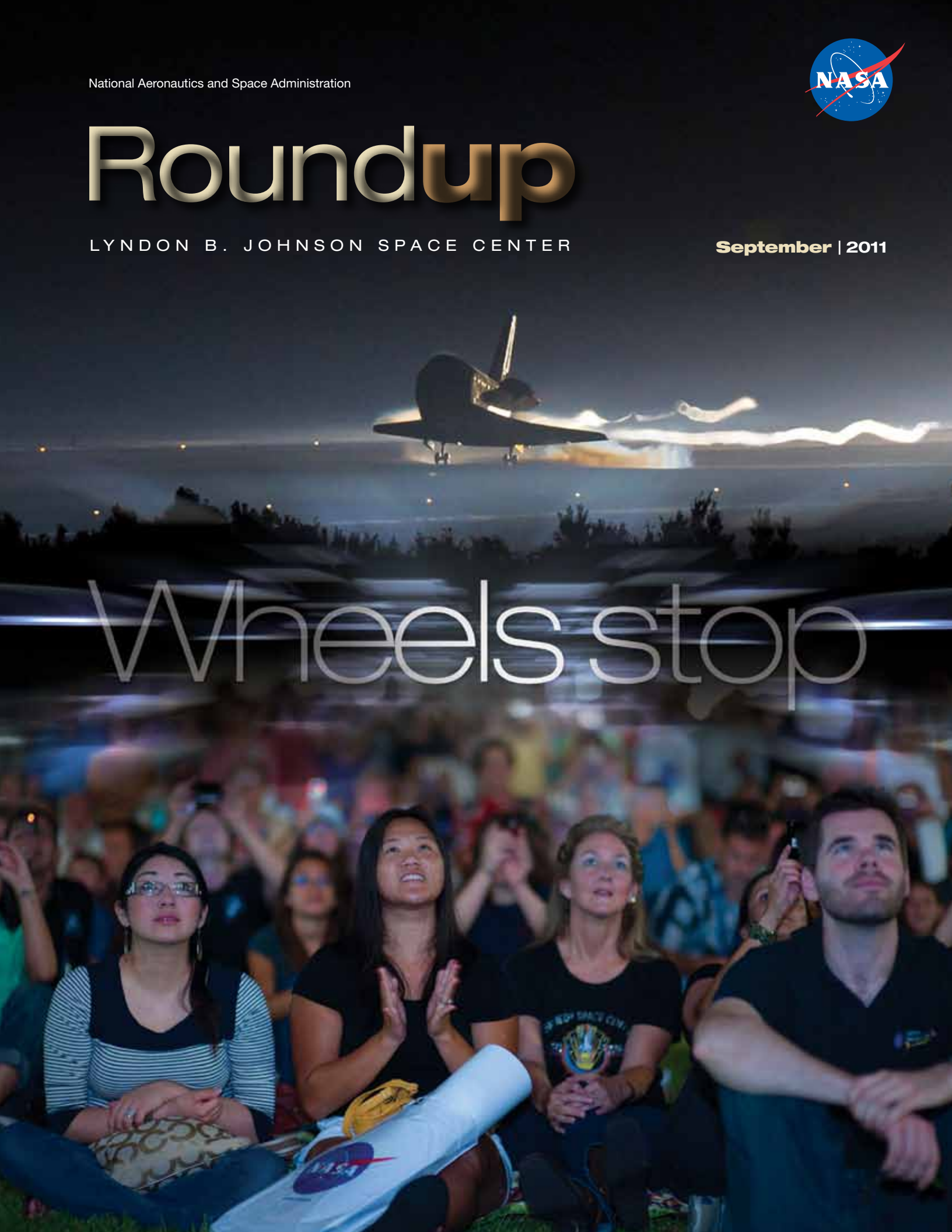
National Aeronautics and Space Administration

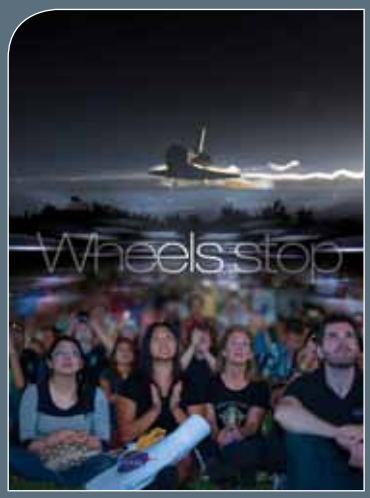
Roundup

LYNDON B. JOHNSON SPACE CENTER

September | 2011



Wheels stop



On the cover:

Johnson Space Center team members watch in awe as Space Shuttle* Atlantis *approaches Kennedy Space Center for final wheels stop.

NASA/PHOTO KYLE HERRING

Photo of the month:

Workers measured and marked in bright red the letters "MLG" at the spot where Space Shuttle* Atlantis' *main landing gear came to rest after the vehicle's final return from space. Securing the space shuttle fleet's place in history with the STS-135 mission,* Atlantis *safely and successfully rounded out NASA's Space Shuttle Program on the Shuttle Landing Facility's Runway 15 at Kennedy Space Center on July 21.

