

Mission Overview

In December 2006, ESA astronaut Christer Fuglesang will become the first Swedish astronaut in space when he is launched to the International Space Station (ISS) on the European Celsius Mission from the Kennedy Space Center in Florida on board Space Shuttle Discovery. A principal focus of the mission will be Fuglesang's spacewalk activities as a Mission Specialist on the STS-116 Space Shuttle flight undertaking ISS assembly mission 12A.1. Fuglesang will also be undertaking experiment, educational and public relations activities as part of the Celsius Mission.

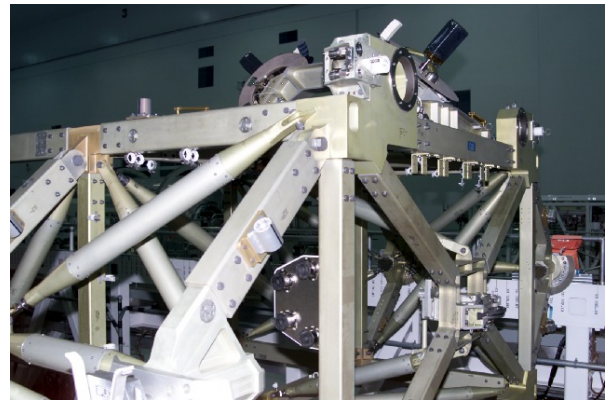


Launch of Space Shuttle Discovery on STS-121 mission on 4 July 2006. ESA astronaut Thomas Reiter was one of the Shuttle crew on his way to become a member of ISS Expedition 13. (Image: NASA)

The 12-day mission marks the continued construction of the International Space Station as well as many important milestones for the European Space Agency, European astronauts, and European science. The focal points of the Celsius mission are as follows:

Installation of the P5 truss section:

The ISS truss, in its complete configuration is used primarily to support the ISS solar arrays for power generation, and house the External Thermal Control System for excess heat



P5 truss section. (Image: NASA)

dispersal. The P5 installation onto the P3/4 truss section will be conducted during the first of three planned extravehicular activities (EVAs) or spacewalks, and will involve use of both the Shuttle and ISS robotic arms. This will be the first of two EVAs undertaken by ESA astronaut Christer Fuglesang together with NASA astronaut Robert Curbeam.

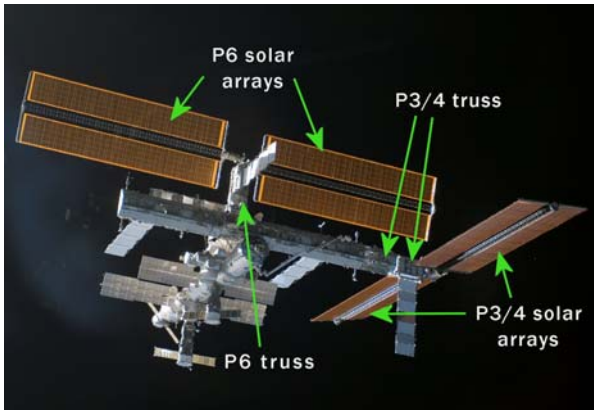


Portrait of Christer Fuglesang in an EVA spacesuit. (Image: NASA)

As such Fuglesang will become the **first ESA astronaut to undertake an EVA on an ISS assembly mission**. This follows on from ESA astronaut Thomas Reiter who became the first ESA astronaut to undertake an EVA from the ISS in August 2006. The P5 truss is the last port side

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truss section to be launched. On the STS-120 flight in August 2007 for ISS assembly mission 10A, the P6 truss, which is already on orbit will be moved to its final location at the end of the P5 truss.



