed with the development of a permanently based, manned space station in the mid-1980s. At President Bill Clinton's direction in 1993, the concept was scaled back, made less costly, and transformed into the International Space Station in progress today. The shuttle has played an integral role in its assembly in space.

Through 2005, the Space Shuttle Program accomplished 112 successful missions and carried more than 614 payloads into orbit. The program has also flown 433 crew members, 69 of whom took spacewalks totaling 491 hours.



NASA ASTRONAUT John Herrington, STS-113 mission specialist, participates in one of the 151 spacewalks during the shuttle program.

Young, Crippen recall thrills of first shuttle flight

By Charlie Plain
Staff Writer

When Space Shuttle Columbia's roaring engines launched STS-1 from Kennedy Space Center on April 12, 1981, the enormous jolt at liftoff told Commander John Young and Pilot Robert Crippen they were about to take an adventurous ride into a new frontier.

"There was no doubt you were headed someplace," said Crippen. "It was a nice kick in the pants."

NASA's new versatile and reusable rocket-glider was a dramatic departure from the slender Saturn V boosters of the previous generation. Powered by multiple engine systems and completely computer controlled, Columbia demanded a crew with exceptional experience and expertise.

NASA's decision to put Young in the commander's seat for the mission was an easy one. Already a veteran of four missions, including a moon walk during Apollo 16, and piloting three types of spacecraft, Young had the seasoned skill and steely confidence to bridle Columbia on its maiden flight. "If you want to go into space for the first time on a new vehicle that's never been flown, you want to go with a pro, and John certainly is a pro," said Crippen.

STS-1 COMMANDER John Young (right) and Pilot Bob Crippen work in the cockpit of space shuttle Columbia before its maiden flight.

FORMER VICE President George Bush receives a model of the space shuttle from Dr. Alan Lovelace, former acting administrator of NASA. At far right is Mrs. Barbara Bush, while John Young (second from right) and Bob Crippen (next to Lovelace) look on.

Crippen was the rookie astronaut thrilled to be piloting a mission. "I was doing handsprings," said Crippen. His mastery of Columbia's sophisticated computer systems garnered Young's appreciation.

"I was really lucky to have Bob Crippen with me because he knew all the software end to end," said Young. "He was a swell fellow and really smart about the vehicle."

The crew spent two days in space putting Columbia through its paces, testing the ship's radically advanced systems. "We had a good time taking it around," said Young. "I just thought it was a great machine."

In the few spare moments the astronauts weren't busy, Young and Crippen delighted in the unique freedom and spectacular views that flying in orbit offers. "The real pleasure was having a chance to enjoy being weightless and spend some time looking out (at Earth)," said Crippen.

For Young, however, space flight not only provides a means of appreciating the planet, but a way of protecting it. He believes technology developed to send humans to the moon or Mars could one day help in preventing or correcting environmental issues. "Over the long haul, it'll save civilization."

While Columbia featured the latest in rocket technology, spending a couple of days within the sparsely outfitted crew cabin did require the pair to "rough it."

"Living inside the shuttle at the time was a little like camping out," said Crippen. Turning in for the night meant sleeping in the cockpit seats, but NASA's latest ship was equipped with a notably improved creature comfort. "The food system had come a long way since back in the Mercury/Gemini days, and we had good food to eat."

Still, certain aspects of the flight were probably a little more back to basics than Young and Crippen would have preferred. "The potty — or the waste management facility — went belly up on the second day," chuckled Crippen. "But John and I dealt with it."

Ultimately, STS-1 was a bold test flight to determine if a rocket launch into space could be a round-trip ticket. Adventure of that magnitude and discovery usually go hand in hand.

For Young, Crippen and NASA, the first flight of Columbia was no exception. "We sure learned a lot," said Young. "When we got back, I think (Johnson Space Center Director) Chris Kraft said it best: We just got infinitely smarter."

BOB CRIPPEN (left) and John Young board the emergency pad escape system, known as the slidewire, during a January 1981 exercise. The slidewire system provides a quick escape from upper launch pad platforms in case of an emergency.

Technology, safety for orbiter fleet evolves

By Elaine Marconi
Staff Writer

NASA's space shuttle, the most complex vehicle in the history of the nation's space program, has experienced significant changes over the years.

To most of the world, the shuttle has represented the epitome of human know-how and determination. From the drawing board to the shuttle's 25th anniversary, the orbiters are a tribute to engineering genius.

The shuttle appears very much the same as it did when the first one was built for mission STS-1, but looks are deceiving. Many enhancements and safety features have been added to the fleet of space vehicles since the original was designed.

Major modification periods for the shuttle orbiters were scheduled at regular intervals to enhance safety and performance, adding new technology and allowing for thorough inspections of the tiles, wiring and the structural integrity of the vehicles.

