Expeditions to the International Space Station

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Expedition 1

Expedition 1

Mission insignia

Call sign	*Expedition 1*
Number of crew	3
Launch	31 October 2000 07:52:47 UTC
Launch site	Baikonur Cosmodrome
Launch craft	Soyuz TM-31
Start	2 November 2000 09:21:03 UTC (docking)
End	18 March 2001 04:32:00 UTC (undocking)
Landing	21 March 2001 07:33:06 UTC (wheels stop)

Landing craft	*Discovery* STS-102
Landing site	Kennedy Space Center
Duration	136 days 17 hours 09 minutes (docking to hatch closing)
Mission duration	140 days 23 hours 38 minutes (launch to landing)

L-R: Sergei K. Krikalev (Russia), William M. (Bill) Shepherd (U.S.A.), and Yuri Pavlovich Gidzenko (Russia)

Previous expedition	Next expedition
Mir	Expedition 2

Expedition 1, or **Expedition One**, was the first long-duration stay on the International Space Station (ISS). The three-person crew stayed aboard the station for 136 days, from November 2000 to March 2001. It was the beginning of an uninterrupted human presence on the station which still continues, as of February 2011. Expedition 2, which also had three crew members, immediately followed Expedition 1.

The official start of the expedition occurred when the crew docked to the station on 2 November 2000, aboard the non-re-usable Russian spacecraft Soyuz TM-31, which had launched two days earlier. During their mission, the Expedition 1 crew activated various systems on board the station, unpacked equipment that had been delivered, and hosted three visiting Space Shuttle crews and two unmanned Russian Progress resupply vehicles. The crew was very busy throughout the mission, which was declared a success.

The three visiting Space Shuttles brought equipment, supplies, and key components of the space station. The first of these, STS-97, docked in early December 2000, and brought the first pair of large U.S. photovoltaic arrays, which increased the station's power capabilities fivefold. The second visiting shuttle mission was STS-98, which was docked in mid-February 2001, delivered the US$1.4 billion research module *Destiny*, which increased the mass of the station beyond that of *Mir* for the first time. Mid-March 2001 saw the final shuttle visit of the expedition, STS-102, whose main purpose was to

exchange the Expedition 1 crew with the next three person long-duration crew, Expedition 2. The expedition ended when *Discovery* undocked from the station on 18 March 2001.

The Expedition 1 crew consisted of an American commander and two Russians. The commander, Bill Shepherd, had been in space three times before, all on shuttle missions which lasted at most a week. The Russians, Yuri Gidzenko and Sergei K. Krikalev, both had previous long-duration spaceflights on *Mir*, with Krikalev having spent over a full year in space.

Crew

Position	Astronaut
Commander	William Shepherd, NASA Fourth spaceflight
Pilot	Sergei K. Krikalev, RSA Fifth spaceflight
Flight Engineer	Yuri Gidzenko, RSA Second spaceflight

The commander, Bill Shepherd, was a former Navy SEAL, whose only spaceflights were on shuttle missions, and at the beginning of the mission his total time in space was about two weeks. Questions had been raised by the Russian space agency about the choice of Shepherd as mission commander due to his lack of experience. Flight engineer Sergei Krikalev had spent over a year in orbit, mostly on *Mir*, and would become the first person to visit the ISS twice. He had felt excitement to have been one of the first people to enter to Zarya module (the first component of the space station) in 1998, during STS-88, and was looking forward to returning. Yuri Gidzenko was designated commander and pilot of the two-day Soyuz mission to the station, had one previous spaceflight, which was a 180 day stay aboard *Mir*.

Shepherd was only the second U.S. astronaut to be launched in a Russian spacecraft, the first being Norman Thagard, who launched on Soyuz TM-21 to visit *Mir* in 1995. Shepherd expected one of the biggest challenges for the ISS would be the compatibility of technologies, such as that between Russian and U.S. technologies.

Background

The first component of the space station was the Zarya module, which was launched unmanned in November 1998. Following this launch, and prior to Expedition 1, there were five manned Space Shuttle flights and two unmanned Russian flights to the ISS. Some of these flights delivered large modules, such as the pressurized *Unity* and *Zvezda* modules, and the first piece of the Integrated Truss Structure. The manned flights were used for partial assembly of the ISS, as well as to start unpacking the supplies and

equipment that we being delivered. Prior to Expedition 1, Krikalev expected the ISS to be very similar to his experience on *Mir* ten years previous, due to the physical similarities of the stations' components.

The launch of the Expedition 1 crew occurred a week before the United States presidential election, so it got little attention in the United States. At the time of the mission, the station was expected to be completed in 2006, and be continuously inhabited until at least 2015. Due to several delays, including the fallout from the Space Shuttle *Columbia* disaster, the station is expected to be completed in late 2011.

Mission highlights

The crew of three were on board the International Space Station for four and a half months, from early November 2000 to mid-March 2001. Major events during this time include the three week long Space Shuttle visits, which occurred in early December, mid-February, and at the end of the expedition in March.

Launch and docking

Expedition 1's Soyuz-U launch vehicle being transported to its launch pad on 29 October 2000

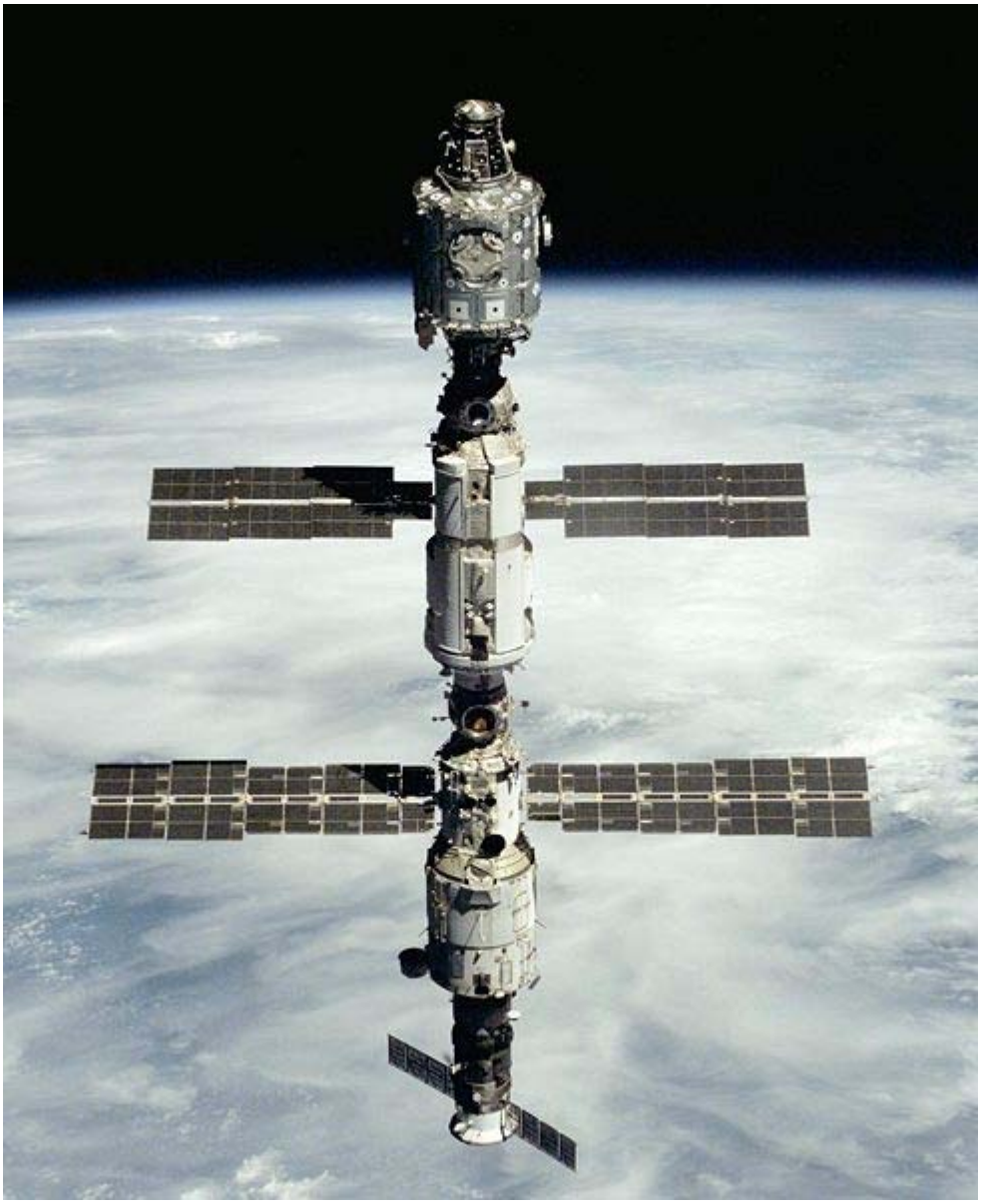
The three-member Expedition 1 crew successfully launched on 31 October 2000, at 07:52 UTC, atop a Soyuz-U rocket on Soyuz TM-31 from the Baikonur Cosmodrome in Kazakhstan; they used launch pad Gagarin's Start, from which the first human to fly in

space, Yuri Gagarin, was launched in 1961. After 33 orbits of the Earth, and a series of rendezvous maneuvers performed by Gidzenko, they docked the Soyuz capsule to the aft port of the Zvezda Service Module on 2 November 2000, at 09:21 UTC. Ninety minutes after docking, Shepherd opened the hatch to Zvezda and the crew members entered the complex.

Alpha

At the end of the first day on the station, Shepherd requested the use of the radio call sign "*Alpha*", which he and Krikalev preferred it to the more cumbersome "*International Space Station*". The name "*Alpha*" had previously been used for the station in the early 90's, and following the request, its use was authorized for the whole of Expedition 1. Shepherd had been advocating the use of a new name to project managers for some time. Referencing a naval tradition in a pre-launch news conference he had said: "For thousands of years, humans have been going to sea in ships. People have designed and built these vessels, launched them with a good feeling that a name will bring good fortune to the crew and success to their voyage." Yuri Semenov, the President of Russian Space Corporation Energia at the time, disapproved of the name "*Alpha*"; he felt that *Mir* was the first space station, and so he would have preferred the names "*Beta*" or "*Mir 2*" for the ISS.

First month



The configuration of the ISS at the start of Expedition 1. From top to bottom, the three modules are: *Unity*, *Zarya* and *Zvezda*.

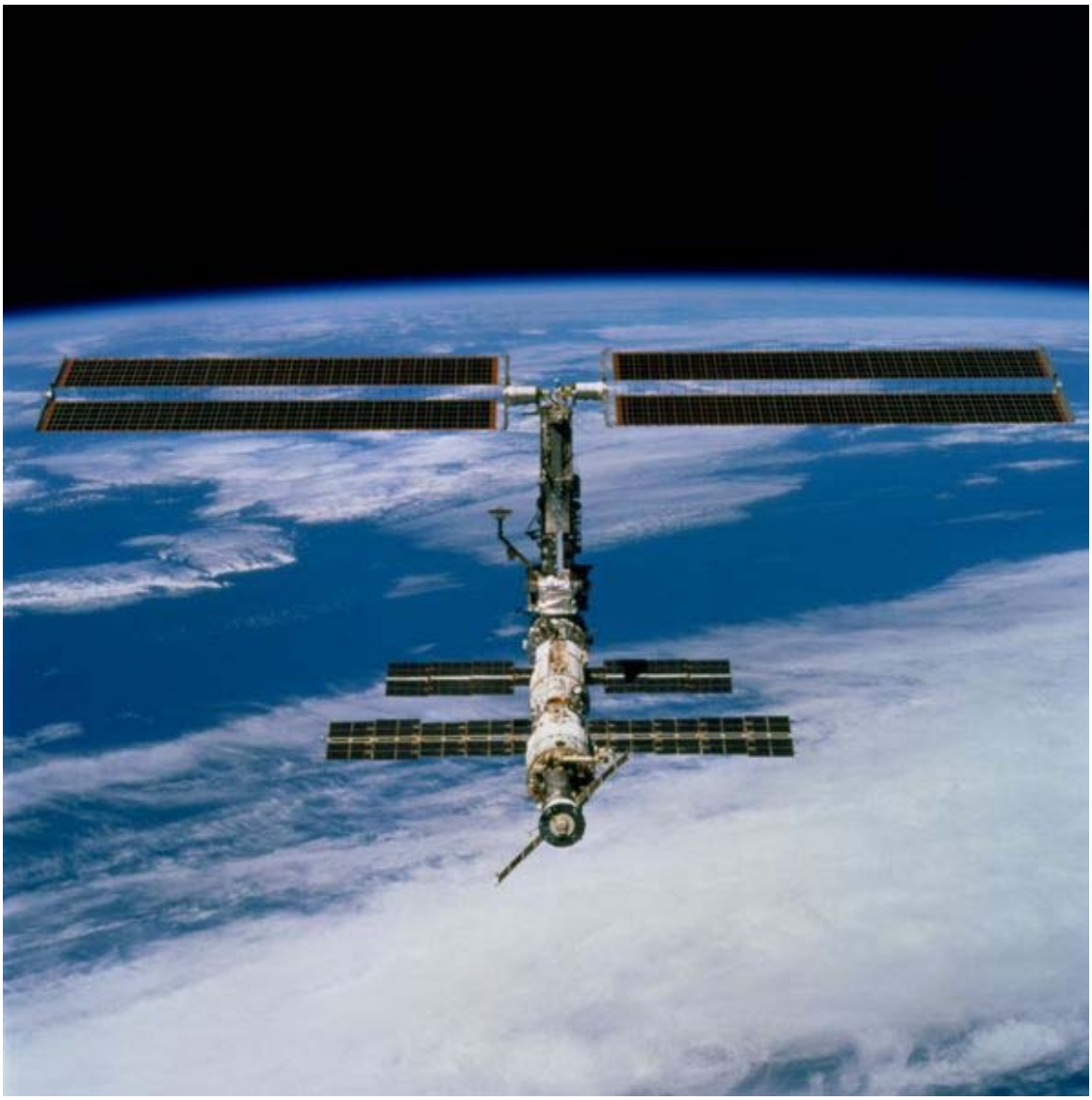
In their first weeks on board, the Expedition 1 crew members activated critical life support systems and computer control, as well as unpacked supplies left behind for them by previous supply missions. At this time the station did not have enough electricity to heat all three pressurized modules, so *Unity* was left unused and unheated. *Unity* had been used for the past two years to allow U.S. flight controllers to command ISS systems and read station system data.

The Russian unmanned resupply spacecraft Progress M1-4 docked to the station on 18 November. The Progress spacecraft's automatic docking system failed, necessitating a

manual docking controlled by Gidzenko using the TORU docking system. Although manual dockings are routine, they have caused some concern among flight controllers since an attempt in 1997 which resulted in the spacecraft colliding with *Mir*, causing significant damage.

The astronauts had a heavy workload in the first month, as Shepherd told reporters in a space-to-ground interview: "To me, the biggest challenge is trying to pack 30 hours into an 18-hour work day." Some of the early tasks took longer than scheduled. For example, the activation of a food warmer in Zvezda's galley was scheduled for 30 minutes, but it took the astronauts a day and a half to turn it on.

STS-97



The ISS, taken from *Endeavour* on 9 December 2000 shortly after undocking. The new solar arrays are visible at the top.

Endeavour docked with the ISS on 2 December 2000, on mission STS-97, bringing four more Americans and a Canadian temporarily to the station. The shuttle also brought the first pair of U.S. provided photovoltaic arrays, which would provide crucial electricity for further development of the station. In total, STS-97 brought 17 tons of equipment to the ISS, which also included expandable metal girders, batteries, electronics and cooling equipment.

Three spacewalks were conducted by the crew of STS-97, all of which were completed prior to opening the hatch between shuttle and station. On 8 December, the hatch between the two was opened and the two crews greeted each other for the first time. It had remained closed to maintain their respective atmospheric pressures. The Expedition 1 crew took this opportunity to leave the station and tour the inside of the space shuttle, which was thought to be good for their psychological well-being.

Progress M1-4

Prior to *Endeavour* docking, the Russian resupply spacecraft Progress M1-4, which came to the station in mid-November, was undocked to make room for the space shuttle. This Progress spacecraft remained undocked for the duration of STS-97, parked in orbit about a mile away from the station. It docked manually again with the station on December 26 by Gidzenko, after *Endeavour* left. The automatic docking system for this Progress spacecraft had failed on the first docking in November. The crew spent much of the following week unloading the Progress spacecraft.

Christmas and New Years

On Christmas Day, the Expedition 1 crew were given the day off work. They opened presents delivered by *Endeavour* and the Progress supply ship. They also each took turns speaking to their families. In the following days they did several video downlinks, some with Russian TV stations. The crew had a quiet New Years. Citing a Naval tradition, for the New Year's entry of the station's log, Shepherd provided a poem on behalf of the crew.

