FINAL JOURNEY

The oldest of the fleet, Columbia made the first space shuttle flight in April 1981 and departed on its final journey on January 16. The time sequence at right chronicles how the flight went wrong in its last minutes.

Normal re-entry and landing

The intricately choreographed maneuvers of a shuttle landing start an hour before its scheduled touchdown and more than halfway around the globe from the landing strip.

1 RE-ENTRY MANEUVER

A Orbiting nose first nearly 200 miles up, with its bottom facing away from the planet, the shuttle fires its thrusters to turn so it is moving tail first.

B The main engines fire for 2 1/2 minutes, slowing the shuttle by about 175 mph and starting its plunge into the atmosphere.

C Thrusters fire again to flip the shuttle over so it is moving nose first, with its bottom facing the atmosphere.

2 BURN, THEN BLACKOUT

As a precaution, most of the leftover fuel is burned before the shuttle heats up during re-entry. Starting about 25 minutes before landing, at an altitude of about 70 miles and a speed of 16,700 mph, an atmospheric fireball envelops the shuttle, briefly blacking out radio communications.

3 LANDING PATHS

During its descent, the orbiter makes a series of S-shaped turns to brake. About 20 miles from landing, the shuttle drops below the sound barrier.

4 TAKING THE WHEEL

At Mach 1, the shuttle pilot takes over. A few miles from touchdown, a sophisticated navigation system using imaginary cylinders as landmarks helps the pilot line up the shuttle with the runway.

5 TOUCHDOWN

The pilot pulls up the nose and deploys the landing gear before landing at 215 mph. A parachute helps bring the orbiter to a stop.

7:53 a.m. CST

More than 40 miles over California, temperature sensors in the brakes and hydraulics stop sending data to flight control. A sensor in the left wheel well shows an unusual temperature rise.

7:54 a.m.

Temperature readings in the left wing have climbed 60 degrees in the past five minutes. The temperature in the right wing has increased only a normal 15 degrees. Two minutes later, temperature readings for the main left wheel are lost.

7:58 a.m.

The left side of the shuttle experiences extra drag over New Mexico, possibly due to skin damage. The drag could force it to roll and turn left; the shuttle's computers adjust the wing flaps to counteract it. Three left wing temperature sensors go dead.

7:59 a.m.

Eight tire pressure and temperature readings are lost as the left side of the shuttle, now over western Texas, continues to experience drag. Ground control contacts the shuttle crew about the sensor troubles, which they acknowledge in their final transmission.

Tracking debris

Thousands of pieces of debris fell in a trail from Fort Worth to Louisiana.

8 a.m.

Mission control loses all contact with Columbia, last tracked moving at 12,500 mph, 207,135 feet above Dallas–Forth Worth. Texas and Louisiana residents report an explosion in the sky.

8:16 a.m.

Columbia's scheduled landing time in Florida passes.

10:00 a.m.

NASA lowers the flags to half-mast at the Kennedy Space Center in Cape Canaveral, Fla.

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