In the 1990s, NASA's B-52 research flight tests led to the development of a drag chute to help the orbiter land more safely and easily. Endeavour became the first to use the chute during a landing.

One of the most spectacular changes to the orbiter was the installation of the new Multi-function Electronic Display System, or MEDS.

The system's 11 full-color, flat-panel screens replaced dozens of outdated electromechanical cockpit dials, instruments and gauges. Atlantis was the first orbiter to receive the MEDS, now commonly known as the "glass cockpit."

The liquid-crystal displays of the glass cockpit help astronauts easily read important flight data, because light sources like the sun produce no glare on the screens. The displays allow for clear viewing from positions at a wide range of angles from the screen. The MEDS system also provides greater backup capability, weighs less and uses less power than the original and obsolete cockpit design.

Engineers and technicians spent about 900,000 hours performing safety enhancements on Endeavour during its Orbiter Major Modification period that started in December 2003. Among the extensive improvements were the glass cockpit and global positioning system.

In October 2005, the vehicle was powered up for the first time in two years to the cheers of the engineering team. The successful power-up signaled the end of Endeavour's modification period.

IN ORBITER Processing Facility bay 3, STS-121 Pilot Mark Kelly (second from left) and Mission Specialist Stephanie Wilson (third from left) are joined by two shuttle technicians as they examine the orbiter boom sensor system.

CARMEN PRATER, with United Space Alliance, works on the glass cockpit of Endeavour in bay 2 of the Orbiter Processing Facility. Below, workers applaud as Endeavour's electrical system is partially powered up.

"The team worked tirelessly to ensure the vehicle progressed though the modification period on time and on budget," said Tassos Abadiotakis, Endeavour's flow director.

During Discovery's modification periods, technicians completed more than 100 upgrades. This included the installation of the glass cockpit.

As part of the safe return-to-flight recommendations, technicians installed an orbiter boom sensor system, an extension that attaches to the end of the orbiter's robotic arm. The STS-114 crew used the boom to reach around the vehicle and scan the reinforced carbon-carbon surfaces to inspect the heat shield while in space.

A new digital camera was added to view the external tank during launch, and sensors were placed in the leading edge of the orbiter's wings to detect changes in temperature.

Since the safe return of Discovery on mission STS-114, the orbiter is being prepared for NASA's next shuttle launch on mission STS-121.

"The orbiter itself is a very complex vehicle, so there's always work to be done," said Stephanie Stilson, Discovery flow director since 2001. Stilson's responsibilities include overseeing periodic maintenance, upgrades and full systems testing on the orbiter.

NASA's space shuttles have continued to evolve through creative innovation and technology, increasing the safety of the orbiters and helping astronauts perform groundbreaking work in space.

Kennedy readies facilities for shuttle in less than a decade

By Anna Heiney
Staff Writer

THE ORBITER Atlantis heads toward the open north door of the Vehicle Assembly Building. The north door of the Vehicle Assembly Building was widened after the Apollo program to allow for the space shuttle's 78-foot wingspan.

Columbia flew its first trailblazing mission on April 12, 1981, but preparations at Kennedy Space Center began nearly nine years earlier.

It was April 14, 1972 — only two days before the launch of Apollo 16 on a mission to the moon — when Dr. George M. Low, then the acting NASA administrator, made the big announcement: Kennedy would be the shuttle's launch site.

Few places in the world are readily equipped with the unique facilities and experienced work force required to launch humans into space. But the major differences between the Apollo/Saturn V and the space shuttle — in size, shape and assembly — meant a lot of work would be necessary to create a shuttle launch center. With so many Apollo-era facilities already in place at Kennedy, it made economic sense to modify existing structures to meet the needs of the shuttle program.

The Vertical Assembly Building was renamed the Vehicle Assembly Building, and employees began working to give the cavernous structure a "technological face-lift." High bays 1 and 3 were equipped for shuttle stacking and checkout, and work platforms were reshaped to give workers plenty of access. Across the transfer aisle, high bays 2 and 4 each were converted to hold one vertical storage cell and one checkout cell. The space shuttle main engine shop was created from a low bay checkout cell, and the building's north door was widened to accommodate the orbiter's 78-foot wingspan.

NASA ENGINEERS added a water sound-suppression system, shown here dumping more than 350,000 gallons on the mobile launcher platform at Launch Pad 39A, to protect the orbiters from sound waves.

A portion of the new Launch Processing System, which helped reduce the shuttle's final countdown from the 28 hours required for Apollo to only three hours, was installed in two of the Launch Control Center's firing rooms.

Some of the most visible changes were made to the launch pads, as well as the three mobile launcher platforms (MLPs). The pads were stripped down to their six fixed pedestals, and fixed service structures were fashioned out of the 380-foot-tall umbilical towers previously mounted on the MLPs. A rotating service structure with a payload change-out room was also built at each pad.