STS-98

Sergei K. Krikalev in the Zvezda module. *Atlantis* is shown outside the window, flying mission STS-98. (NASA)

On 9 February 2001, Space Shuttle *Atlantis* docked to the ISS, bringing the five American crew members of STS-98 temporarily to the station. The mission was originally planned for mid-January, but was delayed due to NASA's concerns about some cables on the shuttles. This mission brought the U.S. built Destiny laboratory, which has a mass of 16 short tons. It was installed with the use of the shuttle's robotic Canadarm, controlled by Marsha Ivins. Astronauts Thomas D. Jones and Robert L. Curbeam helped with the installation during a spacewalk. The *Destiny* module had a cost of US$1.4 billion, and would be used primarily for scientific research. During the spacewalk an ammonia coolant leak created a contamination scare, which happened when Curbean was hooking up coolant lines to *Destiny*. The other two spacewalks went ahead without any problems. While the Shuttle was docked, the control of the station's orientation was switched from propellants to electrically powered gyroscopes, which had been installed in September 2000. The gyroscopes had not been used earlier due to the lack of key navigational electronics.

By the end of STS-98, the crew of Expedition 1 had been on the station for over three months, and Shepherd stated that he was "ready to come home". NASA used several techniques to prevent the three crew members from suffering the effects of the "three-month wall" psychological barrier, which had caused depression in previous astronauts. For example they allowed more time for the crew to speak to their families via videophone, and they also encouraged them to watch movies and listen to music they like.

Progress M-44

On 28 February the third Progress spacecraft to visit the ISS, Progress M-44, docked to the Zvezda module. It brought air, food, rocket fuel and other equipment. It remained

docked until Expedition 2, when it was intentionally burnt up during atmospheric reentry, like all Progress spacecraft.

STS-102

Space Shuttle *Discovery* docked on 10 March 2001, bringing to the ISS the new long-duration three person crew of Expedition 2, as well as four short-term crew members of STS-102. A few hours after docking, the hatch opened, and all ten astronauts greeted each other, setting a new record for the number people simultaneously in the ISS. The day after docking, American astronauts Jim Voss and Susan Helms began a spacewalk which ended up being nearly nine hours long, and still holds the record for the longest spacewalk ever performed, as of August 2010. The length of the spacewalk was partially due to some mistakes, including Voss accidentally releasing a small tool. Unable to retrieve it, NASA engineers tracked the tool, and decided to use *Discovery'*s thrusters on 14 March to boost the station four kilometers higher, to ensure the ISS would not collide with the piece of space debris.

Transferring expedition crews

By 14 March, the expedition crews had completed the change over, but until the shuttle undocked, Shepherd officially remained commander of the station. The morning of the 14th the astronauts' wake-up call was the song "Should I Stay or Should I Go" by The Clash, at the request of Shepherd's wife. Shepherd, a former Navy SEAL, said during the change over ceremony: "May the good will, spirit and sense of mission we had enjoyed on board endure. Sail her well." The commander of *Discovery*, Jim Wetherbee, said ""For Captain Shepherd and his crew, we hold you in admiration as we prepare to bring you home. This has been an arduous duty for you. This ship was not built in a safe harbor. It was built on the high seas."

Undocking and landing

The crew's four and a half month tour aboard the ISS officially ended on 18 March 2001, when *Discovery* undocked. The Expedition 1 crew returned home to Earth on STS-102, landing on 21 March 2001, on a rare night landing at 2:30am local time. Two days after the landing, coincidentally, *Mir* was intentionally burned up during atmospheric reentry, ending its 15 years in orbit.

Daily activities

In a typical day, each crew member divided his time between physical exercise, station assembly and maintenance, experiments, communications with ground personnel, personal time, and bio-needs activities (such as rest and eating). The crew's daily schedule usually operated on UTC; for example, a typical morning had been scheduled to begin with an electronic wake-up tone at about 05:00 UTC. But during the expedition, a more typical wake-up time was actually between 06:00 and 07:00 UTC. The crew's sleep

habits were sometimes shifted to accommodate the schedules of visiting shuttles or resupply vehicles.

Following the wake-up call, the crew was given some time to clean up, have breakfast, and read e-mail which had been uplinked to them from flight controllers. Their work day included a lunch break at midday (UTC), and ended with a mid-afternoon planning session with flight controllers, regarding the next day's activities. Most days ended with some entertainment, with the crew watching all or part of a movie; this was thought to be good for crew bonding as well as their psychological well-being. After watching *2010*, the sequel to *2001: A Space Odyssey (film)*, Shepherd commented, "[There is] something strange about watching a movie about a space expedition when you're actually on a space expedition".

An important part of the crew's schedule was regular exercise. They had three pieces of equipment for this: a stationary bicycle, a treadmill (TVIS), and a resistance device (IRED) for weight-lifting. The bicycle malfunctioned in mid-December 2000, and wasn't fixed until March. The treadmill, which used bungee cords to keep the crew member in place, was designed to reduce the vibrations caused by running. A normal treadmill would have produced enough vibrations to shake the station, and potentially affect the sensitive science experiments on board. The treadmill malfunctioned near the end of February, but some in-flight maintenance fixed the problem within a week.

Ground communications


Yuri Gidzenko, in the *Zvezda* Service Module, communicates with ground controllers

Until the *Unity* module was available for use a month into the mission, the astronauts used the Russian VHF communications gear (also called the "Regul radio link") in *Zvezda* and the *Zarya* module to communicate with the Russian Mission Control Center (known as "TsUP") in Korolev, outside Moscow. The Russian techonology didn't have the use of satellites, so they were restricted to ground passes (called a "comm pass") which lasted for only 10–20 minutes. With the arrival of the solar arrays on STS-97, they activated the S-band Early Communication gear in the Unity Module, allowing for more continuous communication with Mission Control in Houston via NASA's network of Tracking and Data Relay Satellites.

During STS-106 in September 2000, the equipment for a ham radio was delivered to the station. The first ham radio contact with the ground made by the Expedition 1 crew was on 13 November on a pass over Moscow, shortly followed by contact with Goddard Space Flight Center in Maryland. The crew reported that voice quality was best with the ham radio, compared to any other form of ground communication.

The *Amateur Radio on the International Space Station* project had the crew of the station to make brief windows to radio contact with schools and clubs on the ground. The first school to be contacted by the ISS was Luther Burbank School in southwest Chicago. The contact had been planned for 19 December 2000, but due to technical problems, it was delayed to 21 December 2000. Due to the speed of the space station, the window of radio contact only lasted for 5–10 minutes, which was usually enough for 10 to 20 questions.

Science activities

Unlike subsequent expeditions, the crew of Expedition 1 had a somewhat modest amount of science experiments to conduct, due to the priority placed on station construction. The plasma crystal experiment, known as *PKE-Nefedov*, was one of the first natural science experiments conducted on the space station. It was a collaboration between the Max Planck Institute for Extraterrestrial Physics in Germany, and the Institute for High Energy Densities (part of the Russian Academy of Sciences).

On 23 January 2001 the crew photographed a plume of volcanic ash from Popocatépetl volcano, Mexico.

Like previous missions, the astronauts took many photos of Earth from the station, over 700 in total, which have been made freely available. These *Crew Earth Observations*, are intended to record dynamic events on the Earth's surface such as storms, fires, or volcanoes. For example, a photo from 1 January 2001 shows Mount Cleveland, Alaska, with a plume of smoke, prior to its eruption the following month. On 23 January 2001, the crew observed a unique perspective of a plume of volcanic ash coming from Popocatépetl, an active volcano 70 kilometres southeast of Mexico City.

An example of a low-maintenance experiment was the protein crystal growth experiment, which had also been flown on previous shuttle missions. The goal was to produce better protein crystallizations than those produced on the Earth, and hence allowing for a more accurate model of protein structures. Of the 23 proteins and viruses attempted during Expedition 1, only four resulted in successful crystallizations, which was a lower success rate than predicted. Of those successful was the low-calorie sweetener Thaumatin, whose crystals diffracted at a higher resolution than Earth-grown crystal, which resulted in a more accurate protein structure model.

Another research activity was measuring the crew's heart rates and the station's carbon dioxide levels to determine the effect of exercise on the station.

IMAX filming

Throughout the mission the Expedition 1 crew filmed footage for use in the IMAX documentary film, Space Station 3D. Highlights of the footage include the first entry into the *Destiny* module, during STS-98; the Expedition 1 crew showering and shaving in zero gravity; and the docking of STS-102, followed by the change over to the Expedition 2 crew.

Chapter- 2

Expedition 2

Expedition 2

Mission insignia

Call sign	*Expedition 2*
Number of crew	3
Launch	8 March 2001 11:42:09 UTC
Launch site	Kennedy Space Center
Launch craft	Discovery STS-102
Start	10 March 2001 (docking)
End	20 August 2001 (undocking)
Landing	22 August 2001 18:23 UTC

Landing craft	Discovery STS-105
Landing site	Kennedy Space Center
Duration	163 days, 8 hours, 13 minutes
EVA duration	18 h 40 min
Mission duration	167 days, 6 hours, 41 minutes
Number of orbits	2,635
Distance traveled	~111,152,720 kilometres (69,067,100 mi)
Mass	104,018 kilograms (229,320 lb)

L-R: James Voss, Yury Usachev, and Susan Helms

Previous expedition	Next expedition
Expedition 1	Expedition 3

Expedition 2 (also called **ISS EO-2**) was the second long-duration spaceflight aboard the International Space Station, immediately following Expedition 1. Its three person crew stayed aboard the station from March to August 2001. In addition to station maintenance, the crew assisted in several station assembly missions, welcomed the first space tourist Dennis Tito, and conducted some scientific experiments.

The crew consisted of one Russian, Commander Yury Usachev, and two American flight engineers Susan Helms and James Voss. The three had been to the station briefly in the previous year, during the 10-day mission STS-101 in May 2000.

The Expedition 2 crew was brought to the station aboard Space Shuttle *Discovery* during mission STS-102. The Expedition's increment began when *Discovery* undocked on 10 March 2001, bringing Expedition 1 to an end. In addition to the Space Shuttle flights which brought the crew to and from the station, there were two visiting Space Shuttle

missions and one Soyuz mission which docked with the ISS during Expedition Two. In August *Discovery* returned to rotate the long-duration crews again, bringing the crew of the next expedition. The Expedition 2 increment ended when *Discovery* undocked from the station on 20 August 2001.

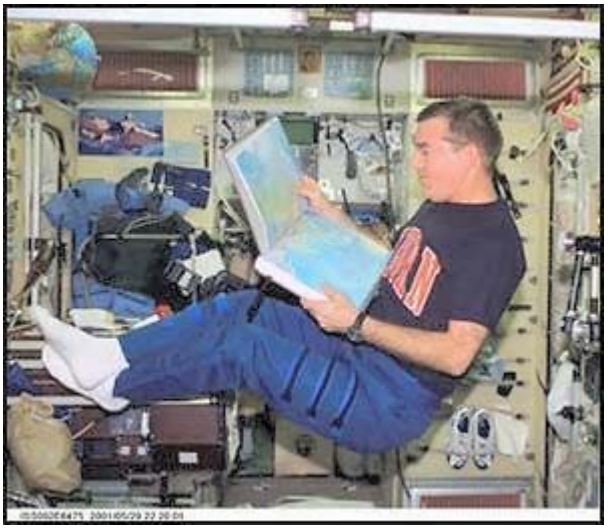
Crew

All three crew members had visited the International Space Station together in May 2000 aboard STS-101. In addition to this spaceflight, the Expedition 2 Commander Yuri Usachev also had two other spaceflights, both of which were long-duration missions aboard *Mir* (EO-15 and EO-21).

In addition to STS-101, flight engineer Susan Helms had three other spaceflights, all of which were Space Shuttle missions (STS-54, STS-64, STS-78). James Voss also had three other spaceflights, all of which were Space Shuttle missions (STS-44, STS-53, STS-69).

Position	Astronaut
Commander	Yury Usachev, RSA Fourth spaceflight
Flight Engineer 1	Susan Helms, NASA Fifth spaceflight
Flight Engineer 2	James Voss, NASA Fifth spaceflight

Mission highlights



James S. Voss, Expedition Two flight engineer, looks over an atlas in the Zvezda Service Module. (NASA)

Expedition 2, the second long-term crew for the International Space Station arrived in March 2001. They returned to Earth on mission STS-105, 22 August 2001 after having spent 163 days aboard the station and 167 days in space. Only Voss performed a spacewalk on STS-101, along with Jeffrey Williams.

During this expedition, research facilities launched to the Space Station included a Human Research Facility, two EXPRESS (Expedite the Processing of Experiments to the Space Station) Racks, one of which contains the Active Rack Isolation System and the Payload Equipment Restraint System. They also prepared the Destiny laboratory to enable upcoming experiments to be conducted.

A major focus was on gaining a better understanding of how to protect crew members from radiation while working and living in space. Radiation exposure in high doses over long periods of time can damage human cells and cause cancer or injury to the central nervous system.

Launch and docking

The three-member Expedition 2 crew successfully launched on 8 March 2001 on Space Shuttle *Discovery* during mission STS-102. They docked with the International Space Station on 10 March, but their the Expedition 2 increment didn't begin until the previous crew undocked from the station on 18 March.

STS-100

The first visitors to the station during Expedition 2 was the crew of STS-100, when they docked Space Shuttle *Endeavour* with the ISS on 21 April 2001. They spent eight days docked to the station. The primary objective of this mission was to deliver and install the Canadarm2 on the ISS, which is a robotic arm similar to the Canadarm which is used on some Space Shuttle flights. A later mission in 2002, STS-111, would deliver a movable base platform which would allow the Canadarm2 to have a larger range.

ISS EP-1

The day after the Space Shuttle undocked, the Russian spacecraft Soyuz TM-32 docked to the station, carrying two cosmonauts with previous spaceflight experience, as well as Dennis Tito, the first ever space tourist. This 8 day mission is sometimes referred to as *ISS EP-1*, *ISS-2S*, *Soyuz 2 Taxi Flight*, or simply by its launching spacecraft *Soyuz TM-32*. The Commander of this visiting mission was Kazakh cosmonaut Talgat Musabayev, who had previously been on two long-duration missions aboard the space station *Mir* in the 1990's. The other crew member of ISS EP-1 was Yuri Baturin, who had one other spaceflight, Mir EP-4, which was a visiting mission to *Mir* launched with the spacecraft Soyuz TM-28. Baturin's first mission occurred during the long-duration mission Mir EO-

25, so he and Musabayev had already been in space together prior to ISS EP-1; in fact both were landed with the spacecraft Soyuz TM-27 in August 1998.

STS-104

In July, Space Shuttle *Atlantis* docked with the station for an eight-day visit as a part of STS-104. The main objective of this mission was to install the Quest Joint Airlock onto the station.

The STS-104 crew performed 3 spacewalks.

First spacewalk; Joint Airlock Installation

The first spacewalk occurred on July 15, and focused on installation of the Quest Joint Airlock. The spacewalkers helped as Susan Helms, using the station's robotic arm, lifted the new station airlock from Atlantis' payload bay and moved it to the station's Unity module. During much of the 5 hour, 59 minute spacewalk, Jim Reilly worked from a foot platform attached to the end of the shuttle's robotic arm, operated by Janet Kavandi. After the spacewalk, crew members inside the Station attached connections to the airlock to prevent thermal damage.

Second spacewalk

The second spacewalk which happened on July 18, lasted 6 hours, 29 minutes. The internal hatches between the shuttle and station were closed at the end of Flight Day 6 so Atlantis' cabin pressure could be lowered in preparation for the second spacewalk. The major objective was to attach and connect an oxygen and a nitrogen tank. Susan Helms operated the station arm to lift the tanks from the shuttle's payload bay and maneuver them to the new airlock. At the airlock, Mike Gernhardt and Jim Reilly latched the tanks in place and connected cables and hoses. The spacewalkers were able to get ahead of schedule and also install another oxygen tank, leaving only one tank to be connected on the third spacewalk.

