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Shuttle Era Ends

Thirty years of US space shuttle operations came to an end when *Atlantis* touched down for the final time July 21.

Photography by NASA photographers



The gantry rolls back from space shuttle Discovery in the hours before its final flight. It waits on Pad 39A, also used for the Apollo missions to the moon. Inset: NASA's patch commemorating 30 years of the shuttle program includes five five-pointed stars representing the five orbiters, and 14 other stars memorializing the astronauts who lost their lives during shuttle operations.



The shuttle program was meant to make access to space cheap and routine. While that goal was never fully achieved, the program proved it could launch payloads, service them in orbit, and bring them back if necessary. **11** Columbia on its maiden flight in April 1981. NASA quit painting the large fuel tank on later missions, saving great weight. **12** Enterprise—yes, President Ford assented to fan requests to name it after the “Star Trek” ship—rode up to its glide tests aboard a specially configured 747. The jumbo jet later carried shuttles from landings in California back to the Kennedy Space Center in Florida.





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11 Enterprise was a full-size, full-weight test vehicle built only to prove glide handling after re-entry. It never flew in space. Here, in 1977, it makes its first descent without an aerodynamic tailcone over the engines. *12* Columbia as imaged from a USAF telescope in Hawaii in 2003, 22 years after it flew the first shuttle mission. Days later, it would be lost during re-entry. *13* Perhaps the most famous shuttle payload was the Hubble Space Telescope, here being released from Discovery in 1990. Serviced by shuttles five times, Hubble is operating well past its planned 15-year life. *14* Atlantis and Endeavour on Pads 39A and B, respectively, await missions in 2008. *15* Gary Payton flew aboard STS-51C, the first all-military-payload shuttle mission in 1985. He later served as deputy undersecretary of the Air Force for space programs.



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11 The only images of a shuttle docked with the International Space Station, in which both are seen in their entirety, were taken by a cosmonaut, Paolo Nespoli, in a Soyuz craft. Endeavour was making its last visit to the ISS, in May. The angle belies the true size of the ISS, which is more than 300 feet wide. **12** Discovery, in a rare view from the top of the gantry, departs on a mission to deploy a Tracking and Data Relay Satellite in 1995. **13** Discovery's cockpit area imaged by space walkers maintaining the ISS in 2009. **14** The STS-70 crew inspects Discovery's nose gear after landing. Shuttles typically landed right on the centerline of KSC's long runway, despite a dead-stick, unpowered flight from orbit.





NASA photo by Carla Thomas

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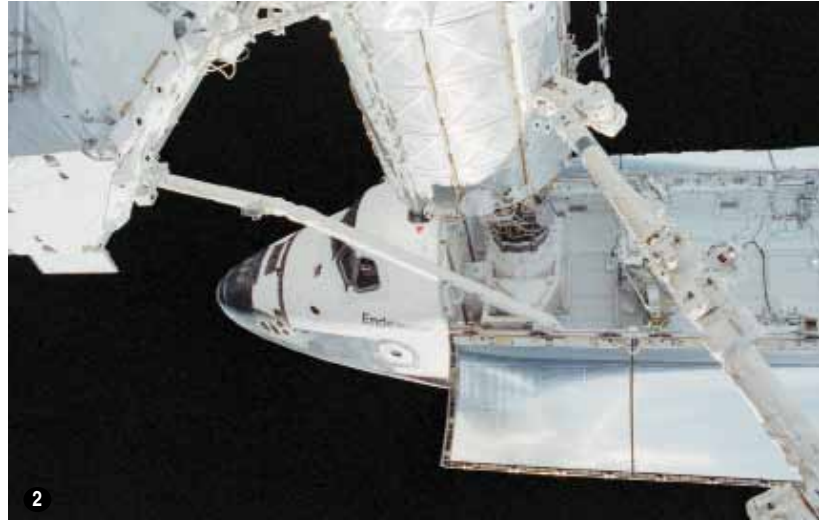