Guest Column

NASA PHOTO

John Shannon
Space Shuttle Program Manager

Congratulations to the Space Shuttle Team! What a terrific way to send the program out on a high note and preserve an outstanding legacy of accomplishments. As I have often said, "If we had to end it, this was the right way to do it!"

Now the question "What's next?" is on everyone's mind. In fact, I was asked that while sitting in the optometrist's chair at the Flight Medicine Clinic, getting my eyes dilated. The doctor asked me what I was planning on doing next, but as I tried to answer, I thought that it was also a good question for our human spaceflight strategy plans. My thoughts on how to answer the question were about as unfocused as my newly dilated eyes.

The human spaceflight team has really been able to concentrate on one primary goal for the last decade: Safely build and outfit the International Space Station. With our International Partners' help, we have completed that difficult task, and we now have a unique laboratory in space.

We should be very proud of this accomplishment. The International Space Station National Laboratory fulfills two very important functions. One, it is a testbed for all sorts of things—human adaptation to space, advanced life-support systems, a home for advanced propulsion technologies and scientific experiments. Two, it provides a destination for a whole new market—low-cost commercial access to low-Earth orbit.

So, we have a space station to be utilized and an up-and-coming new industry to supply logistics and crew to that station. We also have authorization bills and other directions from the administration and Congress to develop a space launch system, build a Multi-Purpose Crew Vehicle, invest in upgraded infrastructure at the launch site and develop new technologies across a wide range of space activities. We have strong relationships with International Partners who have a desire to join with this country in an exploration program.

There are also many "knowns." For example, we know that a crew capsule with the ability to return to Earth directly from distances greater than low-Earth orbit will be needed. We also know we will need a rocket than can lift the mass required to venture beyond the vicinity of Earth. We can certainly be doing these real things while we continue to define the focused mission.

In the "unknowns" category, there are questions of how we should go about exploration—large rockets, small rockets, depots, cyclers, landers, no landers. There are also questions about destinations. The Augustine Commission laid out a logical series of missions that include asteroids as the fifth flight in a series of capability-building missions. Other studies look at lunar or Mars options, as well as Lagrange points and geosynchronous orbits.

The bottom line is that there are many pieces that can be used to build a sustainable, cost-effective exploration program that provides true benefit to our stakeholders, but it will take very thoughtful consideration to decide what we should do and, almost as importantly, what we should not do as an agency.

As a team, we know that many projects are required to enable an exploration program. We should not delay projects that we know are required while the entire plan continues to be developed. This strategy of doing what we can now, while working with our partners to fully develop our future plans, will allow the team to do exactly what my eyes are (finally) doing … regaining our focus.

In this edition…

A legacy most worthy

NASA/PHOTO: FRANKIE MARTIN

Fancy meeting you here … Space Shuttles *Endeavour* and *Discovery* meet in a nose-to-nose photo opportunity as the vehicles switch locations on Aug. 11 at Kennedy Space Center, readying for their "green" pastures.

With a wingspan of 78 feet, a shuttle orbiter resembled a majestic plane more so than the first reusable spacecraft of its kind. That is … until you took into consideration the 17,500 mph velocity this voluminous workhorse could achieve after 2.9 million pounds of solid rocket booster thrust at liftoff.

After seeing a shuttle launch, one understood. This vehicle was definitely no run-of-the-mill anything.

More importantly, NASA's fleet achieved numerous firsts and opened up space to more people than ever before during the Space Shuttle Program's 30 years. The 60-foot-long payload bay gave the shuttle a cargo capacity unparalleled to any spacecraft; therefore, the shuttle was able to mobilize one of the greatest engineering feats in history—construction of the International Space Station. All this happened *in space*, no less.

Engineering marvels and scientific discovery notwithstanding, the Space Shuttle Program alone generated more than 100 technology spinoffs. Some of these breakthroughs include the artificial heart, home insulation, video stabilization software, green lubricants and a land mine removal device.

And while the future beckons us from deep within the cosmos, we pause to take a moment and reflect on a program that Johnson Space Center team members have poured their hearts into for decades.

For we have left a legacy that future generations will smile on, and each and every one of us can be proud of contributing to it.

Space Shuttle Program alumni website coming this fall

For more than three decades, the dedicated men and women of the Space Shuttle Program have been sharing their lives, their passion and their sweat and tears with each other. The Space Shuttle Program alumni website will provide users the opportunity to stay connected, share experiences, network with each other, hear the latest on human spaceflight programs and projects and maintain the legacy of the Space Shuttle Program.

Submit your email address today to be contacted in the coming months with registration details about this public site. Submit here: http://ma.jsc.nasa.gov/sites/workforce/Lists/SSPAlumni/newform1.aspx

NASA/HARNETT JSC2011E068859

On July 19, JSC hosted a Tweetup during the STS-135 mission to the International Space Station. Guests not only got a behind-the-scenes tour of JSC facilities, they also had a chance to fly the space shuttle simulator. Visitors were able to speak with flight directors, trainers, astronauts and managers. The Tweetup participants had more than 20,180 followers combined and represented more than 15 different states.