Third spacewalk

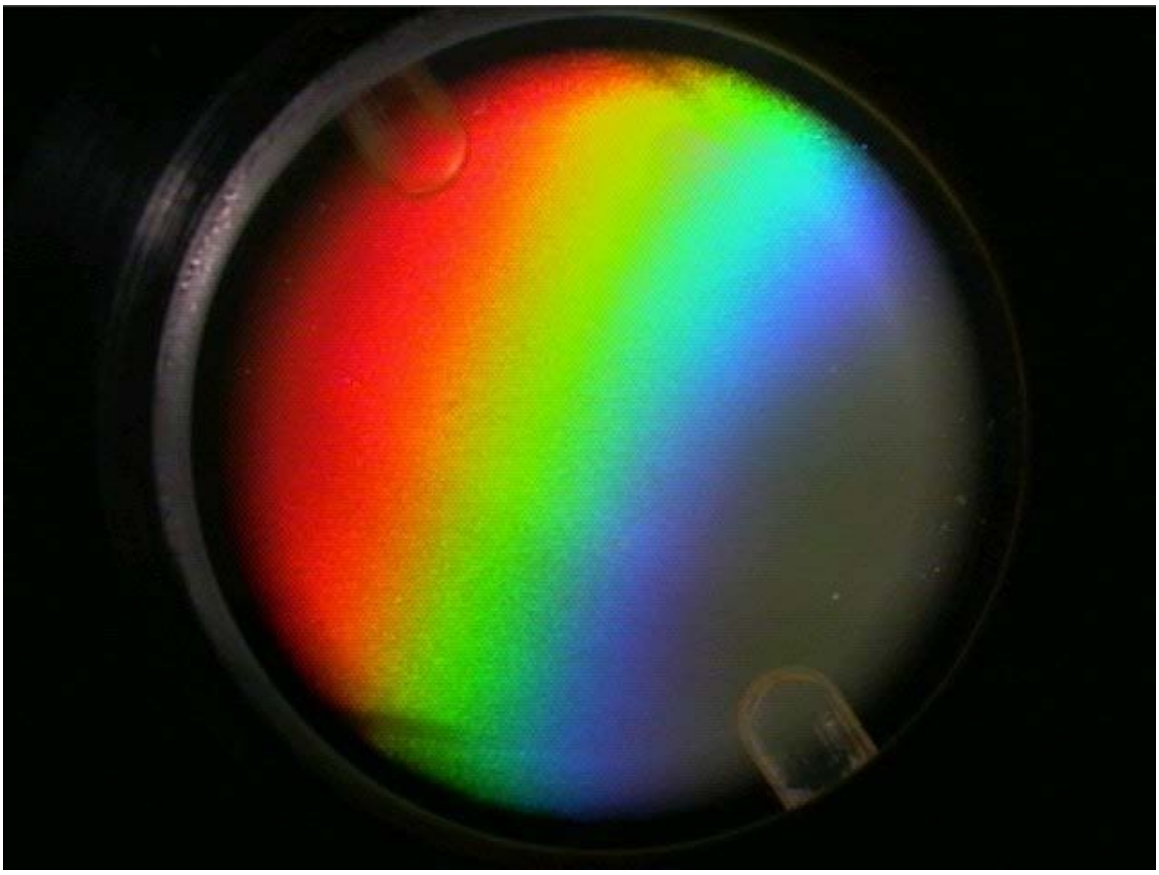
The third spacewalk, which occurred on July 21, was the first spacewalk based out of the new Quest Joint Airlock, and lasted 4 hours, 2 minutes. Primary objective was to install the final nitrogen tank outside the airlock. This spacewalk tested a new protocol developed by former commercial diver Mike Gernhardt: essentially exercising while breathing oxygen to purge nitrogen from the spacewalkers' bodies.

Undocking and landing

In August, Space Shuttle *Discovery* returned to the station during the mission STS-105, which carried the three Expedition 2 crew members back down to Earth. They undocked from the station on 20 August 2001, marking the end of the Expedition 2 increment.

Mission Patch

The International Space Station Expedition Two patch depicts the Space Station as it appeared during the time the second crew was on board. The Station flying over the Earth represents the overall reason for having a space station: to benefit the world through scientific research and international cooperation in space. The number 2 is for the second expedition and is enclosed in the Cyrillic MKS and Latin ISS which are the respective Russian and English abbreviations for the International Space Station. The United States and Russian flags show the nationalities of the crew indicating the joint nature of the program. When asked about the stars in the background, a crew spokesperson said they "...represent the thousands of space workers throughout the ISS partnership who have contributed to the successful construction of our International Space Station."



An early image in Experiment of Physics of Colloids in Space (EXPPCS), taken during Expedition 2. It shows the diffraction pattern of a colloidal crystal made from polymethyl methacrylate spheres index matched to the solvent

Science activities

Two science racks, known as EXPRESS Racks No. 1 and 2, were delivered to the station in April aboard STS-100. One of the experiments on EXPRESS Rank No. 2 was the

Experiment of Physics of Colloids in Space. Several different colloid mixtures were studied, and the analysis is still underway.

Chapter- 3

Expedition 3 & Expedition 4

Expedition 3

Expedition 3

Mission insignia

Call sign	*Expedition 3*
Number of crew	3
Launch	10 August 2001 21:10:15 UTC
Launch site	Kennedy Space Center
Launch craft	Discovery STS-105
Start	12 August 2001 18:41 UTC
End	15 December 2001 17:28 UTC
Landing	17 December 2001 17:56:13 UTC
Landing craft	Endeavour STS-108
Landing site	Kennedy Space Center

Duration	124 days, 22 hours, 47 minutes
EVA duration	17 hours 50 minutes
Mission duration	128 days, 20 hours, 45 minutes, 58 seconds
Number of orbits	2,020
Distance traveled	~85,860,485 km
Mass	104,018 kg

L-R: Mikhail Tyurin, Frank Culbertson, and Vladimir Dezhurov

Previous expedition	Next expedition
Expedition 2	Expedition 4

Expedition 3 was the third expedition to the International Space Station.

Crew

Position	Astronaut
Commander	Frank Culbertson, NASA Third spaceflight
Flight Engineer 1	Mikhail Tyurin, RSA First spaceflight
Flight Engineer 2	Vladimir Dezhurov, RSA Second spaceflight

Mission parameters

- **Perigee:** 384 kilometres (207 nmi)
- **Apogee:** 396 kilometres (214 nmi)
- **Inclination:** 51.6°
- **Period:** 92 min

Vladimir N. Dezhurov, Expedition Three flight engineer in the Unity node on the International Space Station. (NASA)

Mission objectives

Research in space begun by two previous crews aboard the International Space Station (ISS) expanded during the Expedition Three mission. The third resident crew launched on 10 August 2001 on Space Shuttle Discovery during mission STS-105 and took control of the complex on 13 August 2001. The crew conducted a science-intensive increment and completed four spacewalks. The Expedition Three crew ended their 117-day residency onboard the ISS on 8 December 2001 when their custom Soyuz seat-liners were transferred to Space Shuttle Endeavour for the return trip home during mission STS-108.

The Expedition Three crew of the International Space Station enjoyed a unique view of the 2001 Leonid meteor storm. "It looked like we were seeing UFOs approaching the earth flying in formation, three or four at a time," recalls astronaut Frank Culbertson. "There were hundreds per minute going beneath us, really spectacular!" News reports had warned sky watchers in advance: On 18 November 2001, Earth was due to plow through a minefield of debris shed by Comet Tempel-Tuttle. Innumerable bits of comet dust would become meteors when they hit Earth's atmosphere at 144,000 miles per hour (64,000 m/s). Experts predicted an unforgettable display ... and it came. Millions of people saw the show, but only three of them—the ones on board the space station—saw it

from above. "We had to look down to see the meteors," says Culbertson. "That's because the atmosphere (where comet dust burns up) is below the station."

An international crew of three were the third crew to live aboard the International Space Station. The team was led by American Commander Frank Culbertson, and joined by Russian crewmates Vladimir Dezhurov, mission pilot, and flight engineer Mikhail Tyurin. As a part of the STS-105 mission, *Discovery* delivered the Expedition 3 crew to the station. During their four-month stay, the crew saw the orbital complex expand and research work grow. The Expedition 3 crew returned home on mission STS-108.

Spacewalks

All four of the spacewalks during Expedition 3 were completed using the Russian Orlan spacesuit and from the Pirs air lock on the Russian segment of the International Space Station.

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
Expedition 3 EVA 1	Vladimir Dezhurov Mikhail Tyurin	8 October 2001 14:23	8 October 2001 19:21	4 hours 58 minutes
	Dezhurov and Tyurin made connections between Pirs and the station's Zvezda Service Module. The spacewalkers installed a cable that will allow space walk radio communications between the two station sections. They also installed handrails on the new compartment. Then, they installed an exterior ladder that will be used to help spacewalkers leave Pirs' hatch. Tyurin and Dezhurov installed a Strela cargo crane onto the station.			
Expedition 3 EVA 2	Dezhurov Tyurin	15 October 2001 09:17	15 October 2001 15:09	5 hours 52 minutes
	Dezhurov and Tyurin installed Russian commercial experiments on the exterior of Pirs. Among the experiments is a set of investigations of how various materials react to the space environment over a long time. Called MPAC-SEEDS, the investigation is housed in three briefcase-sized containers.			
Expedition 3 EVA 3	Dezhurov Frank Culbertson	12 November 2001 21:41	13 November 2001 02:45	5 hours 4 minutes
	Dezhurov and Culbertson connected cables on the exterior of Pirs for the Kurs automated docking system. They completed checks of the Strela cargo crane, using one space walker at the end of the crane's boom to simulate a cargo. They also inspected and photographed a small panel of one solar array on the Zvezda Service Module that has one portion of a panel not fully unfolded.			
Expedition 3 EVA 4	Dezhurov Tyurin	3 December 2001 13:20	3 December 2001 16:06	2 hours 46 minutes
	Dezhurov and Tyurin removed an obstruction that prevented a Progress			

resupply ship from firmly docking with the International Space Station. They also took pictures of the debris, which was a rubber seal from the previous cargo ship, and of the docking interface.

Mission patch

The Expedition 3 mission patch depicts the book of space history, turning from the chapter with the Russian space station Mir and the space shuttle to the next chapter, one that will be written on the blank pages of the future by space explorers working for the benefit of the entire world. Above the book is a layout of what the station will look like when completed, docked with the space shuttle.

Expedition 4

Expedition 4

Mission insignia

Call sign	*Expedition 4*
Number of crew	3
Launch	5 December 2001 22:19:28 UTC
Launch site	Kennedy Space Center
Launch craft	Endeavour STS-108
Start	7 December 2001 20:03 UTC

End	15 June 2002 14:32
Landing	19 June 2002 09:57:41 UTC
Landing craft	Endeavour STS-111
Landing site	Edwards Air Force Base
Duration	190 days, 5 hours, 31 minutes
EVA duration	17 h 51 min
Mission duration	195 days, 11 hours, 38 minutes, 13 seconds
Number of orbits	3,068
Distance traveled	~130,454,690 km
Mass	119,438 kg

L-R: Daniel W. Bursch, Yuri I. Onufrienko, and Carl E. Walz

Previous expedition	Next expedition
Expedition 3	Expedition 5

Expedition 4 was the fourth expedition to the International Space Station.

Crew

Position	Astronaut
Commander	Yury Onufrienko, RSA Second spaceflight
Flight Engineer 1	Daniel W. Bursch, NASA

	Fourth spaceflight
Flight Engineer 2	Carl E. Walz, NASA Fourth spaceflight

Mission parameters

- **Perigee:** 384 km
- **Apogee:** 396 km
- **Inclination:** 51.6°
- **Period:** 92 min

ISS as seen from Shuttle Endeavour during Expedition Four. (NASA)

Mission objectives

The International Space Station expanded its science investigations, almost doubling the previous amount of experiments performed during the Expedition Four mission. The fourth resident crew launched on 5 December 2001 on board Space Shuttle Endeavour during mission STS-108. They became official station residents at 20:03 UTC on 7 December 2001, and remained on board until June 2002, when they landed on STS-111.

An international crew of three were the fourth crew to live aboard the International Space Station. The team was led by Russian Yuri I. Onufrienko and joined by American crewmates Daniel W. Bursch and Carl E. Walz, both flight engineers. As a part of the STS-108 mission, Endeavour delivered the Expedition 4 crew to the station. They returned to Earth 19 June 2002, aboard Space Shuttle Endeavour following the STS-111 mission.

Spacewalks

The Expedition Four crew conducted three spacewalks during its stay on board the International Space Station. The crew spent a total of 17 hours and 51 minutes outside the station. These spacewalks brought the total up to 34—nine station-based and 25 shuttle-based—that have been conducted at the station for total of 208 hours and 5 minutes.

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
Expedition 4 EVA 1	Yury Onufrienko Carl Walz	14 January 2002 20:59	15 January 2002 03:02	6 hours 3 minutes
	Onufrienko and Walz relocated the cargo boom for the Russian Strela crane. They moved the boom from Pressurized Mating Adapter 1 to the exterior of the Pirs Docking Compartment. The crew also installed an amateur radio antenna onto the end of the Zvezda Service Module. The space walk was based out of the Pirs Airlock and used Russian Orlan space suits.			
Expedition 4 EVA 2	Onufrienko Daniel Bursch	25 January 2002 15:19	25 January 2002 21:18	5 hours 59 minutes
	During Expedition Four's second spacewalk, Onufrienko and Bursch installed six deflector shields for the Zvezda Service Module's jet thrusters. Also, they installed an amateur radio antenna, attached four science experiments, and retrieved and replaced a device to measure material from the thrusters. Like the first EVA, this one was based out of Pirs, and the spacewalkers used Orlan suits.			
Expedition 4 EVA 3	Walz Bursch	20 February 2002 15:19	20 February 2002 17:25	5 hours 49 minutes
	This spacewalk was based out of the Quest Airlock, using U.S. spacesuits. Walz and Bursch tested the airlock and prepared for the four spacewalks that were to be performed during STS-110 in April. The STS-110 crew were to install the S0 Truss onto the station. This spacewalk was the first spacewalk to be based out of Quest without a space shuttle at the station.			

Chapter- 4

Expedition 5 & Expedition 6

Expedition 5

Expedition 5

Mission insignia

Call sign	*Expedition 5*
Number of crew	3
Launch	5 June 2002 21:22:49 UTC
Launch site	Kennedy Space Center
Launch craft	Endeavour STS-111
Start	7 June 2002 16:25 UTC

End	2 December 2002 20:05 UTC
Landing	7 December 2002 19:37:12 UTC
Landing craft	Endeavour STS-113
Landing site	Kennedy Space Center
Duration	178 days, 3 hours, 40 minutes
EVA duration	9 hours 46 minutes
Mission duration	184 days, 22 hours, 14 minutes and 23 seconds
Number of orbits	2,895
Distance traveled	~123,133,253 km
Mass	144,634 kg

L-R: Valery G. Korzun, Peggy Whitson, and Sergei Y. Treshchev

Previous expedition	Next expedition
Expedition 4	Expedition 6

Expedition 5 was the fifth expedition to the International Space Station.

Crew

Position	Astronaut
Commander	Valery Korzun, RSA Second spaceflight

Flight Engineer 1	Peggy Whitson, NASA First spaceflight
Flight Engineer 2	Sergei Treshchev, RSA First spaceflight

Mission parameters

- **Perigee:** 384 km
- **Apogee:** 396 km
- **Inclination:** 51.6°
- **Period:** 92 min

Peggy A. Whitson, Expedition Five flight engineer, wears a Russian Orlan spacesuit as she prepares for an EVA. (NASA)

Mission objectives

The Expedition Five crew took charge of ISS operations on 7 June 2002. An official ceremony between Expedition crews took place 10 June, with the ceremonial ringing of the station's brass bell, symbolizing the transfer of command. The Expedition Five crew carried out approximately 25 new investigations onboard the ISS, as well as continued with various science investigations begun before their stay. The crew wrapped up a 185-day stay in space when they returned home on **STS-113** 7 December 2002.

Space Shuttle Endeavour delivered the Expedition 5 crew during mission **STS-111** which launched 5 June 2002. The fifth crew to live aboard the International Space Station was led by Russian Valery Korzun and joined by fellow Cosmonaut Sergei Treshchev and U.S. Astronaut Peggy A. Whitson, both flight engineers. While onboard, Dr. Whitson was named NASA's first ISS Science Officer by NASA Administrator O'Keefe.

Spacewalks

The Expedition Five crewmembers conducted two spacewalks during their stay at the International Space Station. Both were based out of the Pirs Docking Compartment and used Russian Orlan space suits.

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
Expedition 5 EVA 1	Valery Korzun Peggy Whitson	16 August 2002 09:23	16 August 2002 13:48	4 hours, 25 minutes
	Korzun and Whitson installed six debris panels onto the Zvezda Service Module. They removed the panels from their temporary location on the station's Pressurized Mating Adapter 1 prior to attachment to Zvezda. The panels are designed to shield Zvezda from potential space debris impacts. A total of 23 shields will eventually be installed onto the Service Module.			
Expedition 5 EVA 2	Korzun Sergei Treshchev	26 August 2002 05:27	26 August 2002 10:48	5 hours, 21 minutes
	During Expedition Five's second spacewalk, Korzun and Treshchev installed a frame on the outside of the Zarya Module to house components for future spacewalk assembly tasks. They installed new material samples on a pair of Japanese Space Agency materials exposure experiments housed on the outside of Zvezda. Korzun and Treshchev also installed devices on Zvezda that will simplify the routing of tethers during future assembly spacewalks. They improved future station amateur radio operations by adding two ham radio antennas on Zvezda. Also, Korzun and Treshchev installed the Kromka hardware that was originally slated to take place during Expedition Five's first spacewalk. Kromka measures residue emissions from Zvezda's jet thrusters.			

