

# STS-112 OVERVIEW



# INT'L. SPACE STATION ASSEMBLY MISSION 9A

## To Improve Life Here, To Extend Life to There, To Find Life Beyond.

That is NASA's vision. As part of the continuing assembly of the International Space Station to support world-class science investigations, five American astronauts and a Russian cosmonaut will spend a week at the ISS working with its three residents, to attach the second of 11 truss segments in the expansion of the complex and its intricate rail system.

Atlantis' Commander, Jeff Ashby, says the delivery of the S1 Truss to the ISS, which will expand the current backbone of the station by 45 feet, will set the stage for the arrival next year of additional solar arrays, and eventually, international science modules from Japan and Europe.

"Today, the investment in the International Space Station is paying off through the cooperation we have with these other countries, and the things we're learning about each other, and how we're learning to work together to build such an incredible project in space," Ashby said.

The addition of the S1 Truss not only will provide the platform for the expansion of power capability for the ISS, but will also enable the station's railcar system to move even further outboard from the Destiny Laboratory for future assembly work through the Canadarm2 robotic arm.

"The way to look at it is, if you were building the railway between New York and San Francisco 150 years ago, we're laying down the bit that comes up to the Appalachians," said Mission Specialist Piers Sellers, who will join David Wolf outside Atlantis for three spacewalks to help connect and activate all of the key components of the S1 Truss once it is installed.

For Expedition Five Commander Valery Korzun and Flight Engineers Peggy Whitson and Sergei Treschev, Atlantis' arrival will mark their first visitors to the ISS since they began their increment in early June. Atlantis Pilot Pam Melroy remembers a fledgling ISS in the fall of 2000 when she piloted Discovery on the STS-92 mission and expects to find a very different station when she arrives on board this time.

"The last time I flew was the last time before there was a crew onboard ISS," Melroy said. "So, we arrived to basically an empty house. It is now a house with residents, but a house occupied by good friends."

It is a house which will continue to grow in size and capability in the years to come.

*To understand and protect our home planet  
To explore the Universe and search for life  
To inspire the next generation of explorers  
...as only NASA can.*

That is NASA's mission.

## S1 Truss Extends International Space Station Backbone

The S1 (Starboard-One) Truss is slated for launch to the International Space Station aboard Space Shuttle Atlantis this fall from Kennedy Space Center, Fla. The truss is the next major addition to the space station's Integrated Truss Structure that will eventually span more than 300 feet to carry power, data and environmental services for the orbital outpost. When completed, the ends of the truss structure will also house the station's solar arrays.

During Atlantis' mission, spacewalkers assisted by the ISS robotic arm, will attach S1 to the S0 (Starboard-Zero) Truss already in place aboard the U.S.

Laboratory Module Destiny. Astronauts will make three spacewalks to complete installation and assembly. Space Shuttle Atlantis delivered S0 to the ISS in April 2002. Space Shuttle Endeavour delivers S1's mirror image, the P1 (Port-One) Truss, and attaches it to the other side of S0 in an upcoming flight.

The 27,717-pound S1 Truss is primarily an aluminum structure that is 45 feet long, 15 feet high and 6 feet wide. The structure along with one CETA (Crew and Equipment Translation Aid) hand cart costs about \$390 million.

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## Three Spacewalks Planned to Install New Truss Section

Three spacewalks are scheduled for the STS-112 (9A) mission of Atlantis to the International Space Station. The spacewalks will be performed on alternate days Flight Days 4, 6 and 8. Atlantis Mission Specialists David Wolf and Piers Sellers will perform all three.

Wolf, EV 1 (for Extravehicular Activity crewmember number 1) will wear the spacesuit marked with solid red stripes, while Sellers, EV 2 (Extravehicular Activity crewmember number 2), will wear an all-white spacesuit.

Atlantis Pilot Pam Melroy will be the prime intravehicular (IV) crewmember, offering advice and coordinating

spacewalking activities. Russian Mission Specialist Fyodor Yurchikhin will back up Melroy in this role. The prime Canadarm2 station robotic arm operator during the spacewalks will be Atlantis Mission Specialist Sandra Magnus, with help from Expedition Five Flight Engineer Peggy Whitson. Atlantis Commander Jeff Ashby will assist Melroy in the positioning of the shuttle's robotic arm, providing video and documentation support during the spacewalks.