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11 Endeavour returns from an Edwards AFB, Calif., landing to KSC in 2008, piggyback aboard NASA's 747 shuttle transporter, over the Mojave Desert. *12* Atlantis emerges from the Vehicle Assembly Building in this 1996 photo. Huge cranes in the VAB assembled the side-mounted solid rocket motors, shuttle, and huge external fuel tank to create what was called, for short, the "stack." *13* Challenger, moments before its external tank exploded. Flames can be seen as propellant burns through the solid rocket casing. *14* The crew of Challenger STS-51-L, shown here, was lost in 1986, in an accident chalked up to NASA's pursuit of schedule at the cost of safety. It would take years to return to flight, and the tragedy shifted the Air Force—a prominent shuttle user—back to expendable launch vehicles. Left to right they are Ellison Onizuka, Michael Smith, Christa McAuliffe, Dick Scobee, Greg Jarvis, Ron McNair, and Judy Resnik. USAF named a Space Command facility for test pilot Onizuka in 1986.



111 USAF Col. Eileen Collins led shuttle mission STS-93 in 1999, and, following the Columbia accident, commanded the STS-114 “return to flight” mission in 2005. She is the only woman to have both piloted and commanded shuttles. **121** Endeavour, docked to the ISS Destiny laboratory in 2002, early in construction of the space station. Both the shuttle’s own manipulator arm and that of the ISS—called the “Canadarm,” because it was built by Canada, are in use in this image. **131** Kevin Chilton, Challenger commander, greets cosmonaut Yuri Onufrienko after docking with the Russian Mir space station in 1996. Chilton became a four-star USAF general and head of US Strategic Command. **141** The last shuttle crew, of mission STS-135, before boarding Atlantis in July 2011. Though shuttles routinely carried up to seven people, the last mission was limited to four in case of a problem preventing the shuttle from landing. The crew would have had to return on cramped Russian Soyuz craft, limited to three people each.





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1|1 Endeavour makes the arduous 3.5-mile crawl from the giant Vehicle Assembly Building to Pad 39A for launch of STS-89 in 1998. *12|1* Bruce McCandless tests the Manned Maneuvering Unit, a backpack allowing astronauts to venture away from the shuttle without a tether. The four-hour, 1984 space walk set many records, taking McCandless farther than 300 feet from the shuttle. *13|1* The last crew of Columbia, in their official NASA photo. Incredibly, videotapes made by the crew survived the orbiter's breakup intact. Recovered, they provide a chronicle of an otherwise textbook mission. Crew members are, left to right: David Brown, Rick Husband, Laurel Clark, Kalpana Chawla, Michael Anderson, William McCool, and Ilan Ramon. *14|1* Wreckage of Columbia was strewn across several states. Pieces are still being found. Collected and reconstructed at KSC, the wreckage helped prove the cause of the 2003 accident, which killed the seven astronauts: Insulating foam damaged a wing edge.



1 Susan Helms, first US military woman in space, made five shuttle flights. Now a three-star general and head of 14th Air Force, she holds the record for longest space walk, at nearly nine hours. She is shown aboard the ISS in 2001. *2* A Florida Air National Guard F-15C overflies Endeavour just prior to a mission. Such combat air patrols have been flown in support of shuttle missions since 9/11. *3* Atlantis moves in to dock with ISS over the Bahamas. *4* An F-15E from Seymour Johnson AFB, N.C., helps assure an uneventful liftoff for Atlantis in 2010.



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NASA photo by Kim Shiflett

11 Franklin Chang-Díaz spacewalks outside the ISS in 2002. *12* Atlantis streaks skyward 30 years and three months after Columbia's first flight. The space shuttle's legacy will truly end when ISS, having reached its planned life expectancy, will be de-or-

bited sometime after 2020. *13* Atlantis makes the last shuttle landing on July 21, 2011, after a perfect mission that left many convinced the fleet could have carried on a few more years. Until 2015 at the soonest, US astronauts will have to rely on Russian Soyuz

craft to get to the space station. After that, NASA will rely on commercial rocket companies to provide "space taxi" service to the ISS. ■