Current location of P6 and P3/4 truss sections on ISS.
(Image: NASA)

Reconfiguration of ISS power supply and thermal control: After the P5 truss is installed on the ISS, relevant systems need to be configured and activated to switch the ISS from its early configuration towards its final configuration for power supply and thermal control. Power generated by solar arrays on the P3/4 truss section needs to be patched into the ISS power supply. P3/4 was installed on the last Shuttle mission (STS-115), though not patched in. One set of solar arrays on the P6 truss will be retracted to make room for the P3/4 solar arrays to rotate, and the External Thermal Control Loops will be filled and activated. Reconfiguring the power supply will be the focus of EVA 2 and 3. Fuglesang and Curbeam will carry out tasks to reconfigure half the Station's power on EVA 2. The other half will be reconfigured during EVA 3 by Curbeam and NASA astronaut Sunita Williams.



ESA astronaut Christer Fuglesang during EVA training at the Neutral Buoyancy Laboratory at the Johnson Space Center.
(Image: NASA)

Additional EVA tasks: This includes relocation of two Crew and Equipment Translation Aid (CETA) carts on the Station's truss, and to replace a failed camera, also on the truss. Christer Fuglesang will be involved with these tasks during EVA 1 and 2.



ESA astronaut Christer Fuglesang and NASA astronaut Robert Curbeam (obscured) being lowered into the Neutral Buoyancy Laboratory at the Johnson Space Center on 21 April 2006.
(Image: NASA)

Exchange one member of the ISS permanent crew: ESA astronaut Thomas Reiter who was a member of ISS Expedition 13 crew from 6 July until 26 September 2006 and then became a member of the Expedition 14 crew, will be replaced as Expedition 14 Flight Engineer 2 by NASA astronaut Sunita Williams. As Reiter will be on the return journey with Fuglesang, this will be the **first ISS flight that will have two ESA astronauts on board.**

Undertake a European experiment programme: During his mission, Fuglesang will be undertaking a number of European experiments in the areas of human physiology and radiation dosimetry including experiments with an educational application. One of the experiments that Fuglesang

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ESA astronaut Thomas Reiter, in the US Destiny Laboratory after arriving at the ISS to become Flight Engineer 2 of the Expedition 13 Crew. (Image: NASA)

will perform, ALTEA, looks at the effects of cosmic radiation on brain function. This continues on from previous experiments such as the SilEye experiment on the Mir Space Station from 1995 to 1999 in which Fuglesang was involved as a scientist.

Delivery of supplies in the Spacehab pressurised module: Spacehab is a pressurised aluminium module that travels in the



ESA astronaut Pedro Duque in Spacehab during the STS-95 mission in 1998. (Image: NASA)

Shuttle's cargo bay and is connected to the Shuttle's mid deck by a tunnel. It is similar in design to the European-developed Spacelab. Three previous ISS missions used the Spacehab Logistics Double Module (STS-96, STS-101 and STS-106), though for this fourth ISS mission utilising Spacehab, the Spacehab Logistics Single Module will be used. A Spacehab Single Module was used for the last time for the STS-95 mission, which included ESA astronaut Pedro Duque as a Mission Specialist. This module will have the capacity to store and transport about 2.5 tonnes of supplies, equipment, and research payloads.



View of Spacehab Single Module in the Shuttle Atlantis cargo bay (below centre) during rendezvous and docking with the Mir Space Station as part of the STS-76 mission, which included the ESA Biorack facility. (Image: NASA)

Among supplies being delivered are Service Module Debris Panels, which will increase ISS protection from potential impacts of micro-meteorite debris. These will be temporarily stowed on the external surface of the ISS during the third EVA.



