National Aeronautics and Space Administration

Space Shuttle *Endeavour* Lifts Off Into Space

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Space Shuttle *Endeavour* lifts off on mission STS–100, carrying a next-generation Canadian robotic arm to the International Space Station. Participating in this mission are Commander Kent V. Rominger, Pilot Jeffrey S. Ashby, Mission Specialists Chris A. Hadfield (Canadian Space Agency), John L. Phillips, Scott E. Parazynski, Umberto Guidoni (European Space Agency), and Yuri V. Lonchakov (Russian Aviation and Space Agency). Liftoff occurred at 2:41 p.m. EDT on April 19, 2001.

The main components of the vehicle are clearly visible: the orbiter, external tank, and two solid rocket boosters. Liftoff began with the ignition of the three main engines in the tail of the winged orbiter. Propellants for the engines, liquid hydrogen and liquid oxygen, were supplied from the orange external tank. Seconds later, the two solid propellant boosters placed on either side of the external tank ignited. The nuts form four bolts holding each of the boosters split with pyrotechnic charges, and the space shuttle leapt skyward.

In only 6 seconds, the 37-meter-high vehicle cleared the launch tower. By then, it was already traveling at 160 kilometers per hour. By steering the nozzles of the main engines in the orbiter's tail, the vehicle completed a roll maneuver. This turned the orbiter so that its back faced due east toward the Atlantic Ocean.

Two minutes later, the vehicle was 45 kilometers above the ocean, 250 kilometers down range from the Kennedy Space Center, and traveling at a speed of 6,150 kilometers per hour. With the solid propellant expended, the solid rocket boosters separated from the external tank and parachuted into the ocean below. Using just the thrust of the orbiter's three main engines, *Endeavour* and the external tank continued upward. Six and a half minutes later, the propellants in the external tank were exhausted, and the tank was jettisoned. The tank was destroyed when it reentered the atmosphere. Following a brief firing of *Endeavour's* orbital maneuvering system engines to circularize the orbit, the crew began its 11-day mission to install the Canadian Remote Manipulator System, known as the Canadarm 2, aboard the International Space Station.

The gray structure seen in the picture is called the Rotating Service Structure. Except during the launch, the structure is rotated to the right to surround the back of the orbiter. It provides access points for reaching orbiter engines and other external areas. The dark circular feature near the top right of the structure is the gaseous oxygen vent cap or "beanie cap." It fits over the nose of the external tank and sucks away oxygen that boils from the external tank in the last few hours before launch. The cap is moved to the side just minutes before liftoff. Fine gray wires stretch from the structure off to the left of the picture. These are emergency slide wires. If an evacuation becomes necessary, the crew can abandon the vehicle and jump into baskets that carry them to explosion-proof bunkers.

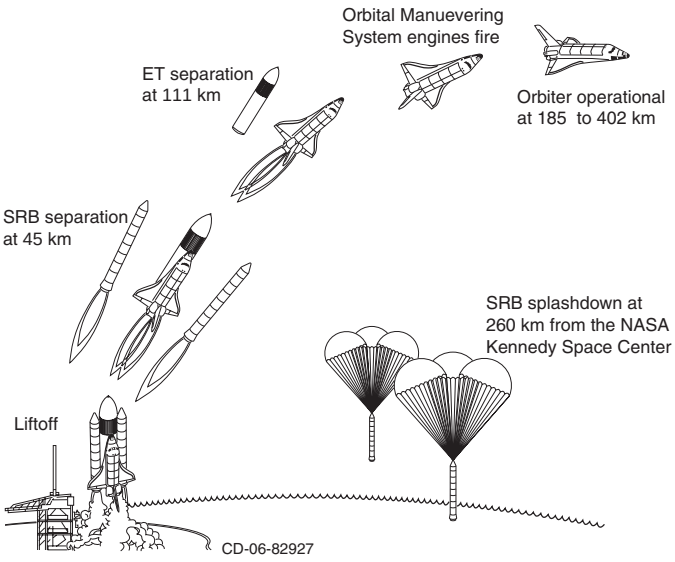
Electronic Resources

Additional information is available over the World Wide Web at the following address: *http://spaceflight.nasa.gov*

Facts and Figures

Orbiter	
Wing span	23.79 meters
Length	37.24 meters
Height	17.27 meters
Payload bay	18.3 by 4.6 meters
Payload weight (launch max.)	24.948 kilograms
Main Engine (each)	
Thrust at 100% throttle:	
Sea level	1,670 kilonewtons
Vacuum	2,100 kilonewtons
External Tank (ET)	
Length	47 meters
Diameter	8.4 meters
Gross weight (full)	750,980 kilograms
Solid Rocket Booster (SRB, each)	
Length	45.46 meters
Diameter	3.7 meters
Thrust at liftoff	14,685 kilonewtons
Gross weight (approx.)	589,670 kilograms
Operations	
Gross liftoff weight (approx.)	2,041,200 kilograms
Total thrust at launch	33,327 kilonewtons
SRB separation altitude	45 kilometers
SRB splashdown distance from Kennedy	260 kilometers
ET separation altitude (approx.)	111 kilometers
Orbital Velocity (approx.)	27,869 kilometers/hour

Space Shuttle Launch to Orbit Profile



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