STS-108
New Station Crew, Supplies and Spacewalk

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Mission Overview

New Station Crew, Logistics Ops., Spacewalk on Tap for STS-108

A new International Space Station crew, the fourth flight of an Italian-built Multipurpose Logistics Module and a spacewalk to install thermal blankets over two pieces of equipment at the bases of the space station’s solar wings are major elements of the STS-108 flight of Endeavour.

The Expedition Four crew consists of Russian Commander Yury Onufrienko and Astronauts Carl Walz and Dan Bursch. They will replace the Expedition Three crew, Commander Frank Culbertson and Cosmonauts Mikhail Tyurin and Vladimir Dezhurov. Expedition Three crewmembers were launched to the station aboard Discovery on STS-105 on Aug. 10, 2001, and will return to Earth aboard Endeavour.

The Italian Multipurpose Logistics Module named Raffaello is making its second visit to the space station. It first flew aboard Endeavour on STS-100 in April 2001. It is one of three virtually identical modules that serve as pressurized moving vans, bringing equipment and supplies to the space station. A sister module named Leonardo has visited the station twice, on STS-102 in March 2001 and on STS-105 in August 2001.
Raffaello will be lifted out of Endeavour's payload bay and attached directly to the station's Unity node for the unloading of its cargo, which consists of the contents of eight resupply stowage racks and four resupply stowage platforms. Much of the material will be transferred to the station's U.S. laboratory Destiny.

Destiny, installed on the STS-98 mission of Atlantis in February 2001, has slots for 24 of the interchangeable racks (six on the top, six on the bottom and six on each side). Eleven are systems racks, and one slot has Destiny's 20-inch-diameter, optical-quality window. Remaining slots are available for scientific racks.

The MPLM will be put back into the cargo bay and returned to Earth for refurbishment and reuse on a subsequent mission. The MPLM is valued at $150 million.

Dominic Gorie, a Navy captain and former test pilot, is commanding his first shuttle flight on STS-108. He has flown twice before as pilot, on STS-91, the final shuttle flight to the Russian space station Mir in 1998, and on STS-99, the Shuttle Radar Topography mission in 2000. Pilot Mark E. Kelly, a Navy lieutenant commander, an honors graduate of the U.S. Merchant Marine Academy and a former test pilot, is making his first spaceflight. Mission Specialist Linda M. Godwin, who holds a Ph.D. in physics, is a veteran of three space flights – STS-37, the Gamma Ray Observatory mission in 1991; STS-59, the Space Radar Laboratory flight in 1994; and the STS-76, a flight to the Russian space station Mir in 1996. Mission Specialist Daniel M. Tani, who holds an M.S. in mechanical engineering from Massachusetts Institute of Technology and was selected as an astronaut in 1996, is making his first space flight.
About 46 hours after its launch, Endeavour is scheduled to dock with the International Space Station. After hatches are opened a welcoming ceremony and a safety briefing will be held for the new arrivals. Transfer operations begin about 2½ hours after docking. Spacesuit transfer from the station to Endeavour in preparation for the mission’s four-hour spacewalk by Godwin and Tani is among the first activities on the logistics schedule.

The purpose of the spacewalk is to install thermal blankets over the Beta Gimbal Assemblies (BGAs) at the bases of the station’s two large solar wings. Together the wings have a span of 240 feet. The BGAs, atop the station’s P6 Truss, control the wings so that they are at an optimal angle to take power from the sun. The blanket installation is a sort of preventative maintenance. The BGAs to be covered continue to function; elements of them have shown some unexplained spikes in power consumption.
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Godwin and Tani will take the blankets out of the airlock with them. The shuttle’s robotic arm, controlled by Kelly, will take them as far up the P6 Truss as it can reach, perhaps 30 feet below the work site. They’ll move the rest of the way to the top of the truss, taking the blankets with them.

The blanket installation is relatively straightforward. After it is completed, Godwin and Tani are likely to have some time to perform “get-ahead” tasks relating to future station assembly work.

After the spacewalk, attention again turns to logistics.