The orbiters, up close and personal

Enterprise (OV-101)

Enterprise was the first space shuttle. Construction began in 1974, with operational flight testing starting in 1977. Originally named Constitution, a write-in campaign urged the White House to select the name *Enterprise* after Starship Enterprise, featured on the TV show "Star Trek."

Enterprise was constructed without engines or a functional heat shield, so it was incapable of spaceflight. NASA used the orbiter for a variety of ground and flight tests across the United States. Afterward, *Enterprise* was ferried across the Atlantic Ocean to participate in several air shows in Europe. On Nov. 18, 1985, *Enterprise* became the property of the Smithsonian National Air and Space Museum. The craft will soon find a new home at the Intrepid Sea, Air & Space Museum in New York.

***Enterprise*, riding atop its 747 carrier aircraft, arrives at the Redstone Arsenal airstrip near Marshall Space Flight Center in Huntsville, Ala., on March 13, 1978.**

Challenger (OV-099)

Challenger was built to serve as a test vehicle for the Space Shuttle Program, but was converted to a space-rated orbiter. Its first voyage, STS-6, was on April 4, 1983. The craft was named after the British Naval research vessel, HMS Challenger, that sailed the Atlantic and Pacific Oceans during the 1870s.

The orbiter deployed 10 satellites and flew 10 flights. Missions included the first spacewalk during STS-6 in 1983 and launching the first U.S. woman, Sally Ride, into space aboard STS-7 in 1983.

Challenger's service to the United States ended in tragedy on Jan. 28, 1986. Just 73 seconds into the STS-51L mission, a booster joint failure caused an explosion that resulted in the loss of seven astronauts as well as the vehicle.

The Earth-orbiting Space Shuttle *Challenger*, beyond the Earth's horizon, is captured by a 70mm camera aboard the uncrewed, free-flying Shuttle Pallet Satellite during STS-7.

Columbia (OV-102)

The second orbiter, *Columbia*, was the first to fly into space. *Columbia* arrived at Kennedy Space Center (KSC) from Dryden Flight Research Facility on March 25, 1979, to be readied for its first flight.

Columbia launched on April 12, 1981, on the STS-1 mission. The spacecraft was named after a small sailing vessel that operated out of Boston in 1792, which explored the mouth of the Columbia River. *Columbia* spent 304 days in space on 28 flights. Missions included launch of the first four-person crew aboard STS-5 in November 1982; the longest shuttle flight in history with STS-80 in November/December 1996 (18 days); and the deployment of the Chandra X-ray Observatory with STS-93 in July 1999.

Columbia and its crew of seven were lost over East Texas on its landing descent to KSC on Feb. 1, 2003, at the conclusion of a microgravity research mission, STS-107.

Space Shuttle *Columbia* begins a new era of space transportation after it lifts off on April 12, 1981.

Discovery (OV-103)

Discovery first launched on Aug. 30, 1984, with mission STS-41D. It is named for two famous sailing ships: one captained by Henry Hudson in 1610-11; the other, by James Cook, while on a voyage that included the discovery of the Hawaiian Islands.

The orbiter flew 39 missions, including both return to flight missions, and spent 365 days in space. Other *Discovery* milestones include the deployment of the Hubble Space Telescope during STS-31 in April 1990; the launching of the Ulysses spacecraft to explore the sun's polar regions during STS-41 in October of that year; and the deployment of the Upper Atmosphere Research Satellite in September 1991. *Discovery* also flew the ninth and final mission to Russia's Mir space station in June 1998. *Discovery's* last flight with the STS-133 crew delivered Robonaut-2, the first humanoid in space, to the International Space Station.

***Discovery* is seen from the space station as the two orbital spacecraft accomplish their relative separation on March 7, 2011.**

Atlantis (OV-104)

Atlantis lifted off on its maiden voyage on Oct. 3, 1985, on mission STS-51J. It is named after a two-masted sailing ship that operated from 1930 to 1966 for the Woods Hole Oceanographic Institution.

Atlantis completed 33 missions and docked with the International Space Station 12 times. Missions include launch of the Galileo interplanetary probe to Jupiter on STS-34 in October 1984; seven historic missions to Russia's Mir space station from 1995-97; and delivery of the Columbus laboratory to the space station in February 2008 aboard STS-122. *Atlantis'* last flight ended the Space Shuttle Program on July 21, returning the STS-135 crew back to Earth.

NASA/BILL INGALLS 201107210007HQ

On July 21, 2011, *Atlantis* is rolled over to the Orbiter Processing Facility shortly after landing at KSC, completing its 13-day mission to the International Space Station and the final flight of the Space Shuttle Program.

Endeavour (OV-105)

Endeavour was the final shuttle constructed, and was a replacement for *Challenger*. *Endeavour* began flight operations in May 1992 on STS-49, a historic mission to rescue and repair an ailing Intelsat.

