



STS-119: A Final Station Power Up

The STS-119 mission, which is also known as International Space Station Assembly Flight 15A, is the 28th mission to the station with a primary objective to deliver the final set of solar array wings and truss element that are needed to complete the station's electricity-generating system. *Discovery* and its crew also will deliver the newest crew member to the space station and return another back home to Earth.

The Crew

Air Force Col. Lee Archambault will lead the crew of STS-119. Archambault served as the pilot of STS-117 in 2007 and has logged more than 14 days in space. He has overall responsibility for the execution of the mission, orbiter

systems operations and flight operations, including landing. In addition, Archambault will fly the shuttle in a slow back flip called the rendezvous pitch maneuver while *Discovery* is 600 feet below the station to enable the station crew to photograph the shuttle's heat shield. He will then dock *Discovery* to the station.

Navy Cmdr. Tony Antonelli will serve as the pilot for the STS-119. Selected in 2000, this will be his first spaceflight. During the mission, Antonelli will be responsible for orbiter systems operations and shuttle robotic arm operations, and will help Archambault in the rendezvous and docking with the station. Antonelli will undock *Discovery* from the station at the end of the joint mission.



The mission specialists for the flight are Joseph Acaba, Steve Swanson, Richard Arnold, John Phillips, and Japan Aerospace Exploration Agency astronaut Koichi Wakata.

Selected as an astronaut candidate in 2004, this will be Joseph Acaba's first spaceflight mission. After completing his initial training, Acaba was assigned to the Hardware Integration Team in the Space Station Branch working technical issues with the European Space Agency. During the mission, Acaba will perform two spacewalks, helping with the installation and outfitting of the space station.

This will be the second trip to space for Steve Swanson, who flew as a mission specialist on STS-117. Swanson conducted two spacewalks on that mission, acquiring more than 13 hours of extravehicular activity time. He will use that experience during this mission as the lead spacewalker. He will perform the first, second and fourth spacewalks as new components are installed on the station.

A classmate of Acaba's, Richard Arnold was also selected in 2004 and is making his first spaceflight. He also worked in the Hardware Integration Team, but working technical issues with the Japan Aerospace Exploration Agency. He, too participated in a NASA Extreme Environment Mission (NEEMO) where he lived and worked in an undersea laboratory for 10 days. He will conduct three spacewalks on this mission and co-lead the transfer activities with Phillips throughout the mission.

John Phillips will be returning to space with more prior spaceflight experience than the rest of his crewmates combined. Phillips flew on shuttle mission STS-100, acquiring more than 12 days of spaceflight experience. He went on to serve as a flight engineer on Expedition 11, a long-duration mission where he performed a spacewalk and acquired nearly 180 days in space. On the STS-119 mission, he will perform robotic arm operations and co-lead the transfer activities with Arnold.



Astronaut Joseph M. Acaba is about to be submerged in the waters of the Neutral Buoyancy Laboratory to practice the extravehicular activities that he will conduct on the International Space Station.

Koichi Wakata will be making his third trip to space. He was the first Japanese mission specialist



Astronauts Lee Archambault (right) and Tony Antonelli, STS-119 commander and pilot, use virtual-reality training hardware and software to practice for some of their duties aboard the space shuttle and space station.

when he flew as part of the STS-72. His second flight was STS-92, a mission to the space station that will now be his new home in space. Once he arrives on the station this time, he'll be joining the onboard crew and become a flight engineer on Expedition 18. He will remain onboard and return with STS-127, scheduled for May 2009.

Astronaut Sandra Magnus will be concluding her long-duration mission aboard the space station and returning to Earth as a mission specialist on STS-119. She arrived on the station with the STS-126 crew in November and has since served as a flight engineer on Expedition 18. This long-duration mission was her second flight to space. She had previously flown as a mission specialist aboard STS-112.

Starboard 6 (S6) Truss Segment with Solar Array Wings

With its two solar array wings (SAWs) for converting solar energy into electrical power and a radiator for rejecting heat away from electrical components, the S6 is the final truss element and completes the station's 11-segment integrated truss structure (ITS). Also called a photovoltaic module (PVM) because of its ability to generate, store and distribute electrical power to the station, the S6 segment will ensure that the outpost is powered to its intended maximum potential.

Launch and Docking

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

On flight day two, inspection of *Discovery*'s heat shield will be performed. Phillips, Antonelli and Acaba will use the shuttle's robotic arm with a 50-foot extension boom to obtain detailed imagery of the orbiter's wings and other critical surfaces. The Orbiter Boom Sensor System,



Astronaut and STS-119 commander Lee Archambault (far right), leads his crew during training at the Space Shuttle Mock-up Training Facility.

or OBSS, uses laser devices and cameras to map the shuttle's heat shield. The crew also will check out space-suits and prepare for the next day's rendezvous and docking with the station.

On flight day three after *Discovery* has closed within 600 feet of the station, Archambault will take control of the orbiter and prepare it for docking with the station. First, Archambault will execute a slow rotational back flip maneuver that will allow station residents Fincke and Magnus to see the belly of the orbiter. They'll use digital cameras to acquire high-resolution photos of *Discovery*'s heat shield before it docks with the station.