Expedition 6

Expedition 6

Mission insignia

Call sign	*Expedition 6*
Number of crew	3
Launch	24 November 2002 00:49:47 UTC
Launch site	Kennedy Space Center
Launch craft	Endeavour STS-113
Start	25 November 2002 21:59 UTC
End	3 May 2003 22:43 UTC
Landing	4 May 2003 02:04:25 UTC
Landing craft	Soyuz TMA-1
Landing site	Arkalyk, Kazakhstan,
Duration	159 days, 0 hours, 44 minutes
EVA duration	13 hours 17 minutes
Mission duration	161 days, 1 hour, 14 minutes, 38 seconds
Number of orbits	2,536
Distance traveled	~107,824,795 km
Mass	187,016 kg

L-R: Donald Pettit , Ken Bowersox and Nikolai Budarin

Previous expedition	Next expedition
Expedition 5	Expedition 7

Expedition 6 was the sixth expedition to the International Space Station. It was the last three man crew to reside on the station until the arrival of STS-114. The crew performed

two spacewalks in support of maintenance and assembly of the International Space Station.

Crew

Position	Astronaut
Commander	Kenneth Bowersox, NASA Fifth spaceflight
Flight Engineer 1	Nikolai Budarin, RSA Third spaceflight
Flight Engineer 2	Donald Pettit, NASA First spaceflight

Mission parameters

- **Perigee:** 384 km
- **Apogee:** 396 km
- **Inclination:** 51.6°
- **Period:** 92 min

Mission objectives

The Station's sixth crew was launched to the Station aboard Space Shuttle Endeavour STS-113 in November 2002. The mission was expected to be a four-month mission that was to end in March 2003 when *Atlantis* STS-114 was to fly to the Station with the Expedition 7 crew. The Columbia disaster changed plans and the crew stayed on the station until May 2003. They returned to earth on **Soyuz TMA-1** and a reduced Expedition 7 crew with just two members was delivered to the ISS on Soyuz TMA-2. The Space Shuttle was expected to be grounded for up to two years. Ongoing logistical support for the ISS would have to be carried out by Soyuz and Progress flights until the Space Shuttle returned to flight.

The sixth crew of the International Space Station returned to Earth just after 10 p.m. EDT on 3 May 2003 the first time U.S. astronauts have landed in a Russian Soyuz spacecraft, though a U.S. space tourist, Dennis Tito, did so in 2001.

Russian Mission Control reported at approximately 2:45 a.m. 4 May that the support helicopters reached the crew and all three astronauts were in good health. The capsule appeared to touch down about 276 miles (444 km) from its planned landing zone.

Originally scheduled to fly on the Expedition 6 Crew in place of Don Pettit was Donald A. Thomas.

Spacewalks

The Expedition Six crew conducted two spacewalks during its stay at the International Space Station. Both were based out of the Quest Airlock, and the spacewalkers used U.S. spacesuits, which are called Extravehicular Mobility Units, or EMUs. The crew was originally scheduled to conduct only one spacewalk, but a second was added to the manifest for 8 April in order to prepare for future assembly missions.

The two Expedition Six extravehicular activities bring the total number of spacewalks conducted in support of ISS assembly and maintenance to 51. Of those 51 EVA's, Twenty-six have been based out of the station, with 17 staged from Quest. Bowersox and Pettit accumulated 13 hours and 17 minutes of spacewalking time at the station.

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
Expedition 6 EVA 1	Ken Bowersox Don Pettit	15 January 2003 12:50	15 January 2003 19:41	6 hours, 51 minutes
	Bowersox and Pettit continued outfitting and activating the International Space Station's newest component, the P1 (P-One) Truss. The P1's radiator assembly was a major focus during the spacewalk. Bowersox and Pettit released the remaining launch locks on the radiator assembly, which allowed the radiator assembly to be deployed. Other scheduled tasks completed included removing some debris that was on a sealing ring on the Unity Module's Earth-facing docking port, and they tested an ammonia reservoir on the station's P6 Truss. They were unable to complete one scheduled task—the installation of a light fixture on one of the station's Crew and Equipment Translation Aid, or CETA, carts. The fixture's attachment was rescheduled for a future spacewalk. To complete the spacewalk, Bowersox and Pettit cut away a thermal cover strap that apparently interfered with the rotation of the Quest Airlock's hatch and delayed the start of the extravehicular activity.			
Expedition 6 EVA 2	Bowersox Pettit	8 April 2003 12:40	8 April 2003 19:06	6 hours, 26 minutes
	Bowersox and Pettit reconfigured cables on the S0 (S-Zero), S1 and P1 Trusses for future Integrated Truss Structure component deliveries and replaced a Power Control Module on the Mobile Transporter. They provided Control Moment Gyro No. 2 with a redundant power channel capability by rerouting cables. Then, they installed Spool Positioning Devices on Destiny Laboratory heat exchangers and reinstalled a thermal cover on an S1 Radiator Beam Valve Module. Bowersox and Pettit also unfurled a light stanchion on the CETA cart that did not unfurl properly during their first spacewalk.			

Cultural references

Expedition 6 is the subject of the book *Too Far From Home: A Story of Life and Death in Space*, by Chris Jones.

A dramatised account of Expedition 6 is told in *Expedition 6*, a play by actor/playwright Bill Pullman. The play was scheduled to run at San Francisco's Magic Theater through 7 October 2007.

Chapter- 5

Expedition 7 & Expedition 8

Expedition 7

Expedition 7

Mission insignia

Call sign	*Expedition 7*
Number of crew	2
Launch	26 April 2003 03:53:52 UTC
Launch site	Baikonur Cosmodrome
Launch craft	Soyuz TMA-2
Start	28 April 2003 05:56:20 UTC

End	27 October 2003 22:17:09 UTC
Landing	28 October 2003 02:40:20 UTC
Landing craft	Soyuz TMA-2
Landing site	near Arkalyk
Duration	182 days, 16 hours, 20 minutes, 49 seconds
EVA duration	None
Mission duration	184 days, 22 hours, 46 minutes, 28 seconds
Number of orbits	2,895
Distance traveled	~123,133,253 km
Mass	187,016 kg

L-R: Yuri Malenchenko and Ed Lu

Previous expedition	Next expedition
Expedition 6	Expedition 8

Expedition 7 was the seventh expedition to the International Space Station.

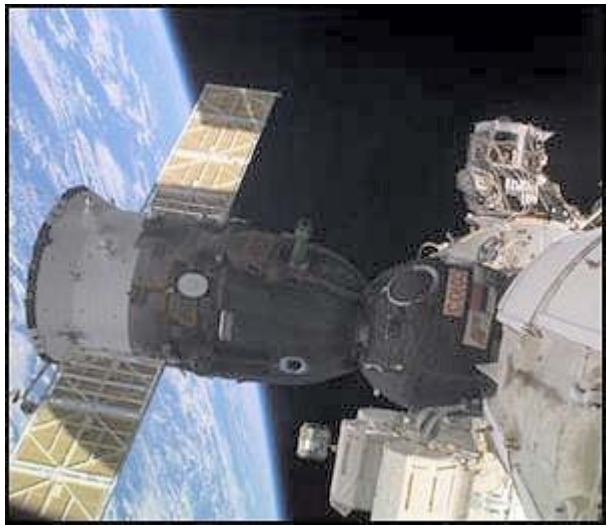
Crew

Position	Astronaut

Commander	Yuri Malenchenko, RSA Third spaceflight
Flight Engineer 1	Ed Lu, NASA Third spaceflight

Mission parameters

- **Perigee:** 384 km
- **Apogee:** 396 km
- **Inclination:** 51.6°
- **Period:** 92 min



Soyuz TMA-2 spacecraft, docked to the functional cargo block (FGB) nadir port on the International Space Station. (NASA)

Mission objectives

The seventh crew of the International Space Station lifted off in **Soyuz TMA-2** from the Russian Space Agency's Baikonur Cosmodrome in Kazakhstan on 25 April 2003, at 05:56:20 UTC. The Soyuz docked on 28 April 2003 and took over command of the ISS. The Expedition Seven crew—along with European Space Agency Astronaut Pedro Duque -- landed back on Earth on 27 October 2003 at Kazakhstan at 02:41:20 UTC, after undocking from the International Space Station in their Soyuz spacecraft at 23:17 UTC.

From Houston, ISS Spacecraft Communicator Mike Fossum informed Expedition 7 Commander Yuri Malenchenko and Science Officer Edward Lu on 15 October 2003 of the successful launch of the Long March rocket carrying the Shenzhou 5 spacecraft and Chinese astronaut Yáng Lìwěi. "It's really some exciting news to share. The world's spacefaring nations have been joined by a new member tonight: China."

"First off, we want to congratulate them," Lu replied. "The more people that go into space, the better off we all are. This is a great achievement and good for everyone in the long run."

In Chinese, he later added, "Welcome to space. Have a safe journey."

"I would also like to say I love to have somebody else in space instead of me and Ed," said Malenchenko. "I also know this is great for thousands and thousands of people from China. I congratulate all of them."

Malenchenko and Lu were previously crewmates on the STS-106 shuttle mission and did a spacewalk together during that flight.

Expedition 8

Expedition 8

Mission insignia

Call sign	*Expedition 8*
Number of crew	2
Launch	18 October 2003 05:38:03 UTC
Launch site	Baikonur Cosmodrome
Launch craft	Soyuz TMA-3
Start	20 October 2003 07:15:58 UTC
End	29 April 2004 20:52:09 UTC
Landing	30 April 2004 00:11:15 UTC

Landing craft	Soyuz TMA-3
Landing site	near Arkalyk
Duration	192 days, 13 hours, 36 minutes and 11 seconds
EVA duration	3 hours 55 minutes
Mission duration	194 days, 18 hours, 33 minutes, 12 seconds
Number of orbits	~3,036
Distance traveled	~129,123,519 km
Mass	187,016 kg

L-R: Alexandr Kaleri and Michael Foale

Previous expedition	Next expedition
Expedition 7	Expedition 9

Expedition 8 was the eighth expedition to the International Space Station.

Crew

Position	Astronaut
Commander	Michael Foale, NASA Sixth spaceflight
Flight Engineer 1	Aleksandr Kaleri, RSA

Fourth spaceflight

Mission parameters

- **Perigee:** 384 km
- **Apogee:** 396 km
- **Inclination:** 51.6°
- **Period:** 92 min

- **Docked**: 20 October 2003 - 07:15:58 UTC
- **Undocked**: 29 April 2004 - 20:52:09 UTC
- **Time Docked**: 192 days, 13 h, 36 min, 11 s

Foale and Kaleri conduct a teleconference with Moscow as part of the Russian New Year celebration.(NASA)

Mission objectives

Expedition 8 Commander and NASA Station Science Officer Michael Foale, Flight Engineer Alexander Kaleri and ESA Astronaut Pedro Duque docked the **Soyuz TMA-3** with the International Space Station at 07:15:58 UTC on 20 October 2003. At the time of docking, both spacecraft orbited the Earth above Russia.

Once the Expedition 7 crew undocked, Foale and Kaleri settled down to work, beginning a more than six-month stint focused on Station operations and maintenance.

The new Station crew, along with Duque, launched from the Baikonur Cosmodrome in Kazakhstan at 05:38:03 UTC, on 18 October 2003.

Spacewalks

The Expedition 8 crew conducted the first two-person spacewalk at the International Space Station. Unlike previous spacewalks conducted by ISS crews, there was not a crewmember inside the Station as the spacewalkers worked outside. The spacewalk was based out of the Pirs docking compartment; the spacewalkers wore Russian Orlan space suits.

This was the 52nd spacewalk devoted to Space Station assembly, operations and maintenance, bringing the cumulative total to 322 hours and 32 minutes. It was the 27th based out of the Station, bringing the total to 155 hours and 17 minutes.

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
Expedition 8 EVA 1	Michael Foale Alexander Kaleri	26 February 2004 21:17	27 February 2004 01:12	3 hours, 55 minutes
	This spacewalk was cut short due a cooling system malfunction in Kaleri's spacesuit. Although the spacewalk ended early, Foale and Kaleri were able to complete a number of their tasks. The first task was the replacement of cassette containers that hold sample materials for an experiment studying the effect of long-duration exposure to the microgravity environment. Later, Foale replaced two similar cassettes housed on the outside of the Zvezda Service Module. A Russian experiment named Matryoshka was attached to the outer hull of Zvezda which will provide data on radiation exposure to the human body during space flight. The spacewalkers also removed one of the suitcase-sized devices associated with the Japanese Aerospace Exploration Agency's MPAC-SEEDS experiment. They relocated a second device. This experiment was studying micro-meteor impacts and material exposure in the space environment. This experiment was installed on the ISS by Expedition 3 spacewalkers 15 October 2001. The crew was not able to complete the removal of laser light retroreflector devices from the aft end of Zvezda. The reflectors were being studied as navigation devices for the European Space Agency's Automated Transfer Vehicle, which first flew to the ISS in 2008. Another task not included was work on a materials science experiment called Kromka. This experiment measured the amount of residue emitted from Zvezda's jet thruster firings. Foale and Kaleri departed the station for earth aboard the Soyuz TMA-3 spacecraft on 29 April 2004 along with ESA Astronaut André Kuipers, who had arrived with the Expedition 9 crew aboard Soyuz TMA-4 nine days earlier.			

Chapter- 6

Expedition 9 & Expedition 10

Expedition 9

Expedition 9

Mission insignia

Call sign	*Expedition 9*
Number of crew	2
Launch	18 April 2004 03:19:00 UTC
Launch site	Baikonur Cosmodrome
Launch craft	Soyuz TMA-4

Start	21 April 2004 05:01 UTC
End	23 October 2004 20:08 UTC
Landing	24 October 2004 00:35:00 UTC
Landing craft	Soyuz TMA-4
Landing site	90km north of Arkalyk
Duration	185 days, 15 hours, 7 minutes
EVA duration	15 h 45 min
Mission duration	187 days, 21 hours, 16 minutes
Number of orbits	2,940
Distance traveled	~121,802,083 km
Mass	187,016 kg

L-R: Edward Fincke and Gennady Padalka

Previous expedition	Next expedition
Expedition 8	Expedition 10

Expedition 9 (2004) was the 9th expedition to the International Space Station.

Crew

Position	Astronaut
Commander	Gennady Padalka, RSA Second spaceflight
Flight Engineer 1	Michael Fincke, NASA First spaceflight

Mission parameters

- **Perigee:** 384 km
- **Apogee:** 396 km
- **Inclination:** 51.6°
- **Period:** 92 min

Edward M. (Mike) Fincke, Expedition 9 NASA ISS science officer and flight engineer, is pictured near fresh fruit floating freely in the Zvezda Service Module of the International Space Station. (NASA)

Mission objectives

Padalka and Fincke arrived at the Station on 21 April 2004 aboard the **Soyuz TMA-4** spacecraft with European Space Agency (ESA) Astronaut André Kuipers. After more than a week of joint operations and handover activities, Padalka and Fincke officially took command of the Station on 29 April when Expedition 8 Commander Michael Foale and Flight Engineer Alexander Kaleri left the Station. This mission was the site for the Advanced Diagnostic Ultrasound in Microgravity Project.

Expedition 8 and Kuipers returned to Earth that same day aboard the Soyuz TMA-3 spacecraft. Kuipers' 11-day mission to the ISS was part of a commercial agreement between ESA and the Federal Space Agency of Russia.

Spacewalks

The Expedition 9 crew conducted four spacewalks during its stay at the International Space Station. The four spacewalks were devoted to ISS maintenance and assembly. All four were based out of the Pirs Docking Compartment and used Russian Orlan spacesuits.

Before these four extravehicular activities (EVAs), 52 spacewalks had been performed at the ISS, with 27 based out of the Station.

EVA cosmonauts and astronauts and suit ID

Gennady Padalka (EV1): red stripes Mike Fincke (EV2): blue stripes

Spacewalk 1 Gennady Padalka, Mike Fincke Time: 14 minutes, 22 seconds Start time: 4:56 p.m. CDT (2156 GMT) 24 June 2004 End time: 5:10 p.m. CDT (2210 GMT) 24 June 2004

The spacewalk was cut short due to a pressure problem in Fincke's prime oxygen tank in his spacesuit. Mission managers decided to reschedule the spacewalk for 30 June.