Another change in the platforms involved replacing one large hole at the center of each platform with three smaller openings, which separately accommodate the liftoff flames and hot exhaust gases emitted from the orbiter's three-engine cluster and the two solid rocket boosters.

As the shuttle program got under way, new needs emerged.

"You do all you can with the drawings, then you do a final fit with the hardware," explained former Kennedy Space Center Director Dick Smith. "But as you would imagine, in the first shakedown, you start finding a bunch of things."

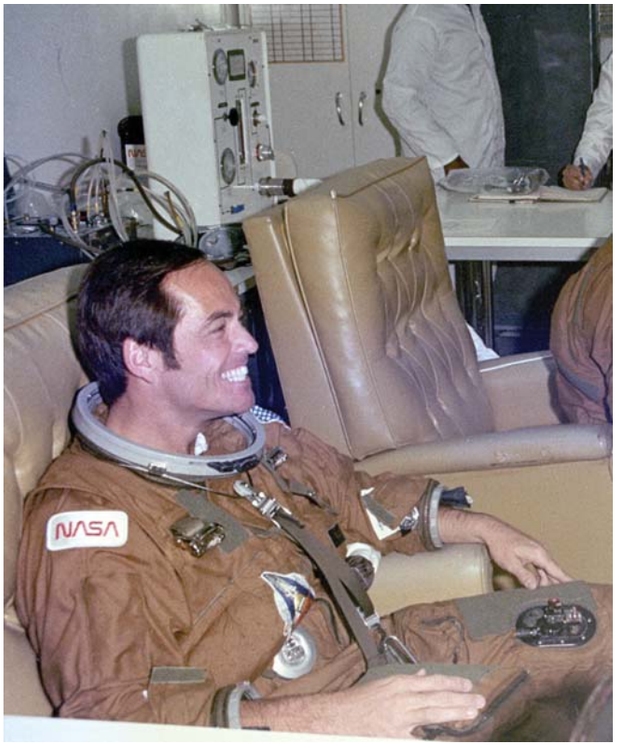
Smith recalled some launch pad upgrades added after the first handful of shuttle flights. For example, when Columbia first launched on STS-1, the shock wave generated at booster ignition caused the orbiter's aft bulkhead to yield. Although the orbiter escaped major damage, the potential for danger got NASA's attention.

"Between the first and second flights, the water sound-suppression system was extensively modified," Smith remembered. "We already had a system that sprayed water over the top of the MLP for heat protection, but everything that's there now above the deck was all added after STS-1."

In the industrial area south of the Launch Complex 39 area, the Operations and Checkout Building was adapted from Apollo needs to serve as a horizontal processing facility for shuttle payloads.

STS-1: A look back at the space shu

SPACE SHUTTLE Columbia moves toward Launch Complex 39A on a mobile launch platform before its April 12, 1981, launch.



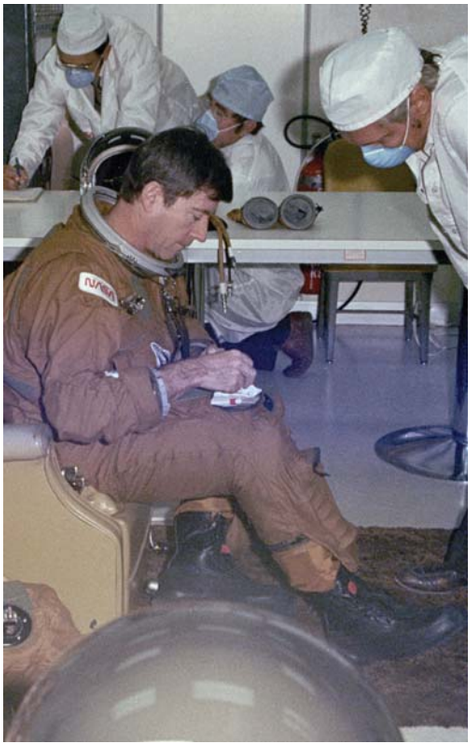
TECHNICIANS ASSIST prime crew astronauts John Young (right) and Bob Crip Operations and Checkout Building on the morning of Columbia's successful lift

THOUSANDS OF Space Center guests line the NASA Causeway awaiting the first launch of the space shuttle. The Vehicle Assembly Building is visible in the distance.

AFTER SIX years of silence, the thunder of manned space flight is heard again on April 12, 1981, with the successful launch of the first space shuttle.

THE STS-1 Launch Pad

shuttle's historic first flight



ng (right) and Bob Crippen in suit-up operations in KSC's umbia's successful liftoff.