Human Spaceflight
SPACE FOR LIFE

Celsius Mission
Information Kit



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Mission Key Reference Data

CREWS:

Flight STS-116/12A.1:

Shuttle Commander:
Shuttle Pilot:
Mission Specialist:
Mission Specialist:
Mission Specialist:
Mission Specialist:
Expedition 14 Flight Engineer (ascent only):
Expedition 14 Flight Engineer (descent only):

Mark Polansky (NASA)
William Oefelein (NASA)
Christer Fuglesang (ESA)
Robert Curbeam (NASA)
Joan Higginbotham (NASA)
Nicholas Patrick (NASA)
Sunita Williams (NASA)
Thomas Reiter (ESA)

SPACECRAFT:

Launch system:
Spacecraft:

Space Shuttle
Orbiter Discovery (OV-103)

LAUNCH and LANDING SITES:

Launch Site:
Landing Sites:

Kennedy Space Center, Florida, U.S.
Kennedy Space Center, Florida, U.S.
Edwards Air Force Base, California, U.S.
White Sands Space Harbor, New Mexico, U.S.

MISSION PARAMETERS:

Launch Date:

7 December 2006 21:36 (EST, Kennedy)
8 December 2006 03:36 (CET, Central Europe)

Docking:

9 December 2006 18:36 (EST, Kennedy)
10 December 2006 00:36 (CET, Central Europe)

Altitude:
Inclination:

~400km
51.6°

Undocking:

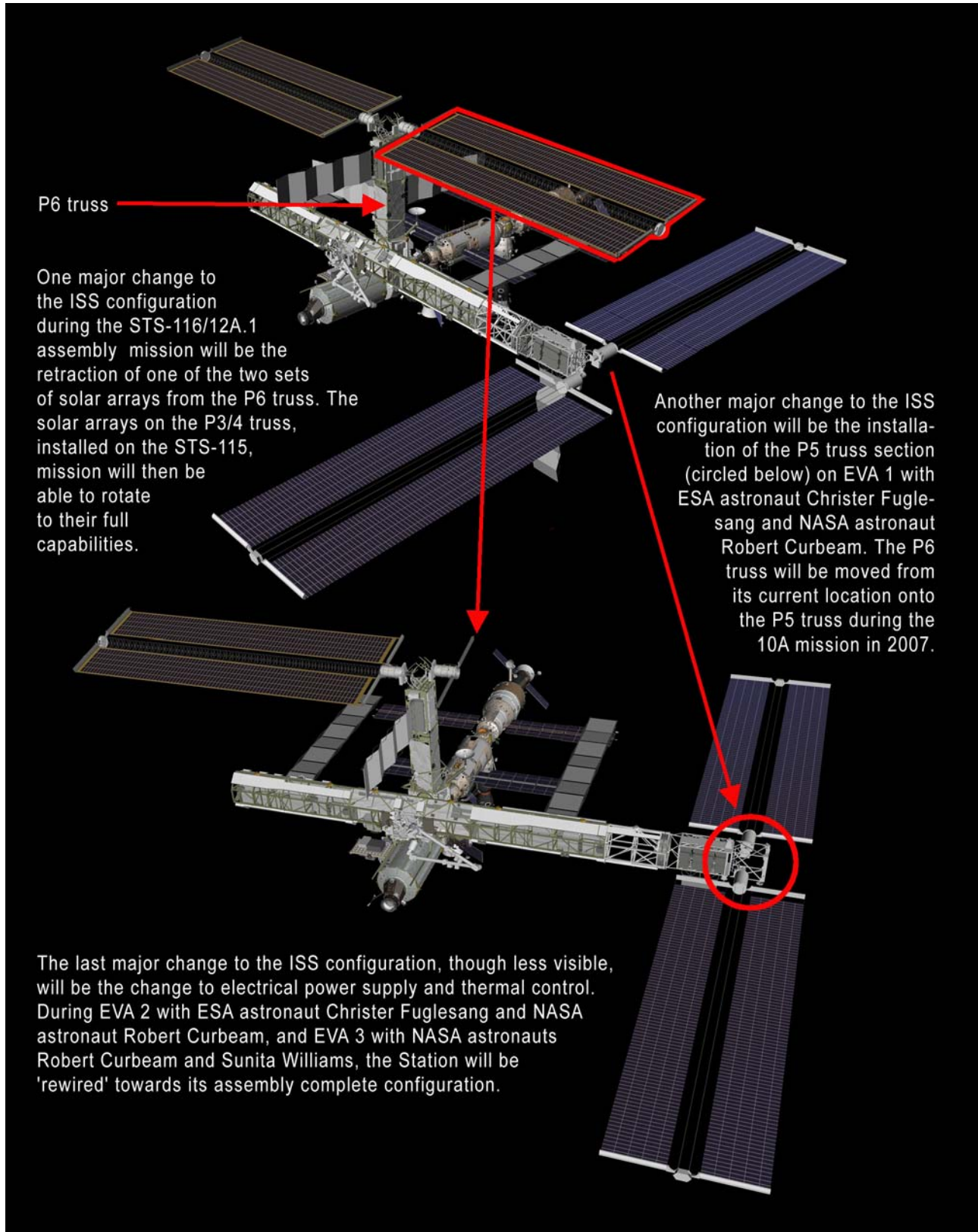
16 December 2006 16:21 (EST, Kennedy)
16 December 2006 22:21 (CET, Central Europe)

