



## STS-124

Space shuttle *Discovery's* upcoming STS-124 mission is the second of three flights that will launch components to complete the Japanese Aerospace Exploration Agency's Kibo laboratory. *Discovery* carries Kibo's large Japanese Pressurized Module, or JPM, and its remote manipulator system, or RMS, to the station.

During the 14-day mission, known as ISS Assembly flight 1J, the shuttle crew will conduct three spacewalks to perform space station maintenance and to install the JPM on the orbital outpost. The mission includes extensive robotic operations by the station, space shuttle, and Japanese robotic arms. It will be the first time that three different robotic arms will be operated during a single space flight mission.

The shuttle also will deliver a new crew member to the ISS and bring back another one following a three month mission.

### The Crew

Navy Cmdr. Mark Kelly will lead the crew of STS-124 on the 26th shuttle mission to the International Space Station. Kelly served as the pilot of STS-108 in 2001 and STS-121 in 2006. Making his third spaceflight, he has logged more than 25 days in space.

Kelly will be joined on *Discovery* by Navy Cmdr. Ken Ham who will make his first journey into space as the pilot of *Discovery* for the STS-124 mission. Ham will act as the mission spacewalk

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From the left: Chamitoff, Fossum, Ham, Kelly, Nyberg, Garan, and Hoshide.



choreographer and will conduct a flyaround of the station after *Discovery* undocks from the station.

*Discovery*'s mission specialists include Karen Nyberg, Air Force Col. Ron Garan, Air Force Reserves Col. Mike Fossum, and Aki Hoshide, who is from Japan and represents the Japanese Aerospace Exploration Agency, JAXA.

Gregory Chamitoff will be launched as the newest space station crewmember, replacing, Garrett Reisman, who will return home after three months on the complex. Chamitoff joins Expedition 17 Commander Sergei Volkov and Flight Engineer Oleg Kononenko, who have been on the station since April. Chamitoff will return to Earth on the STS-126 mission this fall.

Nyberg will be making her first spaceflight and will be the 50th woman to fly in space. She will become the first astronaut to operate three robotic arms on orbit, as she uses the shuttle robotic arm for inspection of *Discovery*'s thermal protection system, the station's Canadarm2 to help install Kibo to Harmony and the initial testing and checkout of the Japanese arm.

STS-124 will be Garan's first flight into space. He is scheduled to conduct three spacewalks to install the new Japanese hardware and will operate the shuttle's robotic arm.

Fossum will be making his second trip into space on STS-124. He flew as a mission specialist with Kelly on STS-121 in 2006, logging over 306 hours in space and conducting three spacewalks. He is the lead spacewalker during this mission and will conduct three more on this flight.

Hoshide will be making his first spaceflight during STS-124. He will be heavily involved in the Kibo assembly and activation, including operating the station robotic arm to install the JPM. He will also be the first person to operate the new Japanese robotic arm.

### **Launch and Docking**

After launching from the Kennedy Space Center, the *Discovery* crew will begin a two-day journey to the station.

The inspection of *Discovery*'s thermal protection heat shield on flight day 2 will be conducted differently than on previous flights. Kibo is so large that the shuttle's Orbiter Boom Sensor System (OBSS) was left at the station during the last mission. There is not enough room in *Discovery*'s cargo bay for both the boom and the new lab. As a result, the camera on the end of the shuttle's robotic arm will be used to take pictures of the heat-resistant tiles on *Discovery* as far as it can reach. Once the boom is retrieved on flight day 4 and handed back to the shuttle's robotic arm, it will be used for a more detailed inspection. The OBSS will then be brought back to Earth to be flown on subsequent shuttle missions.

Prior to docking on flight day 3, Kelly will maneuver *Discovery* through a slow, rotational back flip about 600 feet below the station allowing the station crew to collect digital imagery of the shuttle's heat shield for downlink to analysts on Earth.

About two hours after *Discovery* links up to the Harmony module, hatches will be opened between the two spacecraft to allow the 10 crewmembers to greet one another for the start of nine days of joint operations. Chamitoff will be exchanged for Reisman as the new station crewmember and preparations for the next day's initial spacewalk will begin.



### Japanese Pressurized Module

The JPM, will be the largest pressurized module on the space station and is equipped with its own airlock and robotic arm for external experiments.

Named Kibo, Japanese for 'hope,' the module joins the first component of the Japanese segment of the station, the Experiment Logistics Module-Pressurized Section (ELM-PS), that was launched on STS-123.

The airlock, which is not designed for spacewalks, will be used once the exposed facility components for the Japanese segment of the station are delivered on shuttle mission STS-127.

In all, Kibo can house up to 23 racks of equipment and experiments that will involve research in space medicine, biology, Earth observations, materials production, biotechnology and communications. Kibo experiments and systems are operated from the JAXA's control center called the Space Station Integration and Promotion Center in Tsukuba, Japan, just north of Tokyo.

### Robotic Manipulator System

The new Japanese pressurized module is also equipped with its own robotic manipulator system. The robotic device will be comprised of two separate six-jointed arms.

The Main Arm can handle up to 14,000 pounds of hardware and the Small Fine Arm, when attached to the Main Arm, handles more delicate operations. Each arm has six joints that mimic the movements of a human arm. The Small Fine Arm will be launched to the station at a later date on a Japanese resupply ship.

The initial deployment and checkout of the new arm on flight day 8 marks the first time that three different robotic arms will be operated during a single spaceflight.

### JPM/RMS Installation and Spacewalks

The mission will include three spacewalks, each lasting approximately 6.5 hours, to install the new lab and its robotic arm.

On flight day 4, Garan and Fossum will transfer the Orbiter Boom Sensor System back to the shuttle from its temporary location on the station's truss, or backbone. They will then prepare the JPM to be removed from the shuttle payload bay. Following these preparations, the new module will then be installed on the port side of Harmony using the shuttle's robotic arm. The crew will enter the Japanese module for the first time on flight day 5.

The crew's second spacewalk is scheduled for flight day 6. Garan and Fossum will install covers and external television equipment on the JPM and remove covers on the Japanese robotic arm, which will be deployed on flight day 8.

The lab's logistics module, which was installed in a temporary location during STS-123, will be attached to the new lab on flight day 7.

The third and final spacewalk of this mission occurs on flight day 9. Garan and Fossum will primarily work to replace a failed nitrogen tank assembly on the station's truss with a spare that was temporarily stored on one of the station external platforms. They also will remove the thermal cover from the Japanese robotic arm and retrieve a failed camera system on the truss.

### Undocking and Landing

*Discovery* and the STS-124 crew will leave the station on flight day 12. Ham will guide the orbiter on a flyaround of the station so the crew can take photographs of the newly installed Kibo module and the station's new configuration. Later in the day, the STS-124 crew will conduct an inspection of *Discovery's* heat shield.

Following a much needed day of rest, the crew will begin preparations for landing on flight day 14. *Discovery* is scheduled to land on flight day 15 at the Kennedy Space Center.





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