In addition to the new crew and the Multipurpose Logistics Module, the shuttle also brings to the ISS in its cargo bay the Lightweight Mission Peculiar Support Structure Carrier with four Get Away Special (GAS) experiments. Another cargo-bay payload is the Multiple Application Customized Hitchhiker-1 (MACH-1), situated between Endeavour’s airlock and Raffaello. Among its payloads is the Starshine satellite.

Starshine is an 85-pound, 19-inch-diameter ball with a surface covered with 845 aluminum mirrors and 31 laser retro reflectors. More than 25,000 students from 26 countries polished the mirrors.

Starshine (the name is an acronym for Student Tracked Atmospheric Research Satellite for Heuristic International Networking Experiment) will be deployed by a spring mechanism from Endeavour’s cargo bay the day before landing. It is among several small, optically reflective spherical Starshine student satellites, built by the U.S. Naval Research Laboratory, that are being deployed by NASA. The first was placed in orbit from Discovery on STS-96 in June 1999. A second was launched Sept. 29, 2001, from the Kodiak launch complex in Alaska. Students and other observers around the world precisely observe its position, calculate its orbital decay and use the information to study the density of the atmosphere.

Also aboard the Hitchhiker will be the Capillary Pumped Loop Experiment-3, the Prototype Synchrotron Radiation Detector, two Space Experiment Modules containing multiple small experiments and a GAS can containing seven experiments.
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Just forward of the Hitchhiker, on the right payload bay wall, will be two GAS containers, one housing seven experiments from Utah State University and the other with an experiment looking at smoldering combustion in microgravity.

Behind Raffaello, at the rear of the cargo bay, is the Lightweight Multipurpose Experiment Support Structure Carrier (LMC), with four more GAS cans. One has three Penn State University experiments and another contains 10 student experiments. A third houses a Swedish Space Corp. experiment focusing on weak Marangoni flows and the fourth, from Ames Research Center, is a test of a prototype instrument cooler for planetary missions.

In Endeavour's middeck area will be the Avian Development Facility and the Commercial Biomedical Testing Module – Animal Enclosure Module. The Avian Development Facility is flown to validate subsystems and will contain two experiments on development in space of Japanese quail eggs. The Animal Enclosure Module is a commercial experiment using mice and seeking information that could lead to better treatment of osteoporosis in humans.

STS-108 is the 12th space shuttle mission in support of the space station, the 17th mission of Endeavour and the 107th flight in shuttle program history.

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**Endeavour**

Endeavour, the newest addition to the four-orbiter fleet, is named after the first ship commanded by James Cook, the 18th-Century British explorer, navigator and astronomer.

On Endeavour's maiden voyage in August 1768, Cook sailed to the South Pacific (to observe and record the infrequent event of the planet Venus passing between the Earth and the sun). Determining the transit of Venus enabled early astronomers to find the distance of the sun from the Earth, which then could be used as a unit of measurement in calculating the parameters of the universe.

In 1769, Cook was the first person to fully chart New Zealand (which was previously visited in 1642 by the Dutchman Abel Tasman from the Dutch province of Zeeland). Cook also surveyed the eastern coast of Australia, navigated the Great Barrier Reef and traveled to Hawaii.

Cook's voyage on the Endeavour also established the usefulness of sending scientists on voyages of exploration. While sailing with Cook, naturalist Joseph Banks and Carl Solander collected many new families and species of plants, and encountered numerous new species of animals.

Endeavour and her crew reportedly made the first long-distance voyage on which no crewman died from scurvy, the dietary disease caused by lack of ascorbic acids. Cook is credited with being the first captain to use diet as a cure for scurvy, when he made his crew eat cress, sauerkraut and an orange extract.
The Endeavour was small at about 368 tons, 100 feet in length and 20 feet in width. In contrast, its modern day namesake is 78 tons, 122 feet in length and 78 feet wide. The Endeavour of Captain Cook's day had a round bluff bow and a flat bottom. The ship's career ended on a reef along Rhode Island.

For the first time, a national competition involving students in elementary and secondary schools produced the name of the new orbiter; it was announced by President George Bush in 1989. The space shuttle orbiter Endeavour was delivered to Kennedy Space Center in May 1991, and flew its first mission, highlighted by the dramatic rescue of a stranded communications satellite, a year later in May 1992.