Landing:

19 December 2006 16:37 (EST, Kennedy)
19 December 2006 22:37 (CET, Central Europe)

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Changes to ISS Configuration



Graphic representation of the change to ISS configuration during the Celsius Mission (Image: NASA/Text: ESA)

Mission Name and Logo



Celsius Logo

Mission Name: The Celsius mission takes its name from the famous Swedish scientist and astronomer Anders Celsius (1701 – 1744), who is most noticeably famous for his invention of the standard international temperature scale that bears his name.

Celsius found it important to share and learn more about science outside Sweden, working in France and Germany. He had a thirst for knowledge about the aurora borealis and his collection of 316 observations was published in 1733. In line with this Fuglesang will be involved in a number of education activities during the mission and was previously involved in the SilEye, experiment which investigated light flashes in astronauts eyes on the Mir Space Station between 1995 and 1999.

Both Celsius and Fuglesang share a drive for exploration. Fuglesang by crossing the Atlantic Ocean by boat and going on mission the International Space Station. Celsius with expeditions to the northern part of Sweden and Norway, taking measurements that helped to confirm Newton's belief that the Earth was an ellipsoid flattened at the poles.

Mission Logo: The principal graphic element of the logo is a map of Scandinavia represented in lighter blue stripes and one darker blue (broken) stripe. This darker stripe marks the flight path of the Space Shuttle Discovery, which is represented at the top of this darker blue stripe.

The crossover of these images indicates the national feel of the mission with ESA astronaut Christer Fuglesang coming from Sweden and activities during Scandinavian flyovers of the Shuttle involving institutions and students on the ground. The stripes also symbolise precision, scale and measurement with the darker stripe indicative of a thermometer, tying in with the background of the mission name shown to the right. The upward slanting direction of the darker stripe and the Shuttle furthermore hints at the dynamic nature of the mission and the progress that will be made with relation to the assembly of the ISS and on scientific grounds.

Furthermore with the colours used in the logo matching the chosen colours of the European Space Agency, this shows the wider European nature of the mission. This is again indicated by the appearance of the ESA logo in the bottom right hand corner.

ISS Assembly Mission Patch



The STS-116/12A.1 mission patch symbolises the crew of the Space Shuttle Discovery and their major objectives on ISS construction mission 12A.1: delivery and installation of the ISS's P5 truss segment, configuration and activation of the ISS primary electrical and thermal control systems, and the transportation of ISS Expedition crew members and expedition supplies.

The crew patch depicts the Space Shuttle rising above the Earth and ISS. The United States and

Swedish flags trail the orbiter, depicting the international composition of the STS-116 crew. The seven stars of the constellation Ursa Major are used to provide direction to the North Star, which is superimposed over the installation location of the P5 truss on the ISS.

Located around the patch are the names of the Shuttle crew.