



## STS-127 (29th Space Station Flight)

### Endeavour

#### Pad A:

127th shuttle mission  
23rd flight OV-105  
71st landing at KSC

#### Crew:

Mark Polansky, commander (3rd shuttle flight)  
Doug Hurley, pilot (1st)  
Christopher Cassidy, mission specialist (1st)  
Tom Marshburn, mission specialist (1st)  
Dave Wolf, mission specialist (4th)  
Julie Payette, mission specialist (2nd), with the  
Canadian Space Agency  
Up to ISS: Tim Kopra, mission specialist (1st)  
Down from ISS: Koichi Wakata, with JAXA

#### Orbiter Preps:

**OPF** – 12/13/08  
**VAB** – 04/10/09  
**Pad B** – 04/17/09  
**Pad A** – 05/31/09

#### Launch:

**July 15 at 6:03 p.m. EDT.** The first launch attempt was scheduled for June 13. A hydrogen leak at the Ground Umbilical Carrier Plate during tanking June 12 caused the mission to be scrubbed at 12:26 a.m. June 13. The seal on the 7-inch disconnect valve was replaced and launch rescheduled to June 17. The launch on June 17 was officially scrubbed at 1:55 a.m. EDT when the same type of hydrogen gas leak occurred at the Ground Umbilical Carrier Plate. Vent valve troubleshooting took place for about an hour before it became clear the problem could not be solved. Endeavour's next launch attempt for its STS-127 mission was scheduled for July 11 at 7:39 p.m. EDT. The July 11 launch was postponed one day to give technical teams more time to evaluate lightning strikes at the



launch pad that occurred during thunderstorms July 10. Sensors indicated there were 11 lightning strikes within 0.35 miles, which is inside the launch pad's threshold. Liftoff was rescheduled for 7:13 p.m. July 12. The mission was scrubbed July 12 at 7:02 p.m. due to weather conditions near the Shuttle Landing Facility at Kennedy that violated rules for launching. A fifth attempt was scheduled for July 13 at 6:51 p.m. Lightning and thunderstorms within the 20-nautical-mile circle around the launch pad produced another delay which was called at 6:39 p.m. The sixth launch attempt was scheduled for July 15 at 6:03 p.m.

#### Landing:

**July 31, 2009, at 10:48 a.m. EDT.** Main gear touchdown was at 10:48:08 a.m. EDT. Nose gear touchdown was at 10:48:21 a.m., and wheel stop was at 10:49:13 a.m. Mission elapsed time was 15 days, 16 hours, 44 minutes and 58 seconds. Endeavour traveled 6,547,853 miles over 248 orbits.

The mission was the 29th flight to the station, the 23rd flight of Endeavour and the 127th in the Space Shuttle Program.

NASAfacts

## Mission Highlights:

Robotic arms performed many operations. After EVA No. 1, Commander Mark Polansky and Mission Specialist Julie Payette operated the shuttle robotic arm and Pilot Doug Hurley and Mission Specialist Koichi Wakata operated the station robotic arm to latch the JEF to the Kibo laboratory. Kibo's robotic arm also was used to view the installation.

More robotic activity by Payette and Kopra included installation of the Integrated Cargo Carrier-Vertical Light Deployable, a cargo pallet, on the port side of the space station's mobile base system.

Crew members and flight controllers spent time troubleshooting failure of the Waste and Hygiene Compartment, the toilet in the U.S. Destiny module.

On July 20, the space station and shuttle crews in a way honored the legacy of Apollo 11 by conducting a spacewalk on the same day that 40 years ago Neil Armstrong and Buzz Aldrin walked on the moon for the first time.

After the second spacewalk, Polansky and Payette used the robotic arm on the shuttle to pass the Japanese Logistics Module-Exposed Section from Endeavour to Canadarm2 on the space station. Pilot Doug Hurley and Mission Specialist Koichi Wakata operated the Canadarm2 to attach it to the Kibo lab.

Hurley and Payette used the station's robotic arm to move the ICC securing the batteries to prepare for the P6 truss battery swap.

On July 23, Wakata, Kopra, Polansky, Hurley and Payette used the Japanese robotic arm for the first time to move equipment from a Japanese payload carrier to the Japanese Exposed Facility outside Kibo. When the initial movement was faster than expected, the arm was transitioned to manual mode that was slower. Three experiments -- the Monitor of All-sky X-ray Image, Inter-orbit Communications System and Space Environment Data Acquisition Equipment-Attached payload -- were installed on the facility.

Robotics work concluded with Polansky, Hurley, Payette and Kopra using the shuttle and station arms to grab the Japanese Exposed Section cargo carrier, hand it off and place it in Endeavour's payload bay.

The Carbon Dioxide Removal Assembly on the station tripped a circuit breaker July 25, and the ground team switched to manual operation of the backup heater.

Five spacewalks totaled 30 hours, 30 minutes for Mission Specialists Dave Wolf, Tim Kopra, Tom Marshburn and Christopher Cassidy.

### **EVA No. 1 — July 18: 5 hours, 32 minutes.**

Wolf and Kopra completed all primary tasks: prepared berthing mechanisms on the Kibo laboratory and the Japan Exposed Facility; deployed an unpressurized cargo carrier

attachment system on the Port 3 truss that had failed to unfurl on the STS-119 mission in March.

### **EVA No. 2 — July 20: 6 hours, 53 minutes.**

Wolf removed a Ku-band space-to-ground antenna, a pump module and a linear drive unit from an Integrated Cargo Carrier. He and Marshburn attached them to a stowage platform on the P3 truss. Marshburn mounted a grapple bar onto an ammonia tank assembly that the STS-128 crew will be able to move with a robotic arm. He also attached two insulation sleeves for external power connectors to the Station-to-Shuttle Power Transfer System. A video camera installation was deferred.

### **EVA No. 3 — July 22: 5 hours, 59 minutes.**

Wolf and Cassidy removed insulation covers from the Kibo lab and prepared the Japanese Exposed Section payloads for transfer to the Exposed Facility July 23. They had also installed two batteries before ending the spacewalk when Cassidy's CO<sub>2</sub> levels increased more than expected.

### **EVA No. 4 — July 24: 7 hours, 12 minutes.**

Cassidy and Marshburn installed the remaining four batteries on the P6 truss. They stored four more of the old batteries on the Integrated Cargo Carrier for return to Earth. Wakata and Payette used Canadarm2 to hand the carrier to the shuttle's arm, which Hurley and Polansky then used to stow it in Endeavour's payload bay.

### **EVA No. 5 — July 27: 4 hours, 54 minutes.**

Marshburn and Cassidy installed video cameras on the front and back of the Japanese Exposed Facility to help with rendezvous and berthing of the H-II Transfer Vehicle scheduled to arrive in September. They also secured multi-layer insulation around the Special Purpose Dexterous Manipulator known as Dextre, split out power channels for two space station Control Moment Gyroscopes, tied down cables and installed hand rails and a portable foot restraint to aid future spacewalkers.

After leaving the station and preparing for the return to Earth, the crew deployed two pairs of small satellites from Endeavour's payload bay: the Dual RF Astrodynamics GPS Orbital Navigator Satellite (DRAGONSat) and the Atmospheric Neutral Density Experiment-2 (ANDE-2). The satellites were designed and built by students at the University of Texas in Austin, and Texas A&M University in College Station. The ANDE-2 microsatellites will measure the density and composition of the rarified atmosphere 200 miles above the Earth's surface.

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