National Aeronautics and
Space Administration

More than 300 kilometers above Earth, Space Shuttle *Endeavour* crewmembers perform the first three-person spacewalk to capture the *INTELSAT VI* communications satellite. The large cylindrical *INTELSAT VI* satellite seen in this picture was launched into space two years earlier by a Titan rocket and stranded in a useless, low orbit when the Titan's second stage failed to operate. The 4,064 kilogram satellite was supposed to be deployed in a 36,000-kilometer-high geostationary orbit over the Atlantic Ocean to relay a variety of voice, video, and data communications. In pre-Shuttle days, such a stranding would mean that the satellite was a total loss and would have to be replaced. Because of the Space Shuttle's manned versatility, the satellite was captured and redeployed into space.

Capture operations for the satellite began on the fourth day of the STS-49 mission. The orbiter's flight crew maneuvered *Endeavour* to rendezvous with the satellite. Crewmembers Pierre J. Thuot and Richard J. Hieb donned spacesuits and positioned themselves in the payload bay for the rendezvous. Thuot was attached to the end of the orbiter's remote manipulator system (RMS), a 15-meter-long mechanical arm, while Hieb was attached to the orbiter's bay. Thuot planned to use a specially designed capture bar to latch on to the satellite; however, the satellite proved to be more sensitive to external forces than previously thought. When Thuot exerted a force while attempting to attach the device, the satellite moved away from *Endeavour*. After several failed attempts at capture, *Endeavour* was maneuvered away so that ground controllers could send commands to restabilize the satellite.

Additional attempts to capture the satellite on the fifth day were also unsuccessful. Another attempt was planned for day seven of the mission. In the meantime *Endeavour's* crewmembers suggested a three-person spacewalk to capture and hold the satellite by hand. Astronauts, technicians, and mission planners at the Johnson Space Center in Houston quickly prepared underwater simulations of the revised capture strategy to develop the procedures necessary for the plan to work.

On flight day seven, *Endeavour* was again maneuvered to rendezvous with the satellite. For the final capture attempt, Thomas D. Akers joined spacewalkers Thuot and Hieb. Positioning themselves 120 degrees apart around the satellite, the three reached up and caught the satellite's lower rim. The astronauts in this picture from left to right are Hieb, Akers, and Thuot. Hieb and Akers were attached to *Endeavour's* payload bay by foot restraints. Thuot was attached to the end of the RMS. Part of the RMS is seen as the white beam slanting downward in the picture from the upper right.

Following the *INTELSAT VI* capture, a new booster rocket was attached to the satellite and the satellite was released. Later, when *Endeavour* moved away to a safe distance, the new booster successfully deployed the satellite to its proper orbit.

The STS-49 mission achieved many space firsts and broke several space records. STS-49 was *Endeavour's* first flight. Built to replace the Space Shuttle *Challenger* lost several years earlier, *Endeavour* featured many vehicle improvements including the first use of a drag chute for orbiter landings. During the flight, *Endeavour's* crew achieved the first three-person spacewalk, completed twice as many spacewalks as on any other Shuttle mission, and conducted the longest spacewalks in history for both male and female astronauts.

For the Classroom

1. Discuss how teamwork played an essential role in the successful redeployment of *INTELSAT VI*.

2. What is a geostationary orbit? Why are communications satellites placed in geostationary orbits?

3. Show how heavy objects can be moved by suspending a steel bucket from a high ceiling. Fill the bucket with heavy weights. Tie a small magnet to the end of a string. Standing a few feet away from the bucket, toss the magnet to the bucket so that it sticks. Gently pull the string so that the bucket moves slightly. Let the bucket swing back before the magnet breaks contact. As the bucket swings forward again, exert another pull. After repeating this procedure several times, the bucket will be swinging through a wide arc.