

# About the Orbiter

## General Description:

The orbiter is the manned spacecraft which makes up one element of the Space Shuttle system. It can transport into near earth orbit (area in space from 115 to 690 miles from the earth's surface) cargo weighing up to 56,000 pounds, and it can return to earth with up to 32,000 pounds. This cargo, called payload, is carried in a bay 15 feet in diameter and 60 feet long. The orbiter normally carries a flight crew of four with three additional passengers. A total of 10 people could be carried under emergency conditions. The basic mission is seven days in space, but with additional supplies, a 30 day mission is possible. In its return to earth, the orbiter has a cross-range maneuvering capability of 1,265 miles.

The major structural sections of the orbiter are the forward fuselage - containing the pressurized crew compartment (The crew compartment is divided into two levels, the flight deck on top and the middeck below. The flight deck includes all flight controls used for launch, orbital trajectory corrections, rendezvous operations, and landing. The middeck provides the crew's working, eating, and sleeping environment. It also houses the electronic, guidance, and navigation systems.), the mid fuselage - containing the cargo bay, the aft fuselage - which holds the Shuttle's main engines, and the vertical tail - which splits open along the trailing edge to provide a speed brake used during entry and landing.

## General Statistics of the Orbiter:

- Length = 122.17 feet (37.24 meters)
- Height = 56.58 feet (17.27 meters)

- Wingspan = 78.06 feet (23.79 meters)
- Weight (in pounds with three main engines included)
  - Columbia = 178,000
  - Challenger = 175,111
  - Discovery = 171,000
  - Atlantis = 171,000
  - Endeavour = 172,000

## Purpose of the Orbiter:

The initial concept of the Space Shuttle orbiter was to create a space vehicle that could be launched like a rocket, orbit like a spacecraft, and land like an airplane. The main feature of this vehicle is that it would be reusable. It was believed that reusing the orbiter would drastically reduce the cost of space flight and allow for a much faster turnaround time for the vehicle to be launched again. NASA originally designed the space shuttle program to have multiple launches each month utilizing a fleet of four orbiters. After the first few missions, NASA discovered that the time to process an orbiter after a space flight was several months instead of the intended several days. In addition, each launch cost between \$400 million to \$1 billion dollars, dependent on the payload. One of the largest advantages to the orbiter, however, was that it allowed for NASA to not only carry a payload into space, but the vehicle allowed the orbiter crew to capture and return a significant payload back to earth.

## Orbiter Vehicles (OV) of NASA Fleet:

Enterprise (OV-101): Delivered to Kennedy Space Center (KSC) in 1979 after manufacture ran it through two years of testing. Though it was the first of the orbiters to be built, it was never fitted with the three main engines and

## About the Orbiter

never fitted for space flight. It was used as a test vehicle to ensure that all flight systems worked properly. Enterprise also helped to ensure that the external tank (ET) and the solid rocket boosters (SRB) would mate properly with the orbiters. During the early 1980's, NASA transported it around the world for various events to demonstrate some of the incredible technological advances made to enable the orbiter fleet to be reused. In 1985, Enterprise officially became the property of the Smithsonian Institute.

Columbia (OV-102): Delivered to KSC in 1979 to be the first orbiter fitted for space flight. Several integration tests were conducted on Columbia from 1979 to 1980. A flight readiness firing test took place in February of 1981. Two months later on April 14, Commander John Young and Pilot Robert Crippen were aboard Columbia when it became the first reusable space vehicle launched into space. Seven months later, Columbia became the first reusable space vehicle to be re-launched into space. From 1981 to 2003, Columbia flew 28 separate missions. On its last mission (STS-107), the orbiter and its crew were lost during re-entry.

Challenger (OV-99): Delivered to KSC in 1982 after having been modified from its original form as high-fidelity structural test article (allowed special test to better understand the incredible forces the orbiter would be subjected to during launch and landing). Because NASA had only one working orbiter at the time, it was decided to allow the conversion of the test vehicle into a space rated orbiter. Challenger flew nine successful missions from 1983

to 1985. In 1986, 51L was to be Challenger's 10th space mission; however, the orbiter and crew were lost during launch.

Discovery (OV-103): Delivered to KSC in 1983 and becoming the third of space flight ready orbiters. Because of valuable data gained in the construction and testing of the previous orbiters, the rollout weight of Discovery was 66870 pounds less than Columbia. This reduced weight would allow for heavier payloads to be transported into space. Several special modifications have been made to Discovery to allow it to carry specialized payloads. Since its first launch in 1984, it has successfully carried out 30 missions. Discovery is still in active service.

Atlantis (OV-104): Delivered to KSC in 1985 becoming the fourth active space ready orbiter. As in Discovery, Atlantis was the product of many learned lessons. It had a rollout weight of 6,974 pound less than Columbia and was assembled having a 50 percent reduction in man hours (compared to Columbia). Atlantis was first launched in October of 1985 and has successfully completed 26 missions. Atlantis is still in active service.

Endeavour (OV-105): Delivered to KSC in 1991 as the most advanced orbiter in the fleet to replace the lost Challenger orbiter. Many of the technological advances found in the various systems of Endeavour were later integrated into the other remaining orbiters. Endeavour is capable of flying missions of up to 28 days if needed. Since its inaugural flight in 1992, it has flown 19 successful missions. Endeavour is still in active service.