Spacewalk 2 Gennady Padalka, Mike Fincke Time: 5 hours, 40 minutes Start time: 4:19 p.m. CDT (2119 GMT) 29 June 2004 End time: 9:59 p.m. CDT 29 June 2004 (0259 GMT 30 June 2004)

Padalka and Fincke replaced a Remote Power Controller (RPCM) that failed in late April, causing a loss of power in Control Moment Gyroscope No. 2 (CMG 2). A failed Remote Power Controller Module was responsible for the temporary loss of CMG 2 in April. The gyroscope is one of four that control the ISS' orientation.

Spacewalk 3 Gennady Padalka, Mike Fincke Time: 4 hours, 30 minutes Start time: 1:58 a.m. CDT (0658 GMT) 3 August 2004 End time: 6:28 a.m. CDT (1128 GMT) 3 August 2004

In preparation for the arrival of the European Space Agency's Automated Transfer Vehicle (ATV), Padalka and Fincke removed laser retro reflectors from the Zvezda Service Module assembly compartment and installed three updated laser retro reflectors and one internal videometer target. They installed two antennas.

The spacewalkers removed Kromka Panel No. 2 and installed Kromka Panel No. 3. The Kromka experiment exposes various materials to the space environment. They also replaced another materials science experiment.

Spacewalk 4 Gennady Padalka, Mike Fincke Time: 5 hours, 20 minutes Start time: 16:43 UTC, 3 September 2004 End time: 22:04 UTC, 3 September 2004

Expedition 9's fourth scheduled EVA prepared the Station for future assembly operations and the arrival of the ATV. The spacewalkers replaced the Zarya Control Module flow control panel and installed four safety tether fairleads on Zarya's handrails.

ATV support operations included installing equipment for the air-to-air radio link antennas and removing all covers from antennas.

Other tasks included installing a Pressure Control and Exposure Monitor Sensor on Pirs and installing protective components on the brackets of Pirs' ring handrails on EVA Hatch No. 2.

Mission patch

The design of the Expedition 9 mission patch includes a tribute to astronauts and cosmonauts who gave their lives in space exploration. The outspread wings of the eagle have 16 stars and 1 star of David. They represent the Apollo 1 crew Virgil Ivan "Gus" Grissom, Ed White and Roger Chaffee. Space Shuttle Challenger STS-51L crew Francis "Dick" Scobee, Michael J. Smith, Ronald McNair, Ellison Onizuka, Gregory Jarvis, Judith Resnick and Christa McAuliffe. Space Shuttle Columbia STS-107 crew Rick D. Husband, William C. McCool, David M. Brown, Kalpana Chawla, Michael P. Anderson, Laurel Clark and Ilan Ramon, the first Israeli astronaut. Around the eagles neck are 4 small red stars and one larger red star. The large star is for Yuri Gagarin, the first man in space during Vostok 1, who was killed during training for Soyuz 3. The other 4 are for Soyuz 1 cosmonaut Vladimir Komarov, Soyuz 11 crew Georgi Dobrovolski, Viktor Patsayev and Vladislav Volkov.

Expedition 10

Expedition 10

Mission insignia

Call sign	*Expedition 10*
Number of crew	2
Launch	14 October 2004 03:06 UTC
Launch site	Baikonur Cosmodrome
Launch craft	Soyuz TMA-5
Start	16 October 2004 04:16 UTC
End	24 April 2005 18:45 UTC
Landing	24 April 2005 22:08 UTC
Landing craft	Soyuz TMA-5
Landing site	53 miles northeast Arkalyk
Duration	190 days, 11 hours, 23 minutes
EVA duration	10 h 34 min
Mission duration	192 days 19 hours, 02 minutes
Number of orbits	~2,975
Distance traveled	~122,000,000 km
Mass	187,016 kg

L-R: Leroy Chiao and Salizhan Sharipov

Previous expedition	Next expedition
Expedition 9	Expedition 11

Expedition 10 (2004–2005) was the 10th expedition to the International Space Station, using the Soyuz TMA-5, which stayed during the expedition for emergency evacuation.

Crew

Position	Astronaut
Commander	Leroy Chiao, NASA Fourth spaceflight
Flight Engineer 1	Salizhan Sharipov, RSA Second spaceflight

Mission parameters

- **Perigee:** 384 km
- **Apogee:** 396 km
- **Inclination:** 51.6°
- **Orbital period:** 92 min

Mission objectives

Chiao and Sharipov docked at the Space Station on 16 October 2004 aboard Soyuz TMA-5, to relieve Expedition 9 crewmates Mike Fincke and Gennady Padalka. Chiao was the expedition commander and NASA science officer, and Sharipov was the Soyuz commander and flight engineer. Both Astronauts were researchers in the Advanced Diagnostic Ultrasound in Microgravity Project.

Notable accomplishments included replacing critical hardware in the Quest Joint Airlock; repairing U.S. spacesuits; and submitting a scientific research paper on ultrasound use in space. Chiao was also the first astronaut to vote in a U.S. Presidential election from space.

Notable events

Partial Sun eclipse from ISS, 8 April 2005

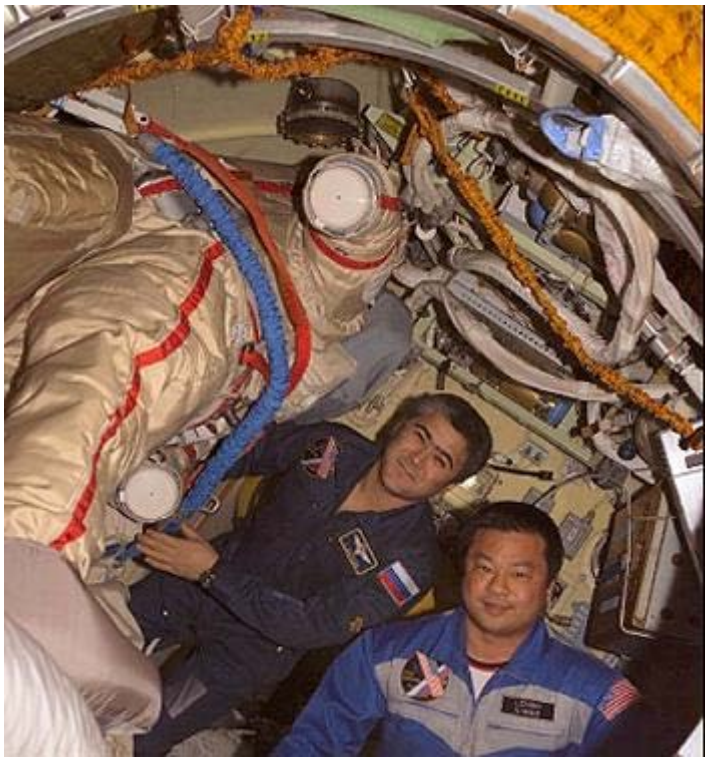
The launch of Expedition 10 was rescheduled. During preflight testing, an explosive bolt was accidentally activated on the Soyuz TMA-5 spacecraft. The resulting damage caused was repaired and the mission launched from Baikonur Cosmodrome in Kazakhstan on 14 October 2004.

During the Expedition 10 mission, two Progress supply spacecraft docked with the International Space Station. The first (Progress 51) docked on 25 December 2004 followed by the second (Progress 52) on 28 February 2005.

European Space Agency Astronaut Roberto Vittori of Italy launched to the Station with the Expedition 11 crew and spent eight days onboard performing scientific experiments. Vittori returned to Earth with the Expedition 10 crew. He was aboard under a contract between ESA and the Russian Federal Space Agency.

The re-entry of the Soyuz TMA-5 spacecraft was perfect, returning the astronauts to Earth 53 miles northeast of the town of Arkalyk after 192 days, 19 hours and 2 minutes in space. The recovery team reached the capsule in minutes.

Crew



Salizhan Sharipov (left) and Leroy Chiao (right) work with their Russian Orlan spacesuits in the Pirs Docking Compartment of the International Space Station (ISS). (NASA)

Chiao is a veteran of three Space Shuttle flights, and spent 13 hours on two spacewalks in 2000 as part of a construction mission at the Station. Sharipov has logged over 211 hours in space. He served as a mission specialist on the Shuttle during the eighth Shuttle-Mir docking mission in 1998.

Spacewalks

The Expedition 10 crew completed two spacewalks, including experiment installation and tasks to prepare the Station for the arrival of the new European Automated Transfer Vehicle in 2006. Instead, the Automated Transfer Vehicle came in 2008. The first spacewalk took place on 26 January 2005 and the second on 28 March 2005.

Chapter- 7

Expedition 11 & Expedition 12

Expedition 11

Expedition 11

Mission insignia

Call sign	*Expedition 11*
Number of crew	2
Launch	15 April 2005 00:46:00 UTC
Launch site	Baikonur Cosmodrome
Launch craft	Soyuz TMA-6
Start	17 April 2005 02:19 UTC
End	10 October 2005 21:49 UTC
Landing	11 October 2005 01:09:00 UTC
Landing craft	Soyuz TMA-6
Duration	176 days, 19 hours, 30 minutes

EVA duration	4 hours and 58 minutes
Mission duration	179 days, 0 hours, 23 minutes
Number of orbits	2,817
Mass	187,016 kg

L-R: Sergei K. Krikalev and John L. Phillips

Previous expedition	Next expedition
Expedition 10	Expedition 12

Expedition 11 (2005) was the 11th expedition to the International Space Station, using the Soyuz TMA-6, which stayed during the expedition for emergency evacuation.

European Space Agency Italian Astronaut Roberto Vittori launched with Expedition 11 on the Soyuz TMA-6 spacecraft and returned 24 April 2005 with Expedition 10 on Soyuz TMA-5.

Crew

Position	Astronaut
Commander	Sergei K. Krikalev, RSA Sixth spaceflight
Flight Engineer 1	John L. Phillips, NASA Second spaceflight

Mission parameters

- **Perigee:** ~384 km
- **Apogee:** ~396 km
- **Inclination:** ~51.6°
- **Orbital period:** ~92 min

Mission objectives

Space Shuttle Discovery photographed by Expedition 11 as it performed the first ever Rendezvous pitch manoeuvre.

The mission was to have conducted space walks on several occasions, using both NASA and Russian space suits.

On 28 July 2005 at 11:18 UTC the Space Shuttle mission STS-114 Orbiter docked and delivered a replacement Control Moment Gyroscope as part of the approximately 4.100 kg cargo carried inside the Multi-Purpose Logistics Module (MPLM) called *Raffaello*. On 6 August 2005 the Orbiter undocked from the ISS taking the MPLM back.

During the Expedition 11 mission, Russian Commander Sergei Krikalev exceeded the record for total time in space (formerly held by Sergei Avdeyev with 747.593 days). Krikalev at launch had spent 624.387 days in space. He passed the record on the 123rd day of the mission, on 16 August 2005. His cumulative time in space was 803 days and 9 hours and 39 minutes upon landing.

On 7 September 2005 the unpiloted Progress spacecraft 53 (P18) undocked from the station and was deorbited, to make way for the arrival of Progress 54 (P19) which docked in September 2008 and transferred around 2300 kg of cargo, (fuel, water, and dry cargo including oxygen generators) to the station.

On 3 October 2005 Soyuz TMA-7 docked bringing the Expedition 12 crew.

Thomas Reiter (ESA) was scheduled to join the mission in October 2005 on the supply mission STS-121 to the ISS, but due to that mission's delay until 2006 he became a crew member of Expedition 13.

Spacewalks

On 18 August 2005 19:02 UTC (3:02 p.m. EDT) the crew started a 4 hour, 58 minute spacewalk. They removed and brought inside the station a Russian Biorisk experiment container housing bacteria from the outside of Pirs; an MPAC (a micrometeoroid and orbital debris collector) and SEED (a materials exposure array) panel from the Zvezda Service Module; and the Matroska experiment, (radiation dosimeters in human-tissue-equivalent material). They installed a television camera on Zvezda, and checked a Korma contamination-exposure experiment tablet, and removed and replaced a materials exposure experiment container.

Expedition 12

Expedition 12

Mission insignia

Call sign	*Expedition 12*
Number of crew	2
Launch	1 October 2005 03:55 UTC
Launch site	Baikonur LC1
Launch craft	Soyuz TMA-7
Start	3 October 2005 05:27 UTC
End	8 April 2006 19:28 UTC

Landing	8 April 2006 23:48 UTC
Landing craft	Soyuz TMA-7
Landing site	Kazakhstan
Duration	187 days, 14 hours, 1 minute
EVA duration	11 hours 5 minutes
Mission duration	189 days, 19 hours, 53 minutes
Number of orbits	2,987
Mass	187,016 kg

William S. McArthur, Jr. (U.S.A. left), Valery I. Tokarev (Russia right)

Previous expedition	Next expedition
Expedition 11	Expedition 13

Expedition 12 (2005) was the 12th expedition to the International Space Station, launched from Kazakhstan using the Russian Soyuz TMA-7 spacecraft. The crew landed back in Kazakhstan on 8 April 2006 with the addition of the first Brazilian astronaut, Marcos Pontes.

American entrepreneur Gregory Olsen was launched in the Soyuz TMA-7 spacecraft and returned with Expedition 11 on Soyuz TMA-6 on 11 October 2005 thereby becoming the third space tourist.

Crew

Position	Astronaut

Commander	William S. McArthur, NASA Fourth spaceflight
Flight Engineer 1	Valery Ivanovich Tokarev, RSA Second spaceflight

Mission parameters

- **Perigee:**
- **Apogee:**
- **Inclination:** 51.6 degrees
- **Orbital period:**

Mission objectives

Station assembly preparations, maintenance and science in microgravity.

Spacewalks

There were two spacewalks outside the ISS during Expedition 12. MacArthur and Tokarev participated in both of them.

EVA 1

The first EVA was on 7 November 2005 for 5 hours and 22 minutes. There were two main objectives, both of which were completed. The first was to install and setup a new camera on the P1 Truss which was later used in the installation of more truss segments. The second was to jettison the Floating Potential Probe which was a failed instrument, designed to measure the station's electrical potential and compare it to the surrounding plasma.

EVA 2

The second spacewalk took place on 3 February 2006 and lasted 5 hours and 43 minutes. The astronauts jettisoned an old Russian Orlan spacesuit, named SuitSat-1, that was equipped with a radio for broadcasts to students around the world. The suit reached the end of its operation life in 2004. They also retrieved the Biorisk experiment, photographed a sensor for a micrometeoroid experiment, and tied off the surviving umbilical of the mobile transporter.

Solar eclipse

Solar eclipse from space 29 Mar 2006

On 29 March 2006 a total solar eclipse took place, and the picture to the right was taken by the Expedition 12 crew. It clearly shows the shadow of the Moon being cast on the Earth.

Concert

While wake-up music is a tradition aboard space shuttle missions, the ISS crew generally use an alarm clock to wake up. Expedition 12 astronauts received a special treat on 3 November 2005 when Paul McCartney performed *Good Day Sunshine* and *English Tea* in a first ever concert linkup from the Arrowhead Pond in Anaheim, California on his *US* tour. The event was broadcast live on NASA TV

Chapter- 8

Expedition 13 & Expedition 14

Expedition 13

Expedition 13

Mission insignia

Call sign	*Expedition 13*
Number of crew	3
Launch	30 March 2006 02:30 UTC (Soyuz TMA-8) 4 July 2006 18:38 UTC (STS-121)
Launch site	Baikonur Cosmodrome, Kennedy Space Center
Launch craft	Soyuz TMA-8, Discovery STS-121
Start	1 April 2006 04:19 UTC

End	28 September 2006 21:53 UTC
Landing	29 September 2006 01:13 UTC (Soyuz TMA-8) & 22 December 2006 22:32 UTC (STS-116)
Landing craft	Soyuz TMA-8, Discovery STS-116
Landing site	Baikonur Cosmodrome, Kennedy Space Center
Duration	180 days, 17 hours, 34 minutes
EVA duration	12 hours 25 minutes
Mission duration	182 days, 23 hours, 44 minutes
Number of orbits	2, 886
Mass	187,016 kg

Previous expedition	**Next expedition**
Expedition 12	Expedition 14

Expedition 13 was the 13th expedition to the International Space Station (ISS), and launched at 02:30 UTC on 30 March 2006. The expedition used the Soyuz TMA-8 spacecraft, which stayed at the station for the duration of the expedition for emergency evacuation.

Astronaut Marcos Pontes launched with Expedition 13 on the Soyuz TMA-8 spacecraft and became the first Brazilian in space. He returned with Expedition 12 on Soyuz TMA-7 after a nine-day mission.