STS-1 ASTRONAUTS John Young (in front) and Bob Crippen are followed by Flight Operations Director George Abbey, crew trainer Richard Nygram, and a space suit technician as they depart KSC's Operations and Checkout Building en route to Pad 39A for boarding of the space shuttle. The orbital mission lasted for 54 hours, ending with an unpowered landing at Edwards Air Force Base in California. The mission demonstrated a safe launch into orbit and return of the orbiter, as well as verified the combined performance of the entire shuttle vehicle — orbiter, solid rocket boosters and external tank.

THE STS-1 space shuttle team celebrates a successful liftoff of Columbia from Launch Pad 39A a few seconds past 7 a.m. on April 12, 1981.

STS-1 Milestones

March 27, 1975 — Start of fabrication for Columbia's aft fuselage in Palmdale, California

Nov. 17, 1975 — Start of fabrication for Columbia's crew module

April 23, 1978 — Completed final assembly and closeout system installation; ready for power-on

March 8, 1979 — Complete closeout inspection

March 24, 1979 — Columbia arrives at KSC

Nov. 3, 1980 — External tank mated to solid rocket boosters in VAB

Dec. 29, 1980 — Columbia rolled to Launch Pad 39A

Jan. 6, 1981 — STS-1 crew participates in Terminal Countdown Demonstration Test at KSC

Feb. 20, 1981 — Flight Readiness Firing of shuttle's three main engines

April 10, 1981 — First launch attempt for STS-1

April 12, 1981 — STS-1 launch at KSC

April 14, 1981 — STS-1 lands at Edwards Air Force Base

April 21, 1981 — Columbia returns to KSC on ferry flight

Diversity of shuttle crews grows since STS-1

By Corey Schubert
Copy editor

The faces have changed. Those friendly smiles of the two men who launched into orbit on the first space shuttle mission in April 1981 represented the country's eagerness to explore the mysteries of space.

But in the 25 years since that historic success, the variety of astronauts who followed in the footsteps of Commander John Young and Pilot Robert Crippen has come to reflect the diverse races and cultures throughout the world.

Their wide-ranging skill sets and backgrounds serve as examples of how the achievements of mission STS-1 and the Space Shuttle Program have brought together people from all walks of life for a universal cause.

From the first African-American to fly in space (Guion S. Bluford on STS-8), to the first tribal-registered Native American astronaut to fly and walk in space (John B. Herrington on STS-113), the range of "firsts" has broadened throughout 114 shuttle flights.

"When we get together and we're working toward this common goal of successful space shuttle missions, you don't think about somebody as a Japanese astronaut or U.S. astronaut, or male or female," said Kay Hire, the first Kennedy Space Center employee to be chosen as an astronaut and to fly on a space mission.

STS-87 MISSION Specialist Winston Scott was the second African-American to fly in the space shuttle. Scott is the executive director of the Florida Space Authority.

"All of that fades. All that really matters is that we're working together."

In early space programs, NASA relied on the skills of military test pilots to prove that man could survive in a spacecraft that left the Earth and safely returned. The creation of the space shuttle allowed astronauts to use the vehicle as an actual working environment, with missions that benefit from crews made up of people with diverse abilities.

This led to a bevy of groundbreaking flights: Dr. Sally Ride, the first American woman in space on STS-7; Dr. Franklin R. Chang-Diaz, the first Hispanic astronaut in space on STS-61C; Dr. Kalpana Chawla, the first East Indian-born woman in space on STS-87; and Pedro Duque, the first Spanish astronaut in space on STS-95, among dozens of others.

For many of these astronauts, being the first of a kind is far from their minds during the mission, as they concentrate on the important tasks at hand.

"I wasn't thinking about it during the launch," said Dr. Ellen Ochoa, the first Hispanic female astronaut to fly in space. "After I was back on the ground, I did get the opportunity to visit a lot of schools that had a high percentage of Hispanic students."

Even years after their missions, shuttle astronauts continue to see examples of ways they've inspired people across the world.

Just last month, Ochoa spoke to students at Stanford University in California and was moved when a Hispanic female approached her after the presentation.

"She said, 'You've been my hero ever since I was in second grade and you came to my class after your first flight,'" Ochoa said. "Ever since then, she said she'd had posters (of the mission) up on her wall. Here she was, 21 years old or so, and she was a junior in mechanical engineering."

Hire said the diversity among astronaut crews likely will continue to grow, especially as NASA works to fulfill the Vision for Space Exploration.

"As we venture into the next steps that we take with space exploration, I think what's going to emerge are requirements for additional skills," Hire said. "To meet those requirements, we'll be reaching out to various groups for new skill sets."

PEDRO DUQUE of Spain, with the European Space Agency, is helped with his flight suit by suit tech Tommy McDonald in the Operations and Checkout Building.