It is named after the first ship commanded by 18th century British explorer James Cook. The orbiter flew 25 missions and traveled more than 122 million miles. Other missions include the first Hubble Space Telescope servicing mission in December 1993 (STS-61); the first shuttle flight to begin assembly of the station in December 1998 (STS-88); and the delivery of the first element of Japan's Kibo module to the orbiting laboratory the summer of 2008 (STS-124). *Endeavour's* final launch on May 16, 2011, was STS-134. The mission delivered the Alpha Magnetic Spectrometer-02, a state-of-the-art particle physics detector, to station.

NASA/KIM SHIFLETT STS134-S-103

NASA Administrator Charles Bolden congratulates the STS-134 crew on a job well done following the successful landing of *Endeavour*. From left: The European Space Agency's Roberto Vittori; Pilot Greg H. Johnson; Commander Mark Kelly; Bolden; and Mission Specialists Mike Fincke, Greg Chamitoff and Drew Feustel.

The Jake Garn Mission Simulator and Training Facility: Past, present and future

The Jake Garn Mission Simulator and Training Facility was prime training ground for astronauts who worked with the Space Shuttle Program. The facility continues to provide for those still participating in the International Space Station Program and is divided accordingly, with the Shuttle Mission Training Facility (SMTF) and the Space Station Training Facility.

Constructed in 1976-77, the SMTF has been operational since late 1978, providing shuttle crew training. The SMTF is the only high-fidelity simulator facility for flight crews and ground controllers during all phases of a shuttle mission, from launch minus 30 minutes to landing and rollout. To support this high-fidelity requirement, the SMTF uses real-world flight computers and associated support equipment and flight software, along with flight cockpit hardware (instruments, displays and controls). In addition, visual, aural and motion cues are provided by computer-generated out-the-window scenes, hidden speakers and a motion platform.

The SMTF includes the Fixed Base Simulator (FBS), Guidance and Navigation Simulator (GNS) and Motion Base Simulator (MBS). Specifically, the MBS provides motion cues essential for an accurate simulation of ascent, deorbit, re-entry and landing. The MBS is a high-fidelity replica of the shuttle forward flight deck, with seating for four astronauts. Simulation software controls the motion platform attitude and rates to give the astronauts the perception of vehicle motion.

NASA/PHOTO JSC2011E016861

STS-134 Commander Mark Kelly completes a simulation exercise in the Jake Garn Mission and Simulation Training Facility's MBS.

"As an instructor for many years and now the manager of the building, it would be difficult to choose one memorable moment," said Jerry Swain, facility manager, Buildings 5 and 35. "I was the instructor team lead for the 51L mission, so the excitement generated during that training was high, but it was certainly offset by the tragedy of the accident in losing so many personal friends. The many VIPs who have come through, who I have briefed, are also high points for me."

Now that shuttle has ended, the FBS is going to the Adler Planetarium in Chicago; the MBS is going to Texas A&M University; and the GNS will reside in the Wings of Dreams Aviation Museum near Jacksonville, Fla.

Currently, the space station simulators are in Building 5 South, and that setup will continue. Building 5 North, where the shuttle simulators are located, will house an Orion-type simulator.

Space Shuttle Program **milestones**

NASA/PHOTO ISS027E035287

April 12, 1981
Columbia, the first of NASA's orbiter fleet, launches into space with STS-1.

Feb. 18, 1977
Space Shuttle *Enterprise* completes its first flight test perched atop a Boeing 747 Shuttle Carrier Aircraft.

NASA/PHOTO 462925MAIN

June 18, 1983
Sally Ride becomes the first American woman in space.

Jan. 28, 1986
The *Challenger* accident occurs 73 seconds into the flight of STS-51L.

NASA/PHOTO 447137MAIN1

April 25, 1990
The Hubble Space Telescope is deployed by the STS-31 crew.

Dec. 6, 1998
Using *Endeavour's* 50-foot-long robotic arm, the Zarya control module was captured from orbit and mated to Unity. The station flew free on Dec. 13, as Pilot Rick Sturckow separated *Endeavour* from the infant laboratory during STS-188.

NASA/PHOTO 531129MAIN_FULL

1980 1990

April 4, 1983
Challenger takes its first trip to orbit with STS-6, which included the first spacewalk for the Space Shuttle Program.

Aug. 27, 1984 President Ronald Reagan announces he was "directing NASA to begin a search in all of our elementary and secondary schools and to choose, as the first citizen passenger in the history of our space program, one of America's finest—a teacher."

May 7, 1992
Maiden voyage of *Endeavour,* which also saw the rescue and repair of the ailing Intelsat VI satellite.

NASA/PHOTO 530939MAIN

June 27, 1995
STS-71 marks the 100th crewed space launch by the United States and the first shuttle docking to Russian space station Mir.

NASA/PHOTO 124564MAIN FULL

NASA/PHOTO 141997/MAIN_IMAGE_FULL

Feb. 1, 2003
Columbia disintegrates upon re-entry over East Texas, resulting in the loss of the STS-107 crew.