Thomas Reiter, from the European Space Agency, became part of the Expedition 13 crew in July 2006. Reiter was launched with the second "Return to Flight" mission on *Discovery* (STS-121) on 4 July 2006. Reiter became the first European long-duration crew member on the International Space Station when he officially joined the crew of the ISS at 19:13 UTC on 6 July 2006 upon the complete installation of his Soyuz spacecraft seat liner, allowing him to return to Earth aboard the docked Soyuz craft.

Reiter's arrival restored the station crew to three members for the first time since May 2003. The station's crew size was reduced to two when shuttle flights were put on hold after the Space Shuttle *Columbia* accident on 1 February 2003.

Crew

Position	First Part (March to July 2006)	Second Part (July to September 2006)
Commander	Pavel Vinogradov, RSA Second spaceflight	
Flight Engineer 1	Jeffrey Williams, NASA Second spaceflight	
Flight Engineer 2		Thomas Reiter, ESA Second Spaceflight

Back-up crew

- Michael Fincke Commander and NASA Science Officer - NASA
- Fyodor Yurchikhin Flight Engineer and Soyuz Commander - RSA
- Léopold Eyharts Flight Engineer - ESA (France)

Original Expedition 13 Patch before the addition of Thomas Reiter

Spacewalks

EVA 1

The first spacewalk for Expedition 13 began on 1 June, and ended on 2 June 2006.

It was originally scheduled to include a golf shot off the space station but the event was postponed to Expedition 14, as NASA was still evaluating the risks.

The spacewalk ran behind schedule, requiring an extra 50 minutes to be added to the length in order to complete the camera replacement. The EVA began 1 June, at 23:48 UTC and ended 2 June at 06:19 UTC, lasting 6 hours and 31 minutes. Other tasks during the walk included repair of a vent for the station's oxygen-producing Elektron unit, and retrieval of experiment packages.

EVA 2

The second spacewalk for Expedition 13 occurred on 3 August 2006. The spacewalk was performed by Jeffrey Williams and Thomas Reiter, it began at 14:04 UTC and ended at 19:58 UTC, for a duration of 5 hours and 54 minutes.

During the spacewalk the astronauts installed the Floating Potential Measurement Unit (FPMU), installed two Materials on Materials International Space Station Experiment (MISSE) containers, installed a controller for a thermal radiator rotary joint, replaced a computer and installed a starboard jumper and spool positioning device (SPD), inspected a radiator beam valve module and installed another, installed a port jumper and SPD, tested an infrared camera, installed a light on the truss railway handcart, replaced a malfunctioning GPS antenna, installed a vacuum system valve, moved two articulated portable foot restraints, photographed a scratch on the airlock hatch, and retrieved a ball stack for inspection from PMA-1.

Expedition 14

Expedition 14

Mission insignia

Call sign	*Expedition 14*
Number of crew	3
Launch site	Baikonur, Cape Canaveral
Launch craft	Soyuz TMA-9 (Lopez-Alegria/Tyurin), Discovery STS-116 (Williams)
Start	18 September 2006, 04:09 UTC (Soyuz TMA-9) & 10 December 2006, 01:47 UTC

	(STS-116)
End	21 April 2007, 12:31 UTC (Soyuz TMA-9) & 22 June 2007 (STS-117)
Landing craft	Soyuz TMA-9 (Lopez-Alegria/Tyurin), Atlantis STS-117 (Williams)
EVA duration	5 hours 38 minutes as of 23 November 2006
Mission duration	215 days 08 hours (Lopez-Alegria/Tyurin)
Number of orbits	3,401 (Lopez-Alegria/Tyurin)

Sunita Williams, Mikhail Tyurin and Michael Lopez-Alegria, mission commander of Expedition 14.

Previous expedition	Next expedition
Expedition 13	Expedition 15

Expedition 14 was the 14th expedition to the International Space Station (ISS). Commander Michael Lopez-Alegria, and flight engineer Mikhail Tyurin launched from Baikonur Cosmodrome on 18 September 2006, 04:09 UTC, aboard Soyuz TMA-9. They joined Thomas Reiter, who had arrived at the ISS on 6 July 2006 aboard Space Shuttle *Discovery* during mission STS-121. In December 2006, *Discovery* mission STS-116 brought Sunita Williams to replace Reiter as the third member of Expedition 14. On 21 April 2007, Lopez-Alegria and Tyurin returned to Earth aboard TMA-9. Landing occurred at 12:31:30 UTC.

Crew

Position	First Part (September to December 2006)	Second Part (December 2006 to April 2007)
Commander	Michael Lopez-Alegria, NASA	

	Fourth spaceflight	
Flight Engineer 1	Mikhail Tyurin, RSA First spaceflight	
Flight Engineer 2	Thomas Reiter, ESA Second Spaceflight	Sunita Williams, NASA First spaceflight

Backup crew

- Peggy Whitson Commander - NASA
- Yuri Malenchenko Flight Engineer - RSA
- Clayton Anderson Flight Engineer - NASA

Mission objectives

- To continue assembly of the International Space Station with three assembly spacewalks and A Space Shuttle mission:STS-116 (Discovery).
- To relocate Soyuz TMA-9 from the aft port of the Zvezda module to nadir port of the Zarya module.
- To service three Progress visits to the ISS, filled with food, fuel, water and supplies to augment supplies delivered by the visiting Space Shuttles.
- Reconfigure power from solar arrays and cooling system.
- Remove and jettison shrouds covering the truss system.

Mission parameters

- **Perigee:**
- **Apogee:**
- **Inclination:**
- **Orbital period:**

- **Docked**: 20 September 2006, 05:21 a.m. UTC
- **Undocked**: 21 April 2007, 09:11 a.m. UTC
- **Time docked**:

Mission highlights

Expedition 14 during the first part of the mission

Launch and docking

The first crew of Expedition 14 launched, alongside spaceflight participant Anousheh Ansari, in Soyuz TMA-9, from Baikonur Cosmodrome in Kazakhstan aboard a Soyuz Rocket at 04:10am UTC on 18 September 2006. Cosmonaut Tyurin piloted the capsule in for a perfect docking two days later at 05:21am UTC on 20 September, with the hatch to the ISS opening at 08:30am UTC. The members of Expedition 14 (along with Ansari)

were greeted warmly by Expedition 13 crew Pavel Vinogradov & Jeff Williams, and also by the third member of their own expedition, ESA astronaut Thomas Reiter, who officially switched from a member of Expedition 13 to membership of Expedition 14 when his soyuz seat-liner was switched.

Atlantis reentry

The day after docking, with the expedition crew working joint operations with Expedition 13, the ISS was positioned in such a way that the station's inhabitants were able to observe the re-entry of Space Shuttle *Atlantis* at the end of STS-115. As they watched *Atlantis* create a glowing contrail during its plunge into the atmosphere, Lopez-Alegria and Williams provided commentary of the re-entry to the Mission Control Center in Houston. The station was a few hundred miles ahead of the shuttle at the time.

EVA 1

The expedition's first spacewalk took place on 22 November 2006, starting at 19:17 EST (23:17 UTC), having been delayed from its scheduled 18:00 EST (20:00 UTC) start time due to a cooling issue in Tyurin's suit. Tyurin got out of the suit and straightened a suspect hose which apparently had become kinked.

During the spacewalk, Tyurin hit a golf ball from the exterior of the Pirs airlock. This "experiment" was sponsored by a Toronto based commercial company, *Element 21*, which manufactures golf clubs made of scandium. The ball weighs just 3 grams, compared with 48 grams for a standard golf ball. At that weight, it was unlikely to damage any station components which might accidentally have been hit. There were three balls allowing two options for repeating the shot if required, but only one shot was actually taken. Taken with a one-handed grip by Tyurin (with Lopez-Alegria stabilising Tyurin by holding his legs), the shot was a substantial slice, with the ball flying off to the right of the station instead of the rear. In 2006, there were plans for the video from the shot to be used in a TV commercial. The progress of the ball, which contains tracking equipment, could be followed on E21's Track the Ball in Space web site which was set up in 2006. Although, the site simply calculates an assumed distance of the ball based on a constant speed and does not perform any real tracking of the ball. The stunt was carried out around 35 years after Alan Shepard hit two golf balls on the moon during Apollo 14.

Commander Michael E. Lopez-Alegria (left) and cosmonaut Mikhail Tyurin conduct pre-spacewalk operations in the Pirs airlock (February 2007)

Inspection of a Kurs antenna on the Progress 23 unpiloted cargo carrier that docked at the aft end of the station's Zvezda Service Module on 26 October 2006 was the next task. Final latching of the spacecraft to the station during the docking procedure was delayed by more than three hours because Mission Control Moscow was not sure the antenna was completely retracted. Tyurin and Lopez-Alegria moved to the rear of Zvezda and photographed the antenna. It was still fully extended, so Tyurin used a screwdriver to release a latch and tried to retract the antenna. Russian flight controllers also tried to retract it by activating a motor. Neither succeeded, and the task was abandoned.

Next they relocated a WAL antenna, which was later used to guide the unpiloted European cargo carrier, the Automated Transfer Vehicle, when it docked with the station. The first ATV, Jules Verne, eventually docked with the ISS on 3 April 2008. In its previous position the antenna interfered with a cover for a Zvezda booster engine.

Then the two installed a BTN neutron experiment, which characterises charged and neutral particles in low Earth orbit. Atop Zvezda, its readings during solar bursts continue to be of special interest to scientists as of 2010. Two thermal covers from the BTN were jettisoned before the spacewalkers returned to the Pirs airlock at 00:55 EST (04:55 UTC) on the morning of 23 November, bringing the 5-hour, 38-minute EVA to a close.

A final scheduled task, an inspection of bolts on one of two Strela hand-operated cranes on the docking compartment, was postponed to a future EVA.

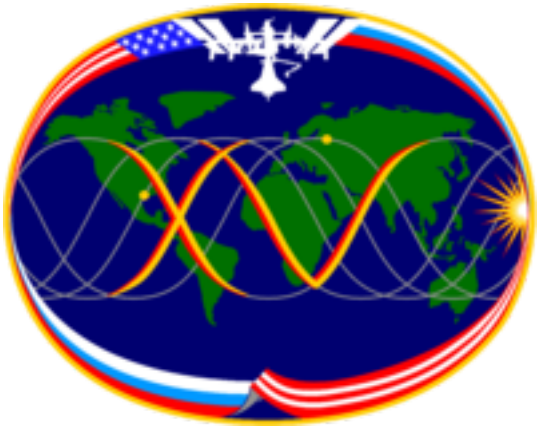
This mission was the longest expedition to the ISS thus far. Also, the Soyuz capsule was the oldest one ever used. Lopez-Alegria, already the U.S. recordholder for spacewalks, now also holds the record for longest spaceflight by a NASA astronaut. This space walk has been named the Lancaster spacewalk and sponsored by UNIvision.

Chapter- 9

Expedition 15 & Expedition 16

Expedition 15

Expedition 15



Mission insignia

Call sign	*Expedition 15*
Number of crew	3
Launch site	Baikonur, Cape Canaveral
Launch craft	Soyuz TMA-10 (Yurchikhin/Kotov), Atlantis STS-117 (Anderson)
Start	7 April 2007 (Soyuz TMA-10), 8 June 2007 (STS-117)

End	21 October 2007 (Soyuz TMA-10), 3 November 2007 (STS-120)
Landing craft	Soyuz TMA-10 (Yurchikhin/Kotov), Discovery STS-120 (Anderson)
Landing site	Ballistic Trajectory Landing Site northwest of Arkalyk
Duration	9 April 2007 07:10 UTC - 21 October 2007 07:14 UTC
EVA duration	11 hours 2 minutes
Mission duration	196 days, 17 hours, 17 minutes

Second part crew from left to right: Clayton Anderson, Fyodor Yurchikhin, Oleg Kotov

Previous expedition	**Next expedition**
Expedition 14 	Expedition 16 

Expedition 15 was the 15th expedition to the International Space Station (ISS). Four crew members participated in the expedition, although for most of the expedition's duration only three were on the station at any one time. During Expedition 15, the ISS Integrated Truss Structure was expanded twice: STS-117 brought the S3/S4 truss, and STS-118 brought the S5 truss.

Crew

Position	First Part (April to June 2007)	Second Part (June to October 2007)

Commander	Fyodor Yurchikhin, RSA Second spaceflight	
Flight Engineer 1	Oleg Kotov, RSA First spaceflight	
Flight Engineer 2	Sunita Williams, NASA First Spaceflight	Clayton Anderson, NASA First spaceflight

Crew Notes

Flight Engineer Sunita Williams was the first Expedition 15 crew member to arrive. She participated in Expedition 14, until Expedition 15 Commander Fyodor Yurchikhin assumed command of the station. Williams arrived at the station on 11 December 2006, aboard the Space Shuttle *Discovery* flight STS-116. Yurchikhin and Flight Engineer Oleg Kotov arrived the station on 9 April 2007 aboard Soyuz TMA-10.

On 26 April 2007, NASA announced that Williams would return to Earth on STS-117, flown by Space Shuttle *Atlantis*, instead of STS-118 as originally planned. Williams was replaced by Clayton Anderson, who arrived at the station aboard *Atlantis*, which docked on 10 June 2007.

Expedition 15 ended officially after Expedition 16 Commander Peggy Whitson arrived at the station aboard Soyuz TMA-11, and the official change of command ceremony took place on 19 October 2007.

Backup crew

- Roman Romanenko Commander - RSA
- Mikhail Korniyenko Flight Engineer - RSA
- Gregory Chamitoff Flight Engineer - NASA (for Anderson)

Mission details

- **Launch**: 7 April 2007 17:31 UTC
- **Docking**: 9 April 2007 07:10 UTC
- **Undocking**: 21 October 2007 07:14 UTC
- **Landing**: 21 October 2007 10:46 UTC
- **LandingSite**: Ballistic Trajectory Landing Site northwest of Arkalyk

On 21 October 2007, after the separation of the Soyuz TMA-10 capsule, Moscow Mission Control reported that the Soyuz had entered into a ballistic trajectory, which resulted in a landing that was 340 kilometers (211 mi) short of the intended Kazakhstan landing site. Landing occurred without incident, and by 10:55 UTC, all crew members were out of the capsule, and the vehicle was secured. Until then, the only other time a Soyuz landing had resulted in a ballistic trajectory was the landing of Soyuz TMA-1, for

Expedition 6. Another ballistic trajectory occurred with the landing of Soyuz TMA-11 on 19 April 2008 for Expedition 16.

EVAs

Original second portion of Expedition 15 crew portrait, from left to right: Daniel Tani, Yurchikhin, Kotov. Due to a change in schedule, Tani joined Expedition 16 in October 2007.

- **EVA 1**: 30 May 2007 - Yurchikhin/Kotov, 5 hours, 25 minutes.
- **EVA 2**: 6 June 2007 - Yurchikhin/Kotov, 5 hours, 37 minutes.
- **EVA 3**: 23 July 2007 - Yurchikhin/Anderson 7 hours, 41 minutes.

Expedition 16

Expedition 16

Mission insignia

Call sign	*Expedition 16*
Number of crew	3
Launch site	Baikonur, Cape Canaveral
Launch craft	Soyuz TMA-11 (Whitson/Malenchenko), *Atlantis* STS-117 (Anderson), *Discovery* STS-120 (Tani), *Atlantis* STS-122 (Eyharts), *Endeavour* STS-123 (Reisman)
Start	10 October 2007 (Soyuz TMA-11), 23 October 2007 (STS-120), 7 February 2008 (STS-122), 11 March 2008 (STS-123)
End	19 April, 10:30 UTC 2008 (Soyuz TMA-11), 7 November 2007 (STS-120), 20 February 2008 (STS-122), 27 March 2008 (STS-123),

	14 June 2008 (STS-124)
Landing craft	Soyuz TMA-11 (Whitson/Malenchenko), *Discovery* STS-120 (Anderson), *Atlantis* STS-122 (Tani), *Endeavour* STS-123 (Eyharts), *Discovery* STS-124 (Reisman)
Mission duration	192 days

The official Expedition 16 crew portrait. (left to right) Anderson, Malenchenko, Tani, Eyharts, Whitson, Reisman

Previous expedition	**Next expedition**
Expedition 15	Expedition 17

Expedition 16 was the 16th expedition to the International Space Station (ISS). The first two crew members, Yuri Malenchenko and Peggy Whitson, launched on 10 October 2007, aboard Soyuz TMA-11, and were joined by spaceflight participant Sheikh Muszaphar Shukor, the first Malaysian in space.