ASTRONAUT KAY Hire talks to Kristy Wiggins at Garland V. Stewart Magnet Middle School, a NASA Explorer School in Tampa, Fla. Hire joined Kennedy Space Center Director Jim Kennedy at the school in sharing the agency's new Vision for Space Exploration with the next generation of explorers.

Generations of families keep NASA's mission soaring

By Jessica Rye
NASA Public Affairs Officer

From the time STS-1 launched on its spectacular test flight on April 12, 1981, Kennedy Space Center has been home to numerous generations of families who have been captivated by working to ensure America's space program continues to thrive.

At Kennedy, the uniqueness of launching humans into space seems to permeate throughout the families of the employees and gets into the blood of the future generations who will continue the quest to the moon and Mars.

For one family, space is definitely in the genes. Connie Lehan is the vehicle processing engineer for orbiter Atlantis and followed in her dad's and older brother's footsteps when she began her career at Kennedy in 1990 and later transitioned to NASA in 2000. Lehan, who holds a bachelor's degree in math theory, recalls growing up in a family so dedicated to the space program.

"My dad, Jose Garcia, was the branch chief for the orbiter electrical division and began to work at Kennedy in 1964. Since so many of my father's co-workers lived in the same neighborhood, I remember the barbecues and get-togethers that were held on the weekends. I loved hearing them reminisce about the past times at the center, the camaraderie, the funny stories and the teamwork they had all experienced over the years."

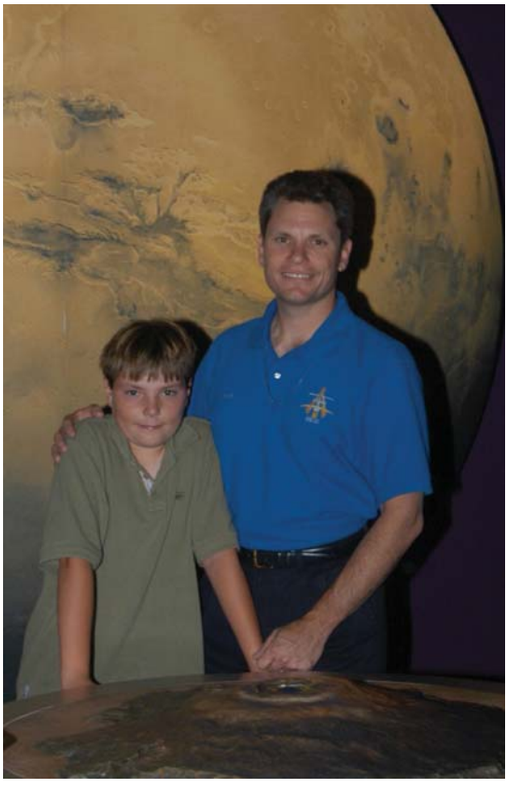
Lehan also remembers watching space shuttle flights lifting off from the pad and dreaming of the day she would have a helping hand in launching missions. "I told my father, 'One day I am going to push the button.' "

Louie Garcia, Lehan's brother, is a ground operations manager for the launch and landing division and began working at the center in 1987 just prior to the return to flight following the Challenger accident.

Although Garcia grew up around the space program and watched his dad achieve great success in his career, he was still unsure what direction his interest would take him.

However, the launch of STS-1 was a turning point for Garcia. "I was a sophomore in high school when Columbia first launched. I sold bumper stickers that said 'Space Shuttle Liftoff: I Saw It' to spectators by the river in Titusville. That launch pushed me over the edge to become an electrical engineer, and the timing was good for me as I was about to enter college."

LOUIE GARCIA, a ground operations manager for the launch and landing division, and his sister, Connie Lehan, vehicle processing engineer for Space Shuttle Atlantis, routinely share advice about job responsibilities.



SHUTTLE PROCESSING'S Crew Exploration Vehicle Manager Scott Thurston says his son, Jordan, has the desire to become an engineer and possibly work for NASA. "At 5 years old, he brought a schematic to me of a trailer he had designed." Thurston is a second-generation space employee.

When Garcia came to work at NASA, he had a very similar job to the one his sister now holds. "The neat part is to see her in that role and how she handles the day-to-day challenges that arise — and does it better than I did."

Nearly 20 years later, Garcia reflects on being a second-generation space worker. "It helps that my father worked here and built a foundation. My sister and I now have relationships continuing that were built through my father."

"It helps that my father worked here," Garcia said. "My sister and I now have relationships continuing that were built through my father."

Lehan says she's happy her brother works at the center. "I really appreciate having him here to bounce ideas off of, because he has a good understanding of the unique environment and can provide sound advice."

As the agency and Kennedy transition into a new program, the work force of today inspire its children and grandchildren to become the future trailblazers who will lead the space exploration of tomorrow.