About two hours after docking, hatches will be opened between the two spacecraft to allow the 10 crew members to greet one another for the start of joint operations. Magnus and Wakata will exchange custom-made Russian Soyuz spacecraft seat liners. With that exchange, Wakata will become a member of the Expedition 18 space station crew and Magnus will become part of *Discovery*'s crew.

Mission Timeline and Spacewalks

On flight day four, Magnus will join Phillips at the robotics workstation in the station's Destiny laboratory to use the station's robotic arm, Canadarm2, to gently lift the S6 truss from the orbiter's cargo bay and hand it to the shuttle robotic arm, which will be controlled by Antonelli and Acaba from inside *Discovery*. While the shuttle arm holds the truss segment, the station arm will be repositioned to the installation worksite. Once in position, the shuttle arm will hand the truss back over to the station robotic arm where it will remain in an overnight parked position. The rest of the day will focus on preparation for the first spacewalk of the mission.

On the fifth day of the flight, Swanson and Arnold will begin the first spacewalk by working with the crew inside

to install the S6 truss segment. Phillips, at the space station's robotic work station, will work in tandem with the two spacewalkers to maneuver the truss segment into its final position on the station where the spacewalkers can then work on the detailed installation tasks. After bolting the S6 to the station, they'll prepare it for deploying its solar arrays and photovoltaic radiator later in the mission.

If deemed necessary, on flight day six Archambault, Acaba and Antonelli will use the OBSS to once again inspect *Discovery*'s heat shield. The crew also will continue with the exchange of supplies and equipment between the shuttle and the station.

On flight day seven, Swanson will be joined by Acaba for the second spacewalk of the mission, the first ever for Acaba. They're scheduled to complete a series of maintenance tasks at several locations across the station's truss structure. Before heading back inside the station, they'll relocate a tool stanchion from the Z1 truss segment to the exterior of the Destiny laboratory and pick up a foot restraint for stowage inside the airlock.

The station should look even brighter after flight day eight when deployment of the solar array wings is completed. The crew will preside first over the deployment of the first



The S6 truss segment at Kennedy Space Center.



Astronaut Richard Arnold uses virtual-reality hardware at NASA's Johnson Space Center to rehearse some of his duties on the upcoming mission to the International Space Station.

array wing toward the end of the station where *Discovery* is docked. When nearly half of the array's length is unfolded, the crew will take a short break to let the array warm up before finishing the deployment. Next, they'll move to the second array, deploying it toward the Russian segment of the complex and allowing for another halfway point warm-up before full extension. This phased approach will give the crew and the ground engineers time to monitor the deployment and ensure that the arrays

are unfolding properly. If inspection of the heat shield is not required on flight day six, the solar array deployment will be moved up 48 hours.

On flight day nine, Acaba and Arnold will venture out for the third spacewalk, the second for each of them. On this spacewalk, the two crew members are scheduled to complete a list of additional maintenance tasks that is focused on the truss structure. They'll also conduct maintenance on the station's robotic arm, Canadarm2, and the Special Purpose Dexterous Manipulator, also called Dextre.

Some off-duty time is scheduled for the crew on flight day 10 before they're back to work transferring supplies and equipment between the shuttle and the station. They'll also conduct a joint crew news conference and review procedures for the next day's spacewalk.

Swanson and Arnold will conduct the final spacewalk on flight day 11. Swanson is scheduled to install an antenna on the Japanese logistics module and work on the Z1 truss patch panel connection while Arnold is taking photos of the S1 and P1 radiators. They'll wrap up this spacewalk by working together to install a new wireless video system and deploy two payload attachment systems.

On flight day 12, the shuttle crew will complete transfers before saying farewell to the station crew and preparing for hatch closure between the two spacecraft.

Undocking and Landing

Discovery is scheduled to undock from the station on flight day 13. Antonelli will conduct a flyaround of the complex so the crew can capture detailed imagery of the station's new configuration with the last of its power-producing solar arrays unfurled. After a little more than a lap around the station, Antonelli will fire the shuttle's jets to send it home. At that time, Antonelli, Acaba and Phillips will take turns with the shuttle's robotic arm and the OBSS to conduct a "late" inspection of the shuttle's heat shield, which is a final opportunity to confirm *Discovery*'s readiness to return to Earth.

On flight day 14, as Archambault, Antonelli and Swanson focus on landing *Discovery*, the rest of the crew will stow equipment and supplies that were used during the mission, store the sensor boom in the payload bay and shut down the shuttle's robotic arm systems. A special "recumbent" seat will be set up in the middeck of the orbiter to assist Magnus as she readapts to Earth's gravity following three months of weightlessness. Also, the entire crew will conduct a review of landing procedures.

Discovery is scheduled to return to Earth with a landing at NASA's Kennedy Space Center, Florida, in the pre-dawn hours, bringing to an end its 36th mission, the 28th shuttle flight to the International Space Station and the 125th flight in shuttle program history.