Expedition 15 Flight Engineer Clayton Anderson did not land with the Soyuz TMA-10, so he was considered part of Expedition 16 for the few weeks prior to the arrival of STS-120. STS-120 launched on 23 October, docked on 25 October, and replaced Anderson with new Flight Engineer Daniel Tani. Following docking, the Soyuz seat liners for Anderson and Tani were swapped, and Anderson became part of the STS-120 crew. Léopold Eyharts, who came aboard during STS-122, joined the mission on 9 February 2008, replacing Tani. The crew was then joined by Garrett Reisman, who was launched aboard *Endeavour* with STS-123, on 11 March 2008, replacing Eyharts. Reisman joined Expedition 16 in progress, and was a part of Expedition 17 as well. Upon reentry, the astronaut's Soyuz TMA-11 spacecraft suffered a minor malfunction, causing the craft to follow a very steep ballistic descent. As a result, the crew experienced forces up to 10 G, ending up about 260 miles (418 km) west of the targeted landing site. Roscosmos reported all three crew members were doing just fine and in good health.

Crew

Position	First Part (October 2007)	Second Part (October 2007 to February 2008)	Third Part (February to March 2008)	Fourth Part (March to April 2008)
Commander	Peggy Whitson, NASA Second spaceflight			
Flight Engineer 1	Yuri Malenchenko, RSA Fourth spaceflight			
Flight Engineer 2	Clayton Anderson, NASA First Spaceflight	Daniel Tani, NASA Second spaceflight	Léopold Eyharts, ESA Second spaceflight	Garrett Reisman, NASA First spaceflight

Backup crew

- Michael Fincke Commander - NASA (for Whitson)
- Salizhan Sharipov Flight Engineer 1 - RSA (for Malenchenko)
- Greg Chamitoff Flight Engineer 2 - NASA (for Anderson)
- Sandra Magnus Flight Engineer 2 - NASA (for Tani)
- Frank De Winne Flight Engineer 2 - ESA (*Belgium*) (for Eyharts)
- Timothy Kopra Flight Engineer 2 - NASA (for Reisman)

Mission details

- **Docked**: 12 October 2007 14:50 UTC
- **Undocked**: 19 April 2008 6:06 UTC
- **Time docked**: 192 days

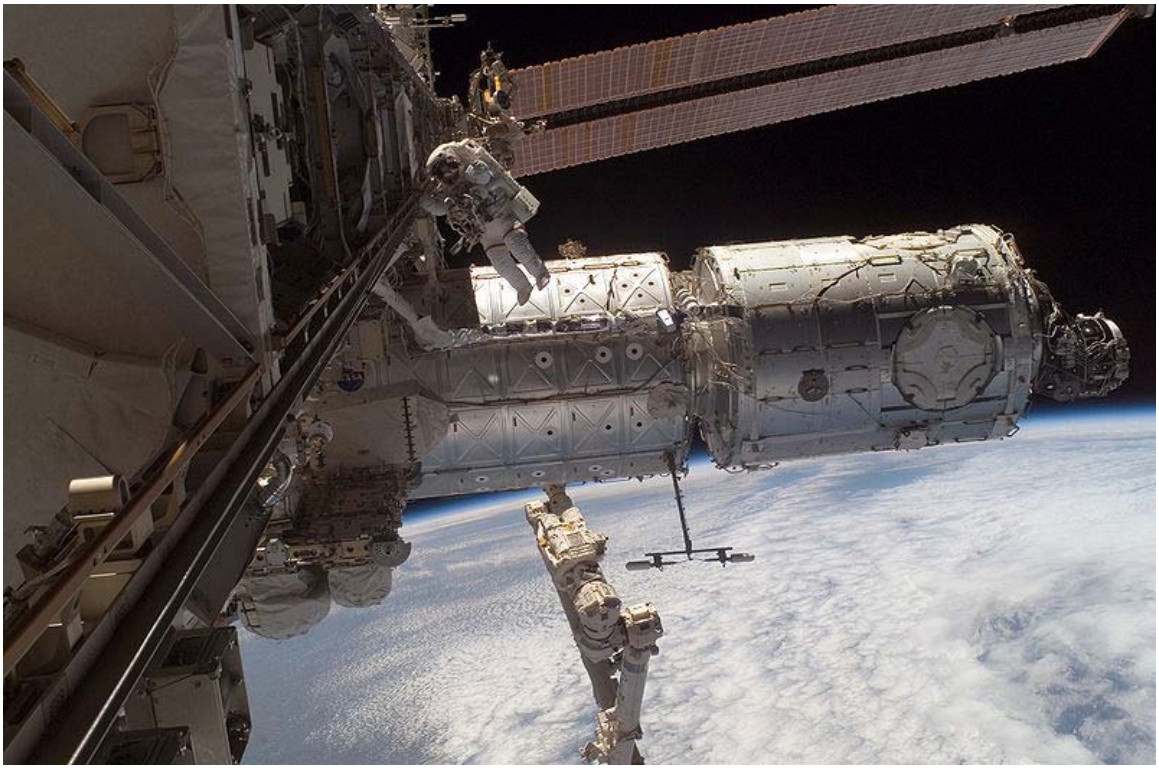
Expedition 16 was the first ISS mission to include two crew members who had served on a previous expedition, and the first time a former commander (Malenchenko) returned as a flight engineer. Whitson was the first female commander of an ISS expedition, and with STS-120 commanded by female astronaut Pamela Melroy, it marked the first time that two female mission commanders were in orbit simultaneously. On her first expedition, Whitson implemented a "Friday night movie night" to help the crew wind down at the end of the week, and plans to keep the custom of adding some levity to the station going for Expedition 16. Anderson incorporated some entertainment into the daily planning conference with the ground, quizzing the ground team on a wide variety of subjects, and Michael Lopez-Alegria did a similar activity with movie and music trivia.

STS-120

The first major objective of the increment was accomplished successfully on 26 October, when the crew of STS-120 delivered the *Harmony* module, and attached it to a temporary

location on the *Unity* module. The new addition added over 2,500 cubic feet (71 cubic meters) to the station's living volume. The joint crews also moved the P6 truss, and relocated it from its position on top of the station, to its final port-side position, during the third of four spacewalks.

Configuration of *Harmony*



Expedition commander Peggy Whitson during the increment's third EVA. Behind Whitson, is the Destiny Laboratory Module, and *Harmony*.

Following the departure of STS-120, a series of Extra-vehicular activity (EVA) and robotic activities were carried out to move the Pressurized Mating Adapter (PMA-2) from the end of the Destiny laboratory, to the end of *Harmony*. Whitson and Malenchenko carried out the increment's first EVA on 9 November, that prepared the docking port for relocation. On 12 November, Whitson and Tani used the station's Mobile Servicing System (robotic arm) to detach the docking port, and relocated it to the forward port of *Harmony*. On 14 November, the Tani and Whitson again used the robotic arm and moved *Harmony* from its temporary location, to its permanent location on the forward port of *Destiny*.

On 20 November, Whitson and Tani completed the second EVA for the increment, a 7-hour, 16-minute spacewalk to outfit the *Harmony* node in its new position. All tasks were accomplished, and three get-ahead tasks were performed. On 24 November, Whitson and Tani completed the third EVA for the increment, a 7 hour, 4 minute spacewalk to complete the outfitting of *Harmony*. All task were accomplished, and photographic

inspection of the starboard Solar Alpha Rotary Joint (SARJ) was performed, as well as some ISS maintenance get-ahead tasks.

EVA milestone

On 18 December 2007, during the fourth spacewalk of Expedition 16 to inspect the S4 starboard Solar Alpha Rotary Joint (SARJ), the ground team in Mission Control informed Whitson that she had become the female astronaut with the most cumulative EVA time in NASA history, as well as the most EVAs, with her fifth EVA. Three hours and 37 minutes into the spacewalk, Whitson surpassed NASA astronaut Sunita Williams with a total time at that point of 29 hours and 18 minutes. At the completion of Whitson's fifth EVA, the 100th in support of ISS assembly and maintenance, Whitson's cumulative EVA time became 32 hours, and 36 minutes, which placed her in 20th place for total EVA time.

STS-122

STS-122 delivered Columbus and replaced Dan Tani with Léopold Eyharts.

STS-123

STS-123 delivered the first element of Kibō and replaced Léopold Eyharts with Garrett Reisman.

ATV *Jules-Verne*

Expedition 16 also saw the arrival of the first Automated Transfer Vehicle (ATV) to the station, named Jules Verne after the science fiction author.

Soyuz TMA-12

Expedition 16 also saw the arrival of the first Korean astronaut, Yi So-yeon.

Extra-vehicular activity

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
EVA 1	Peggy Whitson Yuri Malenchenko	9 November 2007 09:54	9 November, 16:49	6 hours, 55 minutes
	SSPTS cable disconnect and stowage, PMA-2 umbilical stowage, Node 2 avionics umbilical temp stowed.			
EVA 2	Whitson	20	20	7 hours,

	Daniel M. Tani	November 2007 10:10	November, 17:26	16 minutes
	External configuration of PMA-2 and *Harmony*: Fluid, electrical, and data line hookups, avionics line hookup, heater cable hookups, Fluid tray relocation.			
	Whitson Tani	24 November 2007 09:50	24 November, 16:54	7 hours, 04 minutes
EVA 3	Completion of fluid, electrical, and data line hookups for PMA-2 and *Harmony*. Loop B Fluid Tray connection to port side of *Destiny*. Photographic analysis of starboard Solar Alpha Rotary Joint (SARJ) to assist with troubleshooting on the ground, re-installation of CETA cart from a temporary stowage location.			
	Whitson Tani	18 December 2007 09:50	18 December, 16:46	6 hours, 56 minutes
EVA 4	Inspection of the S4 starboard Solar Alpha Rotary Joint (SARJ), and a Beta Gimbal Assembly (BGA). The EVA is the 100th in support of building the International Space Station.			
	Whitson Tani	30 January 2008 09:56	30 January, 17:06	7 hours, 10 minutes
EVA 5	Replacement of a Bearing Motor Roll Ring Module (BMRRM) in the S4 starboard Beta Gimbal Assembly (BGA), further inspection of the Solar Alpha Rotary Joint (SARJ).			

Chapter- 10

Expedition 17 & Expedition 18

Expedition 17

Expedition 17

Mission insignia

Call sign	*Expedition 17*
Number of crew	3
Launch site	Baikonur, Cape Canaveral
Launch craft	Soyuz TMA-12 (Volkov/Kononenko), *Discovery* STS-124 (Chamitoff)
Start	8 April 2008 (Soyuz TMA-12), May 31, 2008 (STS-124),
End	October, 2008 (Soyuz TMA-12), 11 June 2008 (STS-124),

	30 November 2008 (STS-126)
Landing craft	Soyuz TMA-12 (Volkov/Kononenko), *Discovery* STS-124 (Reisman), *Endeavour* STS-126 (Chamitoff)

(Left to right) Greg Chamitoff, Garrett Reisman, Sergei Volkov, Oleg Kononenko

Previous expedition	**Next expedition**
Expedition 16	Expedition 18

Expedition 17 was the 17th expedition to the International Space Station (ISS).

The first two crew members, Sergey Volkov, and Oleg Kononenko were launched on 8 April 2008, aboard the Soyuz TMA-12. Once aboard the station, they joined Garrett Reisman, who transferred from Expedition 16 to join the Expedition 17 crew.

Reisman was replaced by Gregory Chamitoff, who launched aboard the Space Shuttle *Discovery* mission STS-124 on 31 May 2008. Volkov and Kononenko landed safely on 24 October 2008, while Chamitoff remained aboard the station as an Expedition 18 crewmember.

Crew

Position	First Part (April 2008 to June 2008)	Second Part (June 2008 to October 2008)
Commander	Sergey Volkov, RSA First spaceflight	
Flight Engineer 1	Oleg Kononenko, RSA First spaceflight Soyuz TMA-12 Commander	
Flight Engineer 2	Garrett Reisman, NASA First spaceflight	Gregory Chamitoff, NASA First spaceflight

- Sergei Volkov, 35, was the youngest person to command the ISS.
- Garrett Reisman was the first Jewish resident of the ISS.
- Gregory Chamitoff was the first crewmember to take bagels with him to the station; three bags of 18 sesame seed bagels.
- Reisman launched to the station on STS-123 in March, which was during the Expedition 16 spaceflight. He landed on STS-124.
- Chamitoff launched to the station on STS-124 in June, and stayed through Expedition 18, leaving the station on STS-126 in November.

Backup crew

- Maksim Surayev - Commander - RSA (for Volkov)
- Oleg Skripochka - Flight Engineer - RSA (for Kononenko)
- Timothy Kopra - Flight Engineer - NASA (for Chamitoff)

Expedition 18

Expedition 18

Mission insignia

Number of crew	3
Launch site	Baikonur
Launch craft	Soyuz TMA-13, STS-124 Space Shuttle Discovery (Chamitoff), STS-126 Space Shuttle Endeavour (Magnus), STS-119 Space Shuttle Discovery

	(Wakata)
Start	31 May 2008 (STS-124), 12 October 2008 (Soyuz TMA-13), 14 November 2008 (STS-126), 15 March 2009 (STS-119)
End	8 April 2009

(Left to right) Koichi Wakata, Michael Fincke, Sandra Magnus, Yuri Lonchakov, Gregory Chamitoff

Previous expedition	**Next expedition**
Expedition 17	Expedition 19

Expedition 18 was the 18th permanent crew of the International Space Station (ISS). The first two crew members, Michael Fincke, and Yuri Lonchakov were launched on 12 October 2008, aboard Soyuz TMA-13. With them was astronaut Sandra Magnus, who joined the Expedition 18 crew after launching on STS-126 and remained until departing on STS-119 on 25 March 2009. She was replaced by JAXA astronaut Koichi Wakata, who arrived at the ISS on STS-119 on 17 March 2009. Gregory Chamitoff, who joined Expedition 18 after Expedition 17 left the station, ended his stay aboard ISS and returned to Earth with the STS-126 crew.

Crew

Position	**First Part (October 2008 to November 2008)**	**Second Part (November 2008 to March 2009)**	**Third Part (March 2009 to April 2009)**

Commander		Michael Fincke, NASA Second spaceflight	
Flight Engineer 1		Yuri Lonchakov, RSA Third spaceflight	
Flight Engineer 2	Gregory Chamitoff, NASA First Spaceflight	Sandra Magnus, NASA Second spaceflight	Koichi Wakata, JAXA Third spaceflight

Crew notes

Salizhan Sharipov, was originally slated to be the Soyuz commander and Expedition 18 Flight Engineer 1, but was replaced by his back-up Yuri Lonchakov.

Backup crew

- Gennady Padalka - Commander - RSA (for Lonchakov)
- Michael Barratt- Flight Engineer - NASA (for Fincke)
- Timothy Kopra - Flight Engineer - NASA (for Chamitoff)
- Nicole Stott - Flight Engineer - NASA (for Magnus)
- Soichi Noguchi - Flight Engineer - JAXA (for Wakata)

Mission plan

- Launch vehicle: Soyuz TMA-13
- Launch date: 12 October 2008 3:01 a.m. EDT
- Docking: 14 October 2008
- Spacewalks: 22 December 2008 (completed 23 December) and 10 March 2009
- Landing: 8 April 2009

March 2009 debris incident

On 12 March 2009, a piece of debris from the upper stage of a Delta II rocket used to launch a GPS satellite in 1993, passed close to the ISS. The conjunction between the debris and the Space Station was not detected until it was too late to perform a collision avoidance manoeuvre. The crew prepared to evacuate the station by closing hatches between modules, and boarding the Soyuz spacecraft that was docked to provide emergency crew escape. The debris did not hit the station, instead it passed by at 16:38 UTC, and the crew were cleared to resume operations about five minutes later.

Extra-vehicular activity

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
EVA 1	Yuri Lonchakov	23 December	23 December	5 hours, 38

	Michael Fincke	00:51	06:29	minutes
	Installed an electromagnetic energy measuring device, (Langmuir probe) on *Pirs*, removed the Russian Biorisk long-duration experiment, installed the Expose-R experiment package on *Zvezda*, but subsequently removed it after it failed to activate and transmit telemetry on ground command. Installed the Impulse experiment. EVA conducted from *Pirs* airlock in Russian Orlan space suits.			
EVA 2	Yuri Lonchakov Michael Fincke	10 March 2009 16:22	10 March 2009 21:11	4 hours, 49 minutes
	Installed the EXPOSE-R onto the universal science platform of the *Zvezda* module, removed tape straps from the area of the docking target on the *Pirs* airlock and docking compartment, inspected and photographed the exterior of the Russian portion of the station. EVA conducted from *Pirs* airlock in Russian Orlan space suits.			