Feb. 11, 2000
STS-99 rockets into the atmosphere to complete the most comprehensive high-resolution digital topographic database of the Earth.

Feb. 11, 2008
The Columbus module becomes part of the space station during the STS-122 mission to deliver and attach it.

Nov. 3, 2007
STS-120 Mission Specialist Scott Parazynski completes delicate surgery to repair the P6 4B solar array wing that obtained a tear during its deployment.

NASA/PHOTO S130E008168

Feb. 15, 2010
The Cupola, space station's "room with a view," is relocated from the forward port to the Earth-facing port of the newly installed Tranquility node. STS-130 Pilot Terry Virts and Mission Specialist Kathryn Hire moved the Cupola by operating the station's robotic arm from controls inside the Destiny laboratory.

NASA/PHOTO JSC2010E09093

Feb. 24, 2011
STS-133 brings the first humanoid robot, Robonaut-2, to the space station.

2000 2010

July 23, 1999
Eileen Collins becomes the first female shuttle commander with the launch of STS-93.

March 8, 2001
STS-102 conducts the first space station crew swap by delivering the Expedition 2 crew to the orbiting laboratory.

May 11, 2009
The last and most complex Hubble Space Telescope servicing mission begins with STS-125. The mission included five spacewalks to extend the life of the observatory.

July 21, 2011
Wheels stop at Kennedy Space Center in Florida. *Atlantis* begins her retirement after a successful STS-135 mission, and the Space Shuttle Program chapter of human spaceflight is closed.

July 26, 2005
Return to Flight mission after the *Columbia* tragedy. The major focus of STS-114 was testing and evaluating new shuttle flight safety procedures, which included inspection and repair techniques never attempted before.

NASA/PHOTO S125E007221

NASA/PHOTO STS135-S-272

‘Ghost orbiter’ gave real shuttles wings to soar

The Shuttle Avionics Integration Laboratory (SAIL), sometimes referred to as the “ghost orbiter,” is not exactly haunted, but all 135 shuttle missions lingered in the unique facility at one time in the program’s storied history.

“SAIL provided a high-fidelity lab, including a member of the orbiter fleet—OV-095—in which we tested the integrated avionics of the shuttle for all 135 flights, plus all flights of the approach and landing test phase,” said SAIL Chief Engineer Frank Svrcek, a United Space Alliance (USA) employee.

Before any shuttle orbiter launched into space, the mission was “flown” on the ground to test computers, software and other avionics.

“Our philosophy was, ‘Test like you fly, and fly like you test,’” said Don Magnusson, manager, SAIL Test Operations and Maintenance, also with USA.

The SAIL team’s standard of excellence showed in the results it achieved. Testing requirements for every mission were completed in time for analysis and usually well ahead of schedule. Due in large part to the work performed in SAIL, there was never a major in-flight problem with the avionics of the space shuttle during the entire program, from STS-1 in 1981 to STS-135 in 2011.

A small but tightly knit team manned the helm in SAIL, working diligently to orchestrate shuttle missions behind the scenes.

“The test team varied in size, but averaged around 16 employees that mixed and matched in every way possible: operators, engineers, astronauts, NASA, Rockwell, Lockheed, IBM,” Svrcek said. “The test team was supported in the background by more people: configuration management specialists, test procedure writers, safety monitors, librarians … It was the importance of each person’s job to our mission that pushed us to work well together and bond as a team—one which, over the years, morphed into more of a family—whose members were affectionately known as ‘SAILors.’”

SAIL and its SAILors provided a magnificent tool for the Space Shuttle Program, as software changes were made for every flight, and hardware changes were also made quite often. Knowing that these changes had already successfully “flown” on a shuttle added a huge level of confidence to the “Go for launch” commitments preceding each flight.

July 21 marked SAIL’s final test flight. Magnusson and JSC Director Mike Coats were aboard for the ceremonial event, which Magnusson called, “The highlight of my 33-year career in this laboratory.”

While SAIL is no longer flying missions, the laboratory will continue to encourage future explorers—except these explorers will be going to more exotic locales in the solar system.

“NASA has decided to turn the lab into a tourist tram stop with Space Center Houston, to be used at Johnson Space Center to tell the shuttle story,” Magnusson said. “I am excited to be part of this effort of historic preservation of the facility I spent a major part of my professional career in—first to help build it, and now to help preserve it.”

Many veteran SAILors have clocked decades, not just hours, in making SAIL a vital component of mission success. Hopefully, its inspiration will live on decades longer.

NASA/BLAIR JSC2011E068536

An impressive look at the avionics that make up test orbiter OV-095.

PHOTO COURTESY OF WILLIAM HUNT

Don Magnusson (left), manager, SAIL Test Operations and Maintenance, and JSC Director Mike Coats take one last ceremonial ride in the “ghost orbiter” on July 21.

STS-135 wheels stop caps off a historic program

Just before sunrise on July 21, *Atlantis* glided back to Earth, completing 30 years of Space Shuttle Program missions that expanded our understanding of Earth, helped teach humans how to live and work in space and facilitated international partnerships.