Shuttle Processing's Crew Exploration Vehicle Manager Scott Thurston, a second-generation space employee, can already begin to see the mind of an engineer developing in one of his children.

"My 11-year-old son Jordan already has a tremendous aptitude for engineering and wants to become a mechanical engineer," says Thurston. "It must be in his blood because at 5 years old, he brought a schematic to me of a trailer he had designed."

Although Thurston does not know if his son's interest will lead to working on the space program, Jordan's interest in his dad's career and enthusiasm for the space program has put him on a path to achieve the technical excellence needed to pursue a future career with NASA.

Shuttle program boosts Central Florida economy

By Linda Herridge
Staff Writer

During the '60s, at the onset of the space program, most of the towns and cities along the Space Coast were sleepy little burgs with more surfers and tourists than space workers. Only a little more than 100,000 people called Brevard County home, according to the U.S. Census Bureau.

Fast-forward to 2006: Brevard's residents still include surfers and tourists, but more than half a million people live in the county. It's likely no coincidence that Brevard has nearly doubled in residents since the success of STS-1, the first space shuttle mission.

With 112 successful shuttle flights in a quarter of a century, NASA's shuttle program has directly effected growth in the county, as well as Central Florida. Kennedy Space Center has nearly 15,000 workers, and many more work in space-related businesses and industry.

The financial impact of the Space Shuttle Program ripples throughout the community, according to Walter Wood, president of MTN Advertising in Satellite Beach.

"When it's on a roll, tourism and related service business goes up," Wood said. "However, the impact in the long term is more far-reaching as a function of direct jobs from contractors and manufacturers."

Lynda Weatherman, president and chief executive officer of the Economic Development Commission of Florida's Space Coast, said it's clear that NASA and the nation's space program are an integral part of our community and culture.

Last year, the development commission entered into a Space Act Agreement with KSC. The agreement is a foundation document used by both to partner with the local business community in a joint goal of maintaining and enhancing Brevard's vigorous activity in support of the nation's gateway to space, Weatherman said.

In fiscal year 2005 alone, NASA and KSC injected $1.5 billion of direct spending into Brevard, according to a report recently released by the center's Office of the Chief Financial Officer. Bill Dimmer of this office said that as the injection increases in concert with the agency and center budgets, the multiplying effect of the spending fuels the economic impact on the region to a greater extent.

LYNDA WEATHERMAN, president of the Economic Development Commission of Florida's Space Coast, and Jim Kennedy, director of Kennedy Space Center, congratulate each other after signing a three-year Space Act Agreement in 2005 for economic development cooperation in support of existing and future missions of NASA at KSC.

APOLLO 17 Commander Gene Cernan (left) holds the attention of guests at the December 2004 grand opening of the Kennedy Space Center Store at Orlando International Airport. The store educates millions of airport visitors about America's space program and the Vision for Space Exploration.

In FY 2005, Brevard and the rest of Florida realized a $2.20 return on each NASA dollar spent, and 2.52 jobs for each NASA job.

The center also annually boosts the state's economy. The space industry makes a $4.5 billion contribution to Florida's economy each year, with nearly half of that revenue being generated by companies outside the Space Coast, according to a report by the Florida Space Authority's E. Keith Witt, *Beyond Launch – Expanding Florida's Space Economy.*

Amelia Woodbridge, partner at McBride Woodbridge Marketing LLC in Satellite Beach, said her business has benefited from the space program through a contract she secured to manage Space Congress for two years. Along with the significant project, Woodbridge said the contacts she made in the process led to other work including brochures, Web site development and public relations.

"Many small businesses in all industries have been the recipients of contracts and projects that are directly related to the space industry," Woodbridge said. "Everything from food vendors and tourist items to manufacturing, photography, advertising and support services have been affected positively by the space program."

Just open any travel magazine or brochure featuring Brevard and it's easy to find photos of shuttles launching from Florida's famous "Space Coast." On an even larger scale, space images and even astronauts have been featured in nationwide ads on television, billboards, radio and in newspapers and magazines.

These are reflections of the way people throughout the nation recognize the space exploration and shuttle missions that launch from the Space Coast.

"The technology leaps that we witness, that happen almost routinely within the confines of our county lines, is why many of us live here or why we stayed," said Linda Brandt, president of the Brandt Ronat and Co. advertising agency in Melbourne.

"We need to be mindful that we do not take for granted the incredible momentum that has been created by the space industry in Brevard and other places around the state," Brandt said. "We need to fight hard to maintain a leadership role as space enterprise and technology continues to evolve."

NASA-inspired spinoffs extend life on Earth

By Anita Barrett
Staff Writer

Throughout the ages, exploration has led to technological developments that ultimately found their way into the lives of ordinary citizens.