All the spacewalks focus on installation and hookup of the S1 (S-One) segment, the 45-foot-long component, which is the second part of the station's Integrated Truss Structure (ITS), to the

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# MISSION OVERVIEW & Assembly Plan



# STS-112

## Atlantis' 6-Member Crew To Deliver S1 Truss

The major objective of Atlantis' 11-day STS-112 / 9A mission is the delivery of the 45-foot-long, 15-ton S1 (S-One) Truss to the International Space Station. The truss, which includes a cart that will serve as a mobile work platform for future spacewalkers, will be attached to the starboard side of the station's centerpiece truss, the S0 (S-Zero) Truss, on which the Mobile Transporter, Mobile Base System and the Canadarm2 robotic arm are mounted. Three spacewalks are planned to install and activate the truss and its associated equipment.

Jeff Ashby (Capt., U.S. Navy), making his third space flight after two missions as a pilot, will be the commander. Pam Melroy (Col., U.S. Air Force) is the pilot, making her second space flight. Sandy Magnus (Ph.D.), making her first space flight, will serve as the flight engineer. Veteran Astronaut David Wolf (M.D.), one of two spacewalkers, will be making his third space flight, including 119 days as a flight engineer on the former Russian space station Mir. Piers Sellers (Ph.D.), making his first space flight, is the other spacewalker. Russian Engineer Fyodor Yurchikhin from RSC-Energia will join Melroy to choreograph the spacewalks and will work with Magnus to transfer experiments and payloads from Atlantis to the ISS on his first space flight.

Two days after Atlantis is launched, Ashby will guide the shuttle to a linkup with the space station, setting the stage for the start of seven days of joint operations between Atlantis' crew and the resident crew on the ISS, Expedition Five Commander Valery Korzun and Flight Engineers Peggy Whitson and Sergei Treschev.

The following day, Wolf and Sellers will begin spacewalk preparations while Magnus and Whitson use the Canadarm2 from inside the Destiny Laboratory Module to grapple the S1 Truss, lifting it out of Atlantis' payload bay and maneuvering it for its installation. Once outside, Wolf, riding with his feet affixed at the end of Canadarm2, and Sellers, acting as the "free floater," will begin to connect power, data and fluid umbilicals between the newly attached trusses. They will also deploy the station's second S-Band communications system, install the first of two external camera systems and release launch restraints on the truss' crew platform cart.

After a day of transfer activities, Wolf and Sellers will venture outside Atlantis again on Flight Day 6. This time, Sellers will ride at the end of Canadarm2. The duo will set up the second external camera system, continue to connect fluid lines between the S1 and the S0 segments and release launch restraint pins at various points on the S0.

Flight Day 7 is devoted to more transfer work. For the third spacewalk the next day, Sellers will return to the end of Canadarm2 and work with Wolf to install lights and toolboxes on the crew platform cart and release launch lock restraints on one of three radiator beams on S0.

The next day, the shuttle and station crews will complete transfer work. Melroy will undock Atlantis from the ISS on Flight Day 10.

After a day devoted to packing up gear, Atlantis' crewmembers plan to land at the Kennedy Space Center in Florida to wrap up the orbiter's 26th mission, the 15th shuttle flight in support of ISS assembly and the 111th in shuttle program history.



The first Integrated Truss Structure, the S0 Truss, was installed during STS-110. Mission Specialist Ellen Ochoa with assistance from Expedition Four Flight Engineer Dan Bursch used the station's robotic arm to remove the truss from the shuttle's payload bay, then install it atop the Destiny Laboratory.

## Truss Assembly Plan

### STARBOARD TRUSSES

**S0 Truss\***  
Shuttle Mission: STS-110  
ISS Assembly Mission: 8A

**S1 Truss**  
Shuttle Mission: STS-112  
ISS Assembly Mission: 9A

**S3/S4 Truss**  
Shuttle Mission: STS-117  
ISS Assembly Mission: 13A

**S5 Truss**  
Shuttle Mission: STS-118  
ISS Assembly Mission: 13A.1

**S6 Truss**  
Shuttle Mission: STS-119  
ISS Assembly Mission: 15A

### PORT SIDE TRUSSES

**P1 Truss**  
Shuttle Mission: STS-113  
ISS Assembly Mission: 11A

**P3/P4 Truss**  
Shuttle Mission: STS-115  
ISS Assembly Mission: 12A

**P5 Truss**  
Shuttle Mission: STS-116  
ISS Assembly Mission: 12A.1

**P6 Truss\***  
*Delivery Configuration*  
Shuttle Mission: STS-97  
ISS Assembly Mission: 4A

*Permanent Configuration*  
Shuttle Mission: STS-118  
ISS Assembly Mission: 13A.1