NASA/PHOTO ISS028E018221

This unprecedented view of the Space Shuttle *Atlantis*, appearing like a bean sprout against clouds and city lights and on its way home, was photographed by the Expedition 28 crew of the International Space Station. Airglow over Earth can be seen in the background.

During the STS-135 mission, the crew of four experienced astronauts—Commander Chris Ferguson, Pilot Doug Hurley and Mission Specialists Sandy Magnus and Rex Walheim—outfitted the International Space Station with spare parts, food and other provisions that will help furnish the orbiting laboratory through 2012. They also carried out the Robotic Refueling Mission to demonstrate tools and techniques needed to refuel satellites in space, supported spacewalk activities by station crew members and ridded the station of a hefty load of unneeded items.

From launch to landing, STS-135 was an excitement-filled mission. Pesky weather conditions at Kennedy Space Center (KSC) threatened launch, but the clouds parted to let *Atlantis* leap into the sky. When the spaceship cleared the launch tower, the crew and the dedicated veteran mission operations team at Johnson Space Center took the reins to successfully execute an action-packed, 13-day voyage. On Flight Days 1 and 2, the crew members performed their usual inspections and pre-docking checks. Ferguson smoothly completed *Atlantis'* R-bar pitch maneuver as the orbiter approached the space station on Flight Day 3, and successfully flew her in for an on-target docking 240 miles above New Zealand.

During more than a week of docked operations, the crew devoted approximately 130 hours to cargo transfer operations and, with an extension day, completed more than 50 additional tasks. Walheim choreographed the six-and-a-half-hour spacewalk, performed by Expedition 28 Flight Engineers Ron Garan and Mike Fossum, while Hurley and Magnus operated the station's 58-foot-long robotic arm to help maneuver the spacewalkers.

NASA astronaut Sandy Magnus, STS-135 mission specialist, may well be thinking of the word "ocean" for two reasons. Her navigation in the weightlessness of space could be loosely compared to swimming, and she is surrounded by an "ocean" of supplies and equipment in the Raffaello multi-purpose logistics module.

NASA/PHOTO S135E007420

During the excursion, Garan and Fossum placed a station pump module that failed in 2010 inside the shuttle payload bay for return to Earth, among other tasks.

Atlantis' crew said farewell to the space station and departed for the shuttle's two-day journey back to Earth after replenishing the research facility with 10,000 pounds of critical supplies, including more than 2,600 pounds of food. The faithful bird also freed the orbiting lab of more than 5,600 pounds of trash, old packaging material and other unwanted articles.

After a "go" for deorbit burn from Mission Control, the crew initiated reentry into the Earth's atmosphere. Heading toward KSC from the southwest, the orbiter flew over the Yucatan Peninsula, to the west of Cuba, across half of Florida, completing 200 orbits and 5,284,862 statute miles upon wheels stop.

Before departing the space shuttle for the final time, Commander Ferguson left a plaque in *Atlantis'* cockpit that paid tribute to the men and women of the Space Shuttle Program.

It reads:

"This plaque flew on the final Space Shuttle Mission in July, 2011. From the fortunate few who have served in space to the thousands who make spaceflight a reality, thank you for keeping the dream alive. Your passion for these amazing space ships will always stand as proof of what this country can do when it dares to be bold!"

NASA/PHOTO S135E009473

Inside the International Space Station's Node 1, or Unity, STS-135 Commander Chris Ferguson adds his mission's decal as the final piece of the collection of shuttle crew insignias. NASA astronaut Mike Fossum, Expedition 28 flight engineer, looks on.

Remembering shuttle

We asked for your fondest shuttle memories, and boy, did you deliver. Some of them can be read in this special issue. For the rest that could not fit, you can find them on the JSC Features website throughout the month of September.

Thank you for sharing your stories. But more importantly, thank you for your service to this great vehicle and our space program.

A friend of ours, an associate pastor at our church and launch guest of a recent commander, had a history of going to Florida for the launch and having it slip. It was his "curse." At the last launch he attended, the Range Safety Officers caused a five-minute slip within the launch window—and watching it back at Johnson Space Center with friends, we started asking, "Where is that guy and who let him show up?" Alas, the launch happened with seconds to spare, and his "curse" was lifted.

Eric Patenaude, OC4
Cargo Integration/International Space Station Crew Provisioning

I was born at the dawn of the space shuttle era, one month before that first launch of *Columbia* in April 1981. Because of that, and because of my obsession for all things Bradbury, Asimov, Wells and all the other sci-fi greats, I grew up with the dream of manned spaceflight. The space shuttle was the purest embodiment of that dream. Just imagine, a winged aircraft that propels brave men and women, astronauts, into space, and returns them in all of its gliding magnificence! My fondest shuttle memory is of my very first launch experience, *Discovery's* final voyage for manned spaceflight, STS-133, which launched on Feb. 24, 2011. I stood outside the VAB for at least an hour and couldn't take my eyes off that winged wonder as it stood on the launch pad. Shivers ran through my spine, goose bumps covered my arms and I could barely contain my excitement as the countdown began. The thrill of being there to witness one of our greatest accomplishments … the ignition, the plumes of water vapor, the liftoff, the roll, the SRB separation … The sound as it hit me, went over me and through me and literally rocked my world. No words can capture it.

