



STS 135 Atlantis

Landing on 21st July 2011 at KSC Florida
returning from its final flight ISS-ULF-7

Crew:

C. Ferguson, D. Hurley, Sandra Magnus and
R. Waltheim

135 STS Missions in 30 Years:

A Salute to Men and Machine!

The 135 shuttle missions since 1981 are now history but remembering the highlights might help to place this important chapter of American/International human spaceflight in its deserved context.

The most important and most impressive result of the shuttle program was – besides a multitude of outstanding operational and biomedical “firsts” achieved by the astronauts - the installation of the International Space Station (ISS) in low earth orbit with approximately 40 dedicated STS construction flights requiring over 100 successful Extravehicular Activities (EVA). The ISS program developed through many technical and political metamorphoses over the years and was finally carried out with International partners comprising Europe, Canada, Japan and Russia, an arrangement unthinkable at the beginning.

As of today, the partners have agreed to operate the ISS at least until 2020, possibly until 2028.

Since the introduction of the shuttle system with the first flight of the Columbia orbiter on 12th April 1981 the five STS vehicles (Columbia, Challenger, Discovery, Atlantis and Endeavour) performed 135 missions influencing human spaceflight more than any other program since those past 30 years. The shuttle flights enabled 850 men and women (some for multiple missions) from 16 different countries to spend a total of 1350 days (or 3.65 years) in orbit. During 21.150 orbits 872 million kilometers were accumulated. With the 135 shuttle flights 1.600 tons of payload were transported in addition to many satellites and probes including their upper stages as well as the 400 ton space station components including the hardware for 2000 scientific and technical experiments. For Europe, in particular the Spacelab modules and platforms designed and built by European/German industry were of high importance for the systematic advancement of microgravity research.

However, the shuttle concept turned out to be very problematic with respect to the technical implementation: The original goal to achieve weekly flights at much lower cost compared to conventional launches could not be achieved. Instead of the projected 10 Mio \$ per flight the enormous sum of approx. 1 Billion \$ per flight had to be spent at the end of the program. The launch rate of original 50 flights per year had to be reduced to approximately 5 flights (average) per year. The highly advertised reusability of the shuttle system did not turn out as planned, instead of the announced cost reductions steady cost increases occurred. After each flight the orbiters had to be maintained and refurbished at great expense, the reusable boosters rarely could be recovered and used again. On the other hand the operation of such a complex system over so many years was a magnificent technological-operational achievement by NASA and the involved partners.

The two shuttle accidents claiming the lives of 14 astronauts were national tragedies.

In 1986 Challenger (STS-51L crew: Francis Scobee, Michael Smith, Judith Resnik, Ellison Onizuka, Ron McNair, Christa McAuliffe, Greg Jarvis) exploded shortly after lift-off.

In 2003 Columbia (STS-107 crew: Rick Husband, William McCool, David Brown, Kalpana Chawla, Michael Anderson, Laurel Clark, Ilan. Ramon) disassembled due to a temperature breach when reentering the earth atmosphere over Texas.



The Crew of STS-51L

Front row from left:

Mike Smith, Dick Scobee, Ron McNair.

Back row from left:

**Ellison Onizuka, Christa Mc Auliffe,
Greg Jarvis, Judith Resnik.**



The Crew of STS-107

From left to right:

**David Brown, Rick Husband,
Laurel Clark, Kalpana Chawla,
Michael Anderson,
William McCool, Ilan Ramon**

Despite those two incidents the extremely complex shuttle system was rated relatively safe by security experts: within 135 flights only 2 failed which yields a rate of success of 98% - if the other two percent would not have had such catastrophic results. Those two accidents might have also contributed to the sudden end of the shuttle project (last flight was the STS 135 mission with Atlantis, landing on 21st July 2011 at Florida, see picture on top).

The German Space Operations Control Center (GSOC) of the German Aerospace Center (DLR) at Oberpfaffenhofen was involved in the following missions:

- STS-9: First Spacelab Payload Flight- FSLP with U. Merbold as payload specialist,
- STS-22: D-1, Spacelab mission with E. Messerschmidt, R. Furrer and W. Ockels,
- STS-55: D-2 Spacelab mission with U. Walter and H. Schlegel,
- STS-99: SRTM – stereo radar mission with G. Thiele,
- STS-121: ISS supply flight with Th. Reiter,
- STS-122: Columbus delivery with H. Schlegel.

DLR's participation in those flights helped to establish expertise of the German control center teams in human spaceflight operations. This experience is unprecedented in Europe and definitely will be available in the coming decades of human space exploitation.

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One of the most impressive views of the ISS, taken by ESA Astronaut Paolo Nespoli when leaving the ISS in the Russian Soyuz TMA-20 crew transport vehicle shows the completed ISS, the European cargo transporter ATV (Johannes Kepler) in the rear and the space shuttle Endeavour docked to the ISS. Two more vehicles, a Soyuz TMA and a Russian Progress transport vehicle are docked in front of the ATV (May 2011).

[Discovery Flight Deck](#)
Virtual Tour

The most comprehensive virtual tour of all levels and compartments of the Discovery by clicking the following links and navigation arrows

Joachim J. Kehr Editor SpaceOps News (April 2012)