\*Delivered

### Related Web Sites:

- <http://spaceflight.nasa.gov/shuttle/>
- <http://spaceflight.nasa.gov/station/>
- <http://spaceflight.nasa.gov/station/assembly/>
- <http://scipoc.msfc.nasa.gov/>

# CREWMEMBERS



# STS-112

## Meet the Crew



Pictured from left to right is the STS-112 crew:

### **Mission Specialist 2: Sandra Magnus**

Received a bachelor's and master's from the University of Missouri-Rolla in 1986 and 1990, respectively, and a doctorate from the Georgia Institute of Technology in 1996. Reported to NASA for astronaut training in April 1996.

### **Mission Specialist 1: David Wolf**

Received a bachelor's of science in electrical engineering from Purdue University in 1978 and a doctorate of medicine from Indiana University in 1982. Selected as an astronaut in January 1990.

### **Pilot: Pamela Melroy**

Received a bachelor's of science from Wellesley College in 1983 and master's of science from the Massachusetts Institute of Technology in 1984. Selected as an astronaut candidate in December 1994.

### **Commander: Jeff Ashby**

Received a bachelor's of science in mechanical engineering from the University of Idaho in 1976 and a master's of science in aviation systems from the University of Tennessee in 1993. Reported to NASA for astronaut training in 1995.

### **Mission Specialist 3 : Piers Sellers**

Received a bachelor's of science in ecological science from the University of Edinburgh (Scotland) in 1976 and received a doctorate in biometeorology from Leeds University (United Kingdom) in 1981. Selected as an astronaut candidate in April 1996.

### **Mission Specialist 4: Fyodor Yurchikhin**

Qualified as a mechanical engineer in 1983 after studying at the Moscow Aviation Institute. Received a doctorate in economics from the Moscow State Service University. Qualified as a Russian test-cosmonaut in 1999.



**Jeff Ashby**  
Commander



**Pamela Melroy**  
Pilot



**David Wolf**  
Mission Specialist 1



**Sandra Magnus**  
Mission Specialist 2



**Piers Sellers**  
Mission Specialist 3



**Fyodor Yurchikhin**  
Mission Specialist 4

### **Astronaut Bio Links:**

<http://www.jsc.nasa.gov/Bios/astrobio.html>

<http://www.jsc.nasa.gov/Bios/htmlbios/ashby.html>

<http://www.jsc.nasa.gov/Bios/htmlbios/melroy.html>

<http://www.jsc.nasa.gov/Bios/htmlbios/wolf.html>

<http://www.jsc.nasa.gov/Bios/htmlbios/magnus.html>

<http://www.jsc.nasa.gov/Bios/htmlbios/sellers.html>

### **Cosmonaut Bio Links:**

<http://www.jsc.nasa.gov/Bios/cosmo.html>

<http://www.jsc.nasa.gov/Bios/htmlbios/yurchikhin.html>

# Backbone

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Boeing began construction of the truss in May 1998 in Huntington Beach, Calif., and completed the work in Huntsville, Ala., in March 1999. The S1 moved to Kennedy Space Center, Fla., in October 1999 for flight processing. Boeing delivered the S1 to NASA in June 2002 for final preparations and preflight checks.