Zarana Patel, SK
Space Radiation Program Element

I built the satellite capture device for the maiden voyage of *Endeavour*, in which the crew performed the first three-man extravehicular activity (EVA) in order to re-boost a Intelsat satellite. What was special for me about this mission was that my cousin, astronaut Rick Hieb, was one of the mission specialists that performed the first three-man EVA using the capture device I built.

Larry J. Zielke, NT211

As a member of the Powered Flight Analysis team, I developed conceptual flight profiles for the early shuttle missions. One particular mission that the Department of Defense (DoD) planned for shuttle pushed the orbiter maneuver performance past its limit. This mission was the subject of much negotiation between DoD and NASA.

I recall one meeting where the three-star general started off with, "I had dinner with President Reagan last night, and he wanted me to personally tell you that this mission has his highest priority." Whereupon JSC Payload Integration Manager Leonard Nicholson looked at my branch chief, Aldo Bordano, and me for a sign. We shook our heads sideways, indicating no-go for mission feasibility.

So Leonard scooted up to the conference table and stretched to be as tall as he could while looking directly into the eyes of the general. Leonard stated matter-of-factly, "I don't care who you had dinner with last night, you are at the Manned Spaceflight Center now, and if you want to fly on our vehicle, you will fly it our way." The general deflated immediately. We went on to fly several DoD missions, but we didn't fly that one.

Jimmy L. Allison
Data Systems Analysis Directorate
Boeing (McDonnell Douglas)

Memories are hard to express in words but easy to see from the heart. I started working on the Space Shuttle Program in 1977, when I transferred from the Washington metropolitan area. As a young girl, I always wondered about space, and getting the opportunity to work on the shuttle was a very exciting adventure. My greatest memories involved programming the initial flight software, the beginning of the shuttle reconfiguration activity and to see the flight software actually perform during each flight. Although it included long days and many nights, it was fun crafting each vehicle for flight, and it was a dream that came true.

After STS-107, I started expressing my memories in artwork (patchwork memory quilts) for myself and co-workers. These quilts are how I learned to express my memories and love for the Space Shuttle Program.

Anita Moore Senviel
United Space Alliance

Split-second decision-making training paid off one late night on console. I was a flight controller working at the DPS MPSR (green consoles). During the three to seven minutes of LOS, everyone rushes to make their dinner or go to the restroom. I was in the restroom getting ready to return to console. As I flushed, my glasses fell off and into the toilet. They were no longer visible. I had minutes to return to console and seconds to think about what to do. I definitely couldn't read the console data without them. Knowing the physical design of the path, I decided maybe they are stuck in the curve. So I reached in, retrieved my glasses, washed them and went calmly back to console.

Susan Stone, OD2
Boeing

Losing *Columbia* is not one of our fondest memories, but it is one that will stay with us forever. I don't think anyone whoever flew a shuttle mission was more exuberant about being there than Willie McCool. You could see it in his eyes and the childish grin on his face. Willie was happy up there … I keep the following quote on my computer and read it from time to time.

"The colors are stunning. In a single view, I see, looking out at the edge of the Earth: red at the horizon line, blending to orange and yellow, followed by a thin white line, then light blue, gradually turning to dark blue and various gradually darker shades of gray, then black and a million stars above. It's breathtaking." - Willie McCool

I'm reminded of the sacrifices made by our friends and co-workers to this wonderful program. At the same time, I reflect back on all the success of the Space Shuttle Program, which lies squarely on the shoulders of Willie and all the others who rode these magnificent machines into space. Thanks for the ride …

David W. Carraway
Test Safety Officer
Anadarko Industries, LLC

I grew up about 40 miles north of Cape Canaveral, Fla., when the space shuttle came into being, back when I was in elementary school. When a launch was scheduled, depending on the teacher, our class could stand outside, look to the sky and see the shuttle lift into the heavens. Somehow, 30 years has passed since the days of standing in my schoolyard, watching a daytime launch or catching sight of it in my backyard at night—which was by far the best! Today I get to work here at JSC, and those memories of just stepping outside by my back door to watch the shuttle take flight will be with me forever. I know for certain that I was a lucky kid.

Shannon Williamson, AH8
HR Operations
Gapsi-Banner Joint Venture

My favorite shuttle memory occurred on Nov. 14, 1981 (STS-2), before I was even a NASA JSC employee. Myself and about 50,000 Aggie fans were at an afternoon NCAA football game at Kyle Field. During the game, someone in front of us pulled out a small battery-powered TV and announced the shuttle was minutes away from landing. Approximately 20 diehard Aggie football fans gathered around his nine-inch black-and-white TV, completely forgetting about the game. After several minutes of hushed anticipation, we spotted the shuttle dropping into view and gliding to a wheels touchdown (versus an Aggie touchdown), and then wheels stop at Edwards Air Force Base runway. Our entire small group let out an extremely loud cheer of pride and relief, followed up with several high-fives. I did not realize at that moment I had just witnessed something that would later become central to my 25-year professional career at NASA JSC.