Endeavour is called OV-105, for Orbiter Vehicle-105.

Day-by-day summary of the mission:

Day 1 – Launch

Endeavour’s crew will launch in the afternoon of its day during a precisely timed, few-minutes-long launch window that begins the process of rendezvous with the International Space Station. Crewmembers begin a sleep period about seven hours after launch.

Day 2 – Equipment Checkouts, Rendezvous Preparations

Endeavour’s crew will spend its first full day in space checking out equipment that will be used for upcoming major activities -- the shuttle’s robotic arm and the controls and tools used for the final rendezvous and docking with the station. The crew also will power up and prepare the shuttle’s docking system and perform several engine firings to optimize the rate at which Endeavour closes in on the station.

Day 3 – Rendezvous and Docking

Plans call for Endeavour to dock with the International Space Station on Flight Day 3. Expedition Four crewmembers’ Individual Equipment Liner Kits are transferred to the station and stowed temporarily.

Day 4 – Berthing of the MPLM Raffaello

Raffaello will be attached to the station’s Unity node, powered up and activated. The three Expedition Four crewmembers will install their Individual Equipment Liner Kits in the Soyuz capsule docked to the station, thus becoming members of the station crew.

Day 5 – Spacewalk Preparation

Astronauts will check out spacesuits and other spacewalking equipment. The station and shuttle arms will be prepared for the next day’s activities.
Day 6 – The Spacewalk

Goodwin and Tani will install thermal blankets over the Beta Gimbal Assemblies, atop the P6 Truss at the bases of the station’s two large solar wings. The spacewalk is expected to last about four hours. Transfer of equipment and supplies to the station continues, as do handover talks between the Expedition Three and Expedition Four crews.

Day 7 – Transfer and Handover

Transfer operations, including moving powered station payloads to the shuttle, continue. Biotechnology Refrigerator samples also will be transferred to Endeavour.

Day 8 – Equipment, Supplies Transfer

Again station and shuttle crewmembers will transfer equipment and supplies between Raffaello and the station. Raffaello will be loaded with unneeded equipment and supplies from the station for return to earth. Station crewmembers will continue handover activities.

Day 9 – Raffaello Returns to Endeavour

Raffaello will be unberthed from the space station and, loaded with its new cargo of unneeded equipment and supplies from the station, returned to Endeavour’s cargo bay. Station and shuttle crewmembers will review undocking procedures.

Day 10 – Shuttle-Station Hatch Closing, Undocking, Flyaround

The Endeavour and station crews will close hatches between the spacecraft. Gorie and Kelly will undock Endeavour from the station. With Kelly at the controls, Endeavour will do a flyaround of the complex before departing.

Day 11 – Pre-Landing Checkouts, Cabin Stow

Activities include the standard day-before-landing flight control checks of Endeavour by Gorie and Kelly and the normal steering jet test firing. The crew will spend most of the day stowing gear on board the shuttle and preparing for the return home. The Starshine satellite will be deployed.

Day 12 – Entry and Landing

Kennedy Space Center, Fla., is the preferred landing site.
Mission Objectives

Endeavour (OV-105)

Top priorities for the STS-108 (UF-1) mission of Endeavour are rotation of the International Space Station Expedition Three and Expedition Four crews, bringing water, equipment and supplies to the station and completion of spacewalk and robotics tasks.

International Space Station Program priorities include the following tasks to be accomplished.

--Rotation of the Expedition Three and Expedition Four crews.

--Water transfer from the shuttle to the station. The quantity will be determined during the mission.

--Berth the Multipurpose Logistics Module to the station, check it out and transfer critical cargo to the space station, transfer and stow return cargo in the module and return the module to the cargo bay.

--Transfer and activate powered experiments hardware and other cargo on Endeavour’s middeck, the space station’s U.S. laboratory Destiny, and transfer and activate powered experiments from the station to Endeavour’s middeck for return to Earth.

--Conduct spacewalk and robotics activities, including installation of blanket over Beta Gimbal Assemblies at the base of the solar wings.