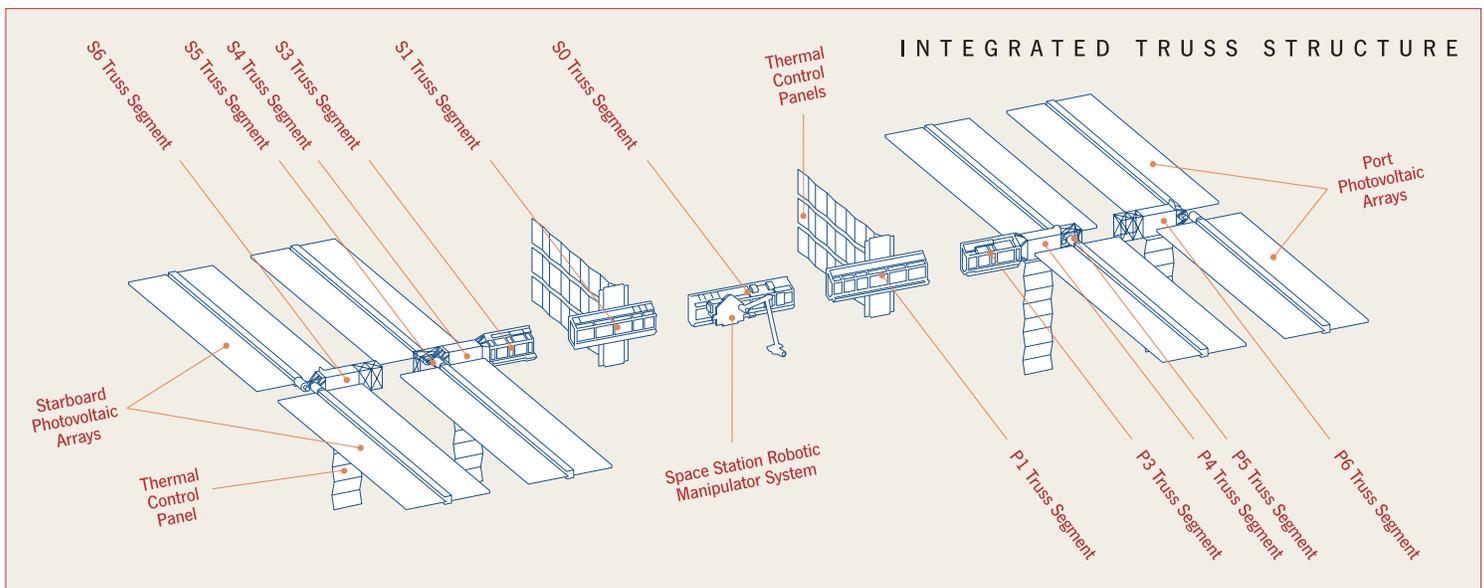
Both S1 and eventually P1 will provide structural support for the Active Thermal Control System, the Mobile Transporter, a CETA cart and antennas. The S1 has an S-band system; the P1 a UHF system. Both trusses also have mounts for cameras and lights.

Additionally, both S1 and P1 carry one radiator each as part of the space station's cooling and heating system. The radiators are deployed in orbit and use 99.9 percent pure ammonia. The radiator assembly also rotates to keep itself in the shade and

away from the sun. Each radiator has 18 launch locks securing the assembly during launch. The locks will be removed during a spacewalk before deploying the radiators.

The addition of S1 also extends the Mobile Transporter (MT) rail line. The MT car travels along the length of the truss structure and carries spacewalkers, tools, construction items and the space station robotic arm. Flying aboard S1 is one of two CETA carts that move spacewalkers along the MT rails to worksites on the truss structure. The cart is manually operated by a spacewalker and can also be used as a work platform. S1 and P1 carry one cart each.

The P1 truss differs slightly from S1 and could be considered a mirror image. It has the same capabilities as the S1 except that P1 carries a UHF antenna. The P1 also carries a second CETA cart.



# Spacewalks

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S0 (S-Zero) Truss, the center of the ITS. The ITS eventually will have 11 segments and stretch 356 feet from end to end. It will support four virtually identical solar array assemblies, including the one now atop the P6 Truss of the ISS, along with radiators to cool the station. The truss, sometimes called the backbone of the station, also will support experiments and already houses a railroad track with a mobile base for Canadarm2.

All the spacewalks will be conducted from the station's Joint Airlock Quest. Before each excursion, Wolf and Sellers will use a special technique designed to purge nitrogen from the

body. The protocol involves breathing pure oxygen while exercising vigorously to purge nitrogen from spacewalkers' bloodstreams. It eliminates the need to spend many hours at reduced cabin pressure and allows hatches between the shuttle and the station to remain open. The protocol was first used on STS-104 during the first spacewalk from the Joint Airlock, which was installed earlier during that mission.

The backup spacewalker for the first EVA will be Expedition Five Commander Valery Korzun. Whitson will be the backup for the second and third spacewalks, if required.