The spring-wound clock, for instance, that was developed in the 18th century for use on ships to help determine longitude, eventually led to wristwatches. In similar tradition, NASA's exploration of space has led to developments that now benefit the public, from medical and safety improvements to recreational equipment.

Below are just a few of the hundreds of technology spinoffs now part of our everyday living.

MONITORING SYSTEMS used in intensive care units were developed from technology used to monitor astronauts in the 1960s.

Medical

The monitoring systems used in intensive care units and heart rehabilitation wards were developed from the systems used to monitor astronauts during the first space missions in the early 1960s. Countless Americans recovering from heart attacks and other serious illnesses or injuries owe their lives to this technology, a direct result of NASA's space program.

Improved breast biopsies were developed as a result of technology for the Hubble Space Telescope program. Biopsies now can be performed with a needle instead of a scalpel.

The needle biopsies benefit patients by leaving only a small mark rather than a large scar and by costing significantly less — an average of one-fourth the cost of the more traditional biopsy.

LIFESHEARS WERE developed from the power source used to separate solid rocket boosters from space shuttles.

Safety

Research at NASA to tackle hydroplaning problems for aircraft and land vehicles began in the 1960s. The unique landing requirements of the Space Shuttle were also a basis for continued studies. NASA researchers determined that cutting thin grooves across concrete runways reduces the risk of hydroplaning.

The grooves, which create channels for excess water to drain, have been shown to improve aircraft tire friction performance in wet conditions by 200 to 300 percent.

Today the Shuttle Landing Facility runway at NASA Kennedy Space Center is equipped with safety grooving in the middle to optimize wet friction performance, and grinding in touchdown areas to minimize tire-spin wear. Hundreds of commercial airports around the world have had their runways grooved.

This technique is now also used nationwide on highway curves and overpasses; pedestrian walkways, ramps and steps; and food processing plants and cattle holding pens. The use of grooves on highways has contributed to an 85 percent reduction in highway accidents.

This could be NASA's most successful technology in terms of lives saved and injuries and accidents avoided.

Lifeshears, a powerful handheld rescue tool, can quickly cut through cars or other enclosures to free persons involved in an accident or other dangerous situation. The tool, which was developed through the joint efforts of the Hi-Shear Technology Corporation, firefighters and NASA, uses the same power source used to separate solid rocket boosters from space shuttles.

Lifeshears were used by rescue workers searching for survivors at the Oklahoma City federal building bombing site in 1995 and the World Trade Center in 2001. Lifeshears are lighter, cheaper and easier to use than traditional rescue equipment.

Recreation

The SpiraFlex system, presently aboard the International Space Station, is used by the crewmembers as a primary countermeasure against musculoskeletal degradation caused by microgravity. Using SpiraFlex technology, Schwinn Cycling and Fitness Inc. launched an international fitness program for health clubs and select retail distributors, called RiPP (Resistance Performance Program).

A cardiovascular conditioner developed for astronauts in space led to the development of a physical therapy and athletic development machine used by football teams, sports clinics and medical rehabilitation centers.

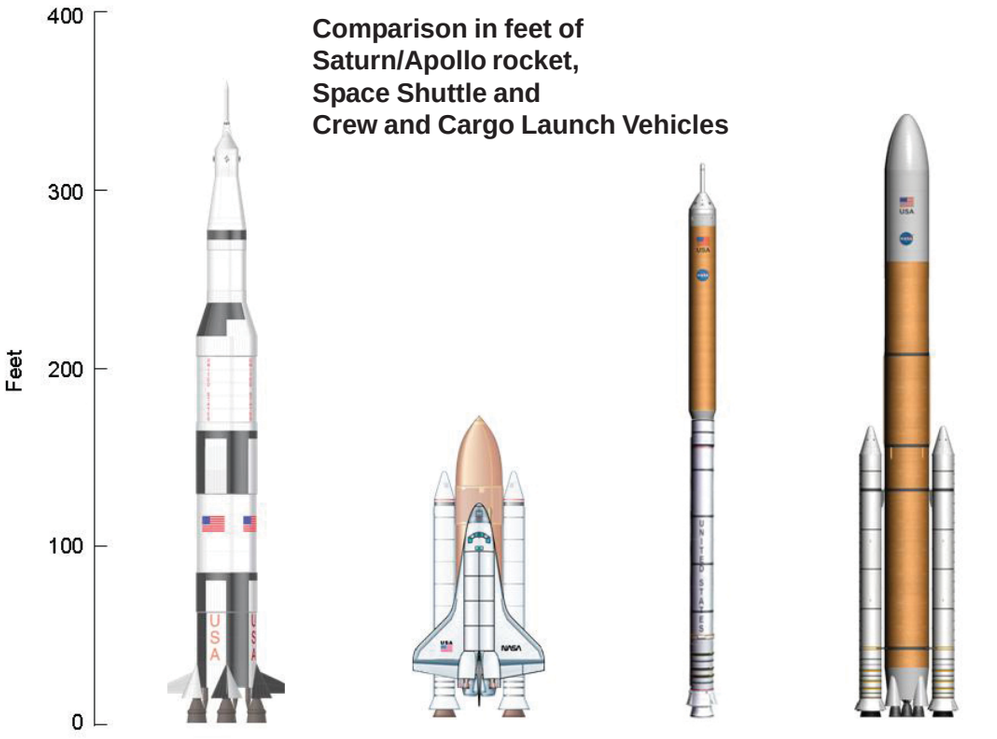
For more information about NASA spinoffs, go to the Web site **http://www.nasa.gov/pdf/54862main_hits.pdf** or **http://www.nasa.gov/vision/earth/technologies/spinoffs_index.html**.