Michael Bradley, LA
Office of Chief Financial Officer

In 1992, while working for Space Industries, Inc., I found myself developing the Commercial Refrigeration/Incubation Module, one of the first commercial payloads to fly as a certified payload on the space shuttle, which was manifested to fly on *Endeavour's* first flight, STS-49. The schedule was tight (as usual), and by the time the payload was ready for fit-check, *Endeavour* was already on the pad. As many can attest, my first trip to the launch pad was invigorating. I remember check-points, the ramp up 39B, removing jewelry, cell phones (then not considered jewelry), tethers and taking the elevator (up) 147 feet to the shuttle door. After the fit-check, I inquired about making a phone call. I was told to just pick up the phone and ask the operator to call the number. So, of course, I called my mother. Staring out at the sunny Florida coast, my exact words to my mom were, "OK, I can die now." Funny as it may seem, this was what I was born do—to be a vital part of NASA. And this bigger-than-life shuttle was, to me, the perfect embodiment of my childhood Apollo expectations and what NASA was born to do.

Jeff Lasater
Oceaneering Space Systems

I was blessed to be one of the Space Shuttle Program Mission Management Team (MMT) secretaries for STS-119 and STS-125 through STS-135. The secretary ensures that meetings run smoothly, announces each agenda item, documents MMT decisions/actions, assists with producing the meeting minutes and supports the board chair by ensuring his requests are met. I was extremely nervous the first time I ever sat down in the secretary chair next to LeRoy Cain. LeRoy turned to me and said, "I am ready to begin—call the meeting to order." He began to move the chairman's gavel towards me. Not wanting to fail in getting the meeting participants' attention, I said in a booming voice, "May I have your attention. Please cease all side conversations so we can get started." The next thing I know, the entire room immediately turns their attention to me, and all the side conversations stopped. You could literally hear a pin drop. The MMT participants were shocked by my statement. LeRoy chuckled, moved the gavel away from me, and said, "I guess you won't be needing this."

Daniel R. Pearson, MG
United Space Alliance

Roundup

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Shuttle era shaped future of sp

NASA's space shuttle fleet began setting records with its first launch on April 12, 1981, and continued to set high marks of achievement and endurance through 30 years of missions. Starting with *Columbia* and continuing with *Challenger*, *Discovery*, *Atlantis* and *Endeavour*, the spacecraft has carried people into orbit repeatedly; launched, recovered and repaired satellites; conducted cutting-edge research; and built the largest structure in space, the International Space Station.

As humanity's first reusable spacecraft, the space shuttle pushed the bounds of discovery ever farther, requiring not only advanced technologies but the tremendous effort of a vast workforce. Thousands of civil servants and contractors throughout NASA's field centers and across the nation demonstrated an unwavering commitment to mission success and the greater goal of space exploration.

Next-generation space vehicle

NASA's Orion Multi-purpose Crew Vehicle (MPCV) is the next craft in line for exploration. It has seen tremendous technological advancements in the past year, undergoing continuous research and development phases so that it can eventually take crews to space.

With computing power 1,000 times faster than current shuttle systems, the Orion MPCV is designed to be the most technically self-sufficient spacecraft ever built. It will use a networking technology called Time Triggered Gigabit Ethernet (TT-GbE), which will allow NASA engineers to categorize different types of data and prioritize how that data should travel through the network.

Taking lessons learned from shuttle and applying those advancements to new craft is part of how the Space Shuttle Program will continue its legacy beyond low-Earth orbit.

What's in store for the future?

American astronauts continue to live and work aboard the International Space Station 24 hours a day, seven days a week, 52 weeks a year, as they have for more than 10 years. This critical research facility, made possible with the shuttle's cargo capabilities, will be the anchor of our human spaceflight program for the next decade.

As the private sector ramps up its own new technologies to aid in exploration, NASA will do what it does best—focus on the next big goal. The agency will invest in high-payoff, high-risk technologies that industry cannot yet tackle. These steps will open up an array of destinations that had previously not been an option.

This transition has been difficult for the devoted Space Shuttle Program workforce that made this flagship program an incredible success for three decades. However, a new approach will allow NASA to focus on the really hard stuff, such as sending humans to an asteroid or to Mars.

"Some say that our final shuttle mission will mark the end of America's 50 years of dominance in human spaceflight; as a former astronaut and the current NASA administrator, I'm here to tell you that American leadership in space will continue for at least the next half-century because we have laid the foundation for success—and failure is not an option," said NASA Administrator Charles Bolden.

PHOTO: LOCKHEED MARTIN

Standing five stories tall fully stacked, the Launch Abort System was mounted atop the Orion MPCV in early August at Lockheed Martin's facilities near Denver. Orion is being prepared for the next round of testing in an acoustic chamber. The test vehicles will provide critical data used to model the spacecraft's capabilities to perform deep space exploration missions.