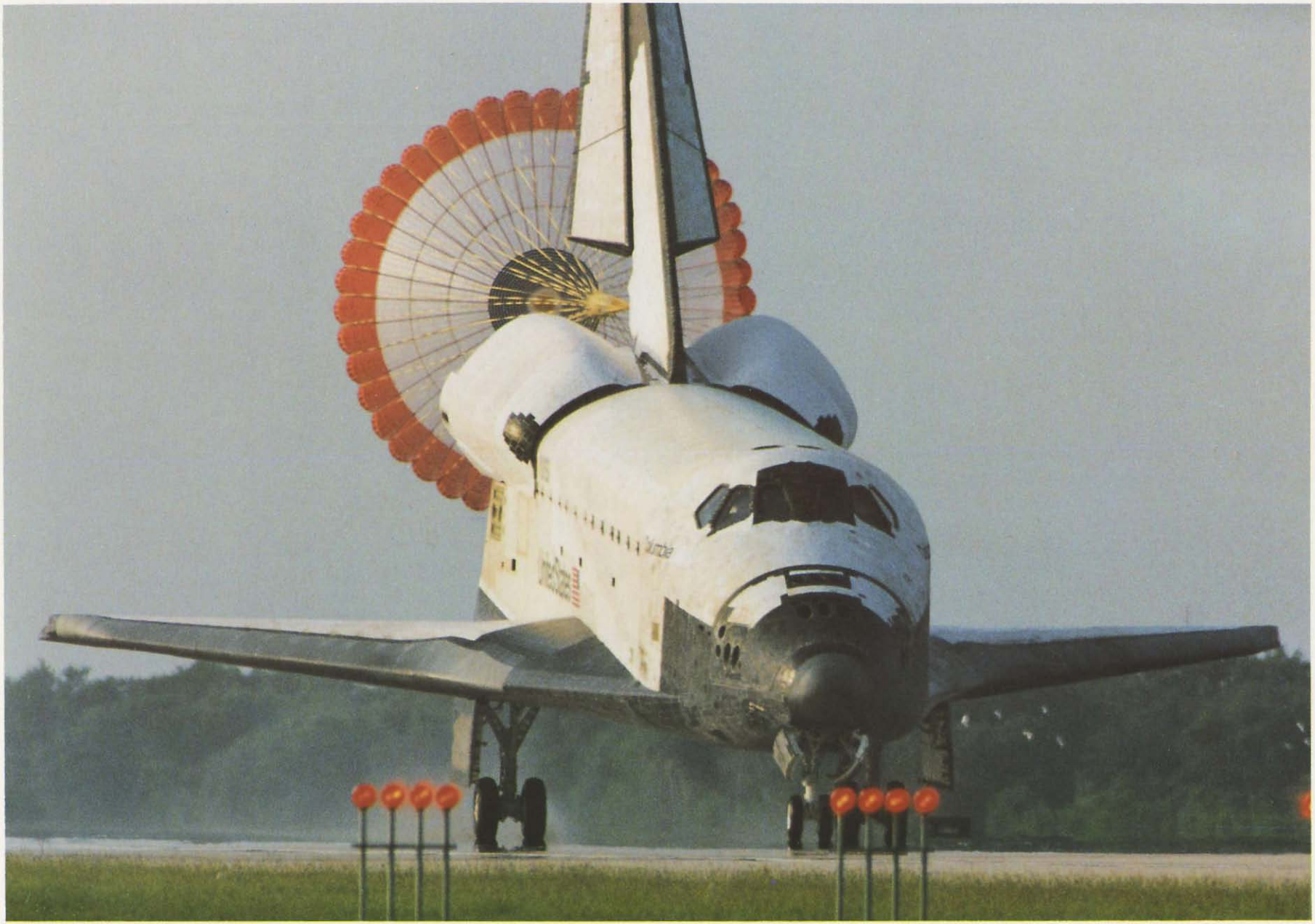
National Aeronautics and Space Administration

Space Shuttle *Columbia* Returns from Space



After 127 orbits of Earth and traveling more than nine million kilometers through space, the Space Shuttle *Columbia* landed at the Kennedy Space Center in Florida. The July 1992 landing concluded the STS-50 mission and *Columbia's* twelfth flight into space. Onboard, seven astronauts and scientists successfully conducted a wide range of materials sciences and biological sciences experiments in the microgravity environment of Earth orbit. The STS-50 mission, also known as the U.S. Microgravity Laboratory, remained a record-breaking 13 days 19 hours 30 minutes in space.

Major accomplishments on the mission included completion of 31 microgravity experiments in five basic areas: fluid dynamics, crystal growth, combustion science, biological science, and technology. Crewmembers also successfully tested several new microgravity experiment facilities and procedures needed for future space station activities.

Columbia began the long glide back to Earth's surface after slowing its speed in space by firing its orbital maneuvering system engines. *Columbia's* return was unpowered, with the exception of firing its small reaction control engines for attitude adjustment during part of its descent. Its delta wings and aerodynamic control surfaces brought *Columbia* safely down on a glide path that averaged a steep 18 degrees on its final leg before touchdown.

Upon touchdown, *Columbia's* commander deployed the new drag parachute that was first tested during the first flight of the Space Shuttle *Endeavour* just one month before. The drag chute assisted *Columbia* by providing stability in the event of a braking problem or a flat tire.

The drag chute consists of a 2.75-meter diameter pilot chute and a 12.2-meter diameter main chute. A mortar at the base of the vertical stabilizer in *Columbia's* tail fired to deploy the pilot chute first. After several seconds, the pilot chute pulled out the main chute that is seen in this picture. Shroud lines extended the main chute 27 meters behind *Columbia*. Several seconds after this picture was taken, the drag chute jettisoned. Also clearly visible in this picture is *Columbia's* split rudder. Upon landing, actuator motors in the rudder (part of the vertical stabilizer) open it lengthwise and deploy its halves to the right and left. This action increases drag during landing and assists in stopping *Columbia.*

For the Classroom

1. How does a drag chute provide stability assurance to *Columbia* during landing rollout?

2. Why is the drag chute jettisoned after it has done its job?

3. Construct small parachutes out of tissue paper, threads, and paper clips. Using the same number of paper clips as a standard mass, experiment with parachutes of different sizes. Drop the parachutes from a height of several meters. Time the length of the fall. Is there optimum size for a parachute supporting a standard mass?