More than 1,000 consumer products and services are built on NASA-inspired technologies

- **Solar water heaters**
- **Reflective insulation**
- **Graphite used in sports and safety equipment**
- **Wireless networks**
- **Bacteriostatic water softeners**
- **Technologies for artificial limbs and heart pumps**
- **Home security systems**
- **Flat-screen and projection televisions**
- **Lasik laser technology**
- **Cordless power tools**
- **Early warning weather observation technology**

Shuttle components, facilities power future exploration

By Cheryl Mansfield
Staff Writer



Take the space shuttle solid rocket boosters and super-size them, stretch the external tank and add proven flight engines. You now have the heavy-lift propulsion components capable of powering a new cargo vehicle to the moon.

By also using these safe and reliable elements on the Crew Launch Vehicle, NASA's launch technology is well on its way to beginning the next phase of space exploration.

While the space shuttle will be retired in the not-too-distant future, key propulsion components that carried it aloft will live on in upcoming missions to explore our solar system.

First up will be the new Crew Launch Vehicle that will ride a first stage made of a five-segment solid rocket booster similar to the twin boosters that now lift the shuttle from the pad. Sitting atop the booster will be a new liquid propellant second stage that sports a J-2X upper stage, like the ones used in the Saturn V Apollo program.

As these new launch vehicles are built, both the Kennedy work force and infrastructure will adapt to handle and launch the rockets that will carry forth the new wave of exploration.

"The center needs to be transformed and ready for the next steps in the Vision for Space Exploration to be successful," Center Director Jim Kennedy told the work force in February. "This center is NASA's launch operations center."

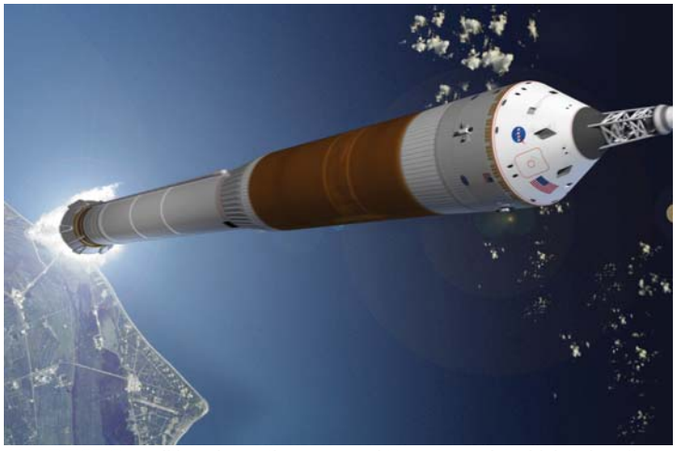
Kennedy's existing shuttle facilities will undergo transformation as the new vehicles are processed, transported and launched.

The Vehicle Assembly Building, crawler transporter and Launch Complex 39 launch pads that accommodated the shuttles and the vehicles that launched our first drive to the moon will be called upon to service yet another era of space exploration.

Shuttle Program Manager Wayne Hale recently told workers gathered at Kennedy that he is dealing with issues like when the shuttle program will give up one of the launch pads for the needs of the new vehicles. These needs will be determined by coordinating with NASA's Constellation Program.

"As they make decisions, then we can put a plan together that transitions launch pads, MLPs (Mobile Launch Platforms), firing rooms and all those facilities. And I have no doubt that all of that is going to come together just fine," he said.

Just as transformation was necessary before, the next few years will bring the beginning of the transition to support the new launch vehicles at Kennedy Space Center that will help NASA accomplish the Vision for Space Exploration.



AN ARTIST'S rendition shows the proposed Crew Launch Vehicle take off from Kennedy Space Center, NASA's launch operations center.

John F. Kennedy Space Center
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