

NASA Facts

National Aeronautics and
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Shuttle Carrier Aircraft



NASA photo EC98 44740-3.

NASA uses two modified Boeing 747 jetliners, originally manufactured for commercial use, as Space Shuttle Carrier Aircraft (SCA). One is a 747-100 model, while the other is designated a 747-100SR (short range). The two aircraft are identical in appearance and in their performance as Shuttle Carrier Aircraft.

The 747 series of aircraft are four-engine intercontinental-range, swept-wing “jumbo jets” that entered commercial service in 1969.

The SCAs are used to ferry space shuttle orbiters from landing sites back to the launch complex at the Kennedy Space Center and also to and from other locations too distant for the orbiters to be delivered by ground transportation. The orbiters are placed atop the SCAs by Mate-Demate Devices, large gantry-like structures that hoist the orbiters off the ground for post-flight servicing and then mate them with the SCAs for ferry flights.

Features which distinguish the two SCAs from standard 747 jetliners are:

- Three struts with associated interior structural strengthening protrude from the top of the fuselage (two aft, one forward) on which the orbiter is attached.

- Two additional vertical stabilizers, one on each end of the standard horizontal stabilizer, to enhance directional stability.
- Removal of all interior furnishings and equipment aft of the forward No. 1 doors.
- Instrumentation used by SCA flight crews and engineers to monitor orbiter electrical loads during the ferry flights and also during pre- and post-ferry flight operations.

The two SCAs are under the operational control of NASA's Johnson Space Center, Houston, Texas.

NASA 905

NASA 905 was the first SCA. It was obtained from American Airlines in 1974. Shortly after acceptance by NASA, the SCA flew a series of wake vortex research flights at the Dryden Flight Research Center, Edwards, Calif., in a study to seek ways of reducing turbulence produced by large aircraft. Pilots flying as much as several miles behind large aircraft have encountered wake turbulence that has caused control problems. The NASA study helped the Federal Aviation Administration modify flight procedures for commercial aircraft during airport approaches and departures.

Following the wake vortex studies, NASA 905 was modified by Boeing to its present SCA configuration and the aircraft was returned to Dryden for its role in the 1977 Space Shuttle Approach and Landing Tests (ALT). This series of eight captive and five free flights with the orbiter prototype Enterprise, in addition to ground taxi tests, validated the aircraft's performance as an SCA, in addition to verifying the glide and landing characteristics of the orbiter configuration — paving the way for orbital flights.

A flight crew escape system, consisting of an exit tunnel extending from the flight deck to a hatch in the bottom of the fuselage, was installed during the modifications. The system also included a pyrotechnic system to activate the hatch release and cabin window release mechanisms. The flight crew escape system was removed from the NASA 905 following the successful completion of the ALT program.

NASA 905 was the only SCA used by the space shuttle program until November 1990, when NASA 911 was delivered as an SCA. Along with ferrying Enterprise and the flight rated orbiters between the launch and landing

sites and other locations, NASA 905 also ferried Enterprise to Europe for display in England and at the Paris Air Show.

NASA 911

The second SCA is designated NASA 911. It was obtained by NASA from Japan Airlines (JAL) in 1989. It was also modified by Boeing Corporation. It was delivered to NASA on Nov. 20, 1990.

SCA Descriptions

Dimensions

Wingspan: 195 ft. 8 in.

Length: 231 ft. 10 in.

Height: Top of vertical stabilizer, 63 ft. 5 in.

To top of cockpit area, 32 ft. 1 in.

Weight: Basic weight, NASA 905, 318,053 lbs

NASA 911, 323,034 lbs

Maximum gross taxi weight, 713,000 lbs

Maximum gross brake release weight, 710,000 lbs

Maximum gross landing weight, 600,000 lbs

Engines

Four Pratt and Whitney JT9D-7J gas turbine engines, each producing 50,000 lbs of thrust

Performance

Airspeed limits with, and without an orbiter:
250 knots or Mach 0.6

Altitude: Typical cruise with orbiter, 13,000-15,000 ft; typical cruise unmated, 24,000-26,000 ft. Minimum temperature at altitude 15 degrees (F) (-9 degrees C)

Range: Typical mated, 1000 nautical miles (with reserves); maximum unmated, 5500 nautical miles

Fuel Capacity

47,210 gallons (316,307 lbs) jet fuel

Crew

Minimum for flight is two pilots and one flight engineer. Minimum for mated flight is two pilots and two flight engineers.