Chapter- 11

Expedition 19 & Expedition 20

Expedition 19

Expedition 19

Mission insignia

Number of crew	3
Launch site	Baikonur Cosmondrome, Kazakhstan
Launch craft	STS-119, Soyuz TMA-14
Start	28 March 2009 13:05 UTC
End	29 May 2009 12:34 UTC
Landing craft	Soyuz TMA-14, STS-127
Duration	61 days, 23 hours, 29 minutes

(Left to right) Michael Barratt, Gennady Padalka, Koichi Wakata

Previous expedition	Next expedition
Expedition 18	Expedition 20

Expedition 19 was the 19th expedition to the International Space Station. This expedition launched on 26 March 2009, at 11:49 UTC aboard the Soyuz TMA-14 spacecraft. Expedition 19 was the final three crew member expedition, before the crew size increased to six crew members with Expedition 20. Because of the shift to six crew members the average duration of the expeditions was reduced from six to three months.

The expedition was commanded by Russian Air Force Colonel Gennady Padalka. On 31 March 2009, Padalka raised an issue concerning shared use of facilities such as exercise equipment and toilet facilities. Padalka claims that initial approval to use exercise equipment owned by the U.S. government was subsequently turned down. Russian and American members of the crew have now been informed to use only their own toilets and not to share rations. The result was a general lowering of morale on the station.

Crew

Position	Crew Member
Commander	Gennady Padalka, RSA Third spaceflight
Flight Engineer 1	Michael Barratt, NASA First spaceflight
Flight Engineer 2	Koichi Wakata, JAXA Third Spaceflight

Backup crew

- Jeffrey Williams - Commander - NASA (For Barratt)
- Maksim Surayev - Flight Engineer - RSA (For Padalka)

- Soichi Noguchi - Flight Engineer - JAXA (For Wakata)

Expedition 20

Expedition 20

Mission insignia

Number of crew	6
Launch site	Baikonur Cosmondrome, Kazakhstan
Launch craft	Soyuz TMA-14, STS-127, Soyuz TMA-15, STS-128
Start	29 May 2009 12:34 UTC
End	11 October 2009
Duration	5 Months

Front Row: Frank De Winne, Gennady Padalka, Roman Romanenko

Back Row: Robert Thirsk, Michael Barratt, Nicole Stott, Timothy Kopra, Koichi Wakata

Previous expedition	Next expedition
Expedition 19	Expedition 21

Expedition 20 is the twentieth long duration flight to the International Space Station. Soyuz TMA-15 launched from Baikonur Cosmodrome at 10:34 UTC on 27 May 2009. The vehicle docked with the station on 29 May 2009, officially changing the station crew from Expedition 19 to Expedition 20.

Expedition 20 marked the first time a six-member crew had inhabited the station. To accomplish the six-member crew, there were two separate Soyuz-TMA flights launched at two different times (each Soyuz-TMA can hold only three people): Soyuz TMA-14 launched the Expedition 19 crew on 26 March 2009, and Soyuz TMA-15 on 27 May 2009.

Gennady Padalka was the first commander of a six-member station crew, and the first commander of two consecutive expeditions (Expedition 19 and 20). Nicole Stott was the final expedition astronaut to be launched on the shuttle.

Koichi Wakata performed an experiment where he did not change his underpants in order to test a specially designed underwear which he wore for 1 month without washing or changing and did not develop body odor.

Crew

Position	First Part (May to July 2009)	Second Part (July to August 2009)	Third Part (August to October 2009)
Commander	Koichi Wakata, JAXA Third spaceflight	Gennady Padalka, RSA Third spaceflight	Nicole Stott, NASA First spaceflight
Flight Engineer 1		Michael Barratt, NASA First spaceflight	
Flight Engineer 2		Timothy Kopra, NASA First spaceflight	
Flight Engineer 3		Frank De Winne, ESA Second spaceflight	
Flight Engineer 4		Roman Romanenko, RSA	

Flight Engineer 5	First spaceflight Robert Thirsk, CSA Second spaceflight	

Backup crew

- Jeffrey Williams - Commander
- Maksim Surayev
- Timothy Creamer
- Catherine Coleman
- Chris Hadfield
- Dimitri Kondratyev
- André Kuipers

Extra-vehicular activity

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
Expedition 20 EVA 1 ‡	Gennady Padalka Michael R. Barratt	5 June 2009 7:52	5 June 2009 12:46	4 hours, 54 minutes
	Prepared the *Zvezda* service module transfer compartment for the arrival of the *Poisk* module, installed docking antenna for the module, photographed antenna for evaluation on the ground, and photographed the Strela-2 crane.			
	Gennady Padalka Michael R. Barratt	10 June 2009 6:55	10 June 2009 7:07	12 minutes
Expedition 20 EVA 2	Internal spacewalk in the depressurised *Zvezda* transfer compartment, to replace one of the *Zvezda* hatches with a docking cone, in preparation for the docking of the *Poisk* module later in 2009. *Poisk* docked automatically to the zenith port of *Zvezda* on 12 November 2009, and serves as an additional docking port for Russian vehicles.			

‡ denotes spacewalks performed from the *Pirs* docking compartment in Russian Orlan suits.

On 3 July 2009 expedition members undocked the Soyuz TMA-14 craft from the aft port of the Zvezda service module and piloted it over to the Pirs docking compartment. This was done to clear the way for the arrival of a Progress supply craft.

The Expedition 20 crew lands in Arkalyk, Kazakhstan


ROSCOSMOS
ROSCOSMOS

Chapter- 12

Expedition 21 & Expedition 22

Expedition 21

Expedition 21

Mission insignia

Number of crew	6 (5 after departure of Nicole Stott)
Launch site	Baikonur Cosmondrome, Kazakhstan
Launch craft	Soyuz TMA-15, STS-128, Soyuz TMA-16
Start	30 October 2009
End	1 December 2009
Landing craft	Soyuz TMA-15
Landing site	Arkalyk, Kazakhstan

Duration 186 days

from left to right: Maksim Surayev, Nicole Stott, Jeffrey Williams, Frank De Winne (commander), Robert Thirsk, Roman Romanenko

Previous expedition	**Next expedition**
Expedition 20	Expedition 22

Expedition 21 lifts off.

Expedition 21 was the 21st long-crew-flight of the International Space Station (ISS). The expedition began on 30 September 2009. Frank de Winne is the first ESA astronaut to command a space mission.

The handover between Expedition 20 and Expedition 21 required three Soyuz vehicles being docked to the station at the same time, the first time this has occurred.

Soyuz TMA-16 brought the final members of Expedition 21 to the ISS along with space tourist Guy Laliberté. Laliberté returned on Soyuz TMA-14 with two members of Expedition 20.

Nicole P. Stott was the last ISS expedition crew member to fly on the Space Shuttle. She returned to Earth aboard STS-129 in November 2009.

Crew

Position	First Part (October 2009 to November 2009)	Second Part (November 2009 to December 2009)
Commander	Frank De Winne, ESA Second spaceflight	
Flight Engineer 1	Roman Romanenko, RSA First spaceflight	
Flight Engineer 2	Robert Thirsk, CSA Second Spaceflight	
Flight Engineer 3	Jeffrey N. Williams, NASA Third spaceflight	
Flight Engineer 4	Maksim Surayev, RSA First spaceflight	
Flight Engineer 5	Nicole P. Stott, NASA First spaceflight	

Source

NASA

Backup crew

- Chris Hadfield - Commander
- Dimitri Kondratyev
- André Kuipers
- Shannon Walker
- Aleksandr Skvortsov
- Catherine Coleman

Expedition 22

Expedition 22

Mission insignia

Number of crew	5
Launch site	Baikonur Cosmodrome, Kazakhstan
Launch craft	Soyuz TMA-16, Soyuz TMA-17
Start	30 November 2009
End	17 March 2010
Landing craft	Soyuz TMA-16
Landing site	Arkalyk, Kazakhstan
Duration	167 days
Mission duration	169 days

(l-r) Creamer, Williams, Surayev, Kotov and Noguchi

Previous expedition	Next expedition
Expedition 21	Expedition 23

Expedition 22 was the 22nd long duration crew flight to the International Space Station (ISS). This expedition began in November 2009 when the Expedition 21 crew departed. For a period of 3 weeks, there were only 2 crew members; it was the first time that had happened since STS-114 had delivered a third person to restore the ISS crew to 3. Commander Jeff Williams and flight engineer Maksim Surayev were joined by the rest of their crew on 22 December 2009, making the Expedition 22 a crew of five.

The expedition ended when Soyuz TMA-16 undocked on 17 March 2010, and was immediately followed by the start of Expedition 23.

Crew

Position	First Part (November 2009 to December 2009)	Second Part (December 2009 to March 2010)
Commander	Jeffrey N. Williams, NASA Third spaceflight	
Flight Engineer 1	Maksim Surayev, RSA First spaceflight	
Flight Engineer 2		Oleg Kotov, RSA Second spaceflight
Flight Engineer 3		Soichi Noguchi, JAXA Second spaceflight
Flight Engineer 4		Timothy Creamer, NASA First spaceflight

Source
NASA

Backup crew

- Shannon Walker - Commander
- Aleksandr Skvortsov
- Douglas H. Wheelock
- Anton Shkaplerov
- Satoshi Furukawa

Spacewalks

EVA	Spacewalkers	Start (UTC)	End (UTC)	Duration
EVA 1	Oleg Kotov Maksim Surayev	14 January 2010 10:05	14 January 2010 15:49	5 hours, 44 minutes
	Prepared the *Poisk* module for future dockings. Spacewalk was performed using Orlan spacesuits.			

Chapter- 13

Expedition 23 & Expedition 24

Expedition 23

Expedition 23

Mission insignia

Number of crew	6
Launch site	Baikonur Cosmodrome, Kazakhstan
Launch craft	Soyuz TMA-17, Soyuz TMA-18
Start	17 March 2010 08:03 UTC
End	2 June 2010 00:04 UTC
Landing craft	Soyuz TMA-17
Landing site	Kazakhstan
Duration	76 days, 16 hours, 1 minute

(l-r) Korniyenko, Caldwell-Dyson, Skvortsov, Kotov, Creamer and Noguchi

Previous expedition	Next expedition
Expedition 22	Expedition 24

Expedition 23 was the twenty-third long-duration mission to the International Space Station (ISS). Expedition 23 began with the Soyuz TMA-16 undocking on 18 March 2010. Shortly thereafter cosmonauts Aleksandr Skvortsov and Mikhail Korniyenko and astronaut Tracy Caldwell-Dyson arrived at the Space Station on Soyuz TMA-18 on 4 April 2010. The Soyuz spacecraft lifted off from the Baikonur Cosmodrome at 00:04 EST on 2 April 2010.

Crew

Position	First Part (March 2010 to April 2010)	Second Part (April 2010 to June 2010)
Commander	Oleg Kotov, RSA Second spaceflight	
Flight Engineer 1	Soichi Noguchi, JAXA Second spaceflight	
Flight Engineer 2	Timothy Creamer, NASA First spaceflight	
Flight Engineer 3		Aleksandr Skvortsov, RSA First spaceflight
Flight Engineer 4		Mikhail Korniyenko, RSA First spaceflight
Flight Engineer 5		Tracy Caldwell Dyson, NASA Second spaceflight

Source
NASA

Backup crew

- Douglas H. Wheelock - Commander
- Anton Shkaplerov
- Satoshi Furukawa
- Mikhail Tyurin
- Aleksandr Samokutyayev
- Scott J. Kelly

Mission overview

Three Russian cosmonauts, two American and one Japanese astronauts made up the Expedition 23 crew. It was the first ISS crew to include three Russians at once. The Expedition 23 crew continued outfitting the newest modules of the nearly completed space station. The crew welcomed the shuttle flight STS 131 in April 2010. The Expedition 23 crew also saw the arrival of the Rasvet Russian docking module (MRM1) aboard Space Shuttle *Atlantis* on STS 132, which launched on 14 May 2010.

Expedition 24

Expedition 24

Mission insignia

Number of crew	6
Launch site	Baikonur Cosmodrome, Kazakhstan
Launch craft	Soyuz TMA-18, Soyuz TMA-19
Start	1 June 2010 00:04 UTC
End	25 September 2010 02:02 UTC
Landing craft	Soyuz TMA-18, Soyuz TMA-19

Landing site Arkalyk, Kazakhstan

(l-r) Wheelock, Caldwell-Dyson, Skvortsov, Korniyenko, Walker and Yurchikhin

Previous expedition	**Next expedition**
Expedition 23	Expedition 25

A last quarter crescent moon above Earth's horizon is featured in this image photographed by an Expedition 24 crew member.

Expedition 24 was the twenty-fourth long-duration mission to the International Space Station (ISS). Expedition 24 initially had 2 planned spacewalks, one Russian and one American Extra-vehicular Activity (EVA). The U.S. EVA was re-planned and a second U.S. EVA was added.

Crew

Position	First Part (June 2010)	Second Part (June 2010 to September 2010)
Commander	Aleksandr Skvortsov, RSA	

	First spaceflight
Flight Engineer 1	Mikhail Korniyenko, RSA First spaceflight
Flight Engineer 2	Tracy Caldwell Dyson, NASA Second spaceflight
Flight Engineer 3	Fyodor Yurchikhin, RSA Third spaceflight
Flight Engineer 4	Shannon Walker, NASA First spaceflight
Flight Engineer 5	Douglas H. Wheelock, NASA Second spaceflight

Source
NASA

Backup crew

- Mikhail Tyurin
- Aleksandr Samokutyayev
- Scott J. Kelly
- Andrei Borisenko
- Paolo Nespoli
- Catherine Coleman

Incidents

Ammonia Pump Module

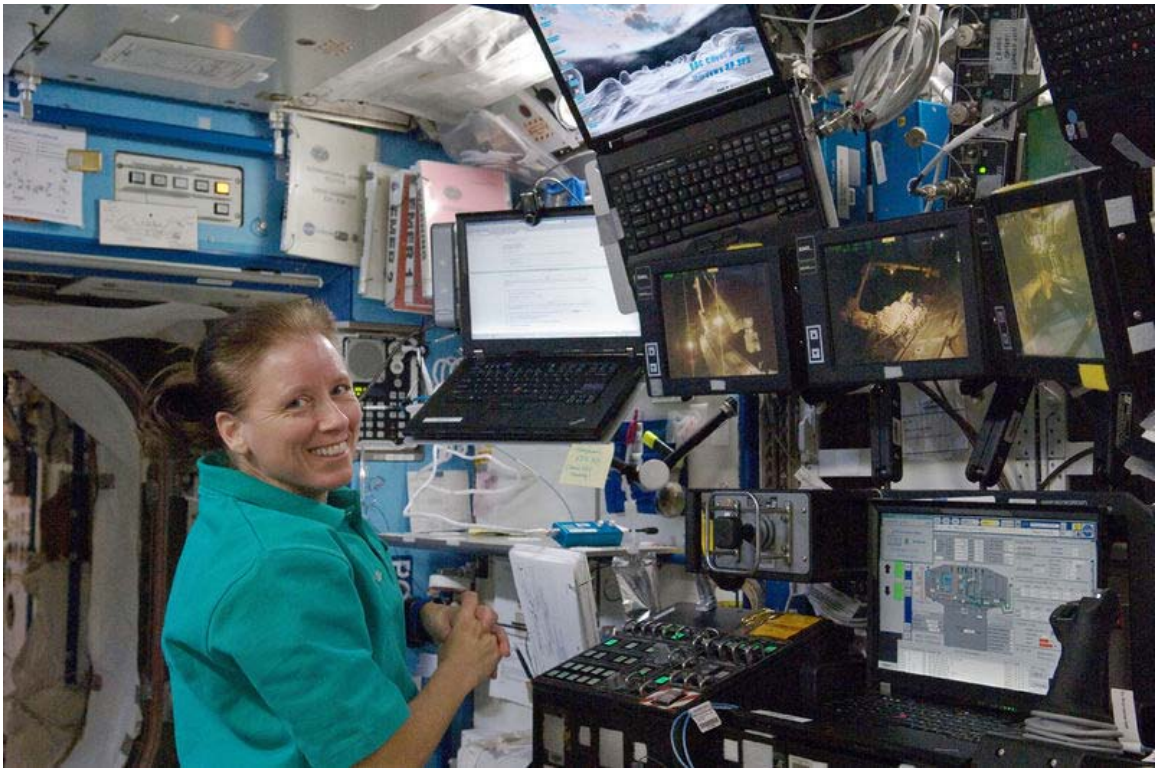
On 31 July 2010, the Expedition 24 crew was awoken by an alarm on the station. The alarm was caused by a cooling pump that had failed and caused a Remote Power Controller to trip and cut power to some of the International Space Station (ISS). Astronauts Tracy Caldwell-Dyson and Doug Wheelock performed some steps to assist ground controllers in re-powering some of the station components such as two main power buses and one Control Moment Gyroscope. After the steps had been completed Capcomm James Kelly told the crew they could go back to bed as all the work required by the crew on the ISS was complete. A short time later, another alarm sounded and awoke the crew, when the ground attempted to restart the pump module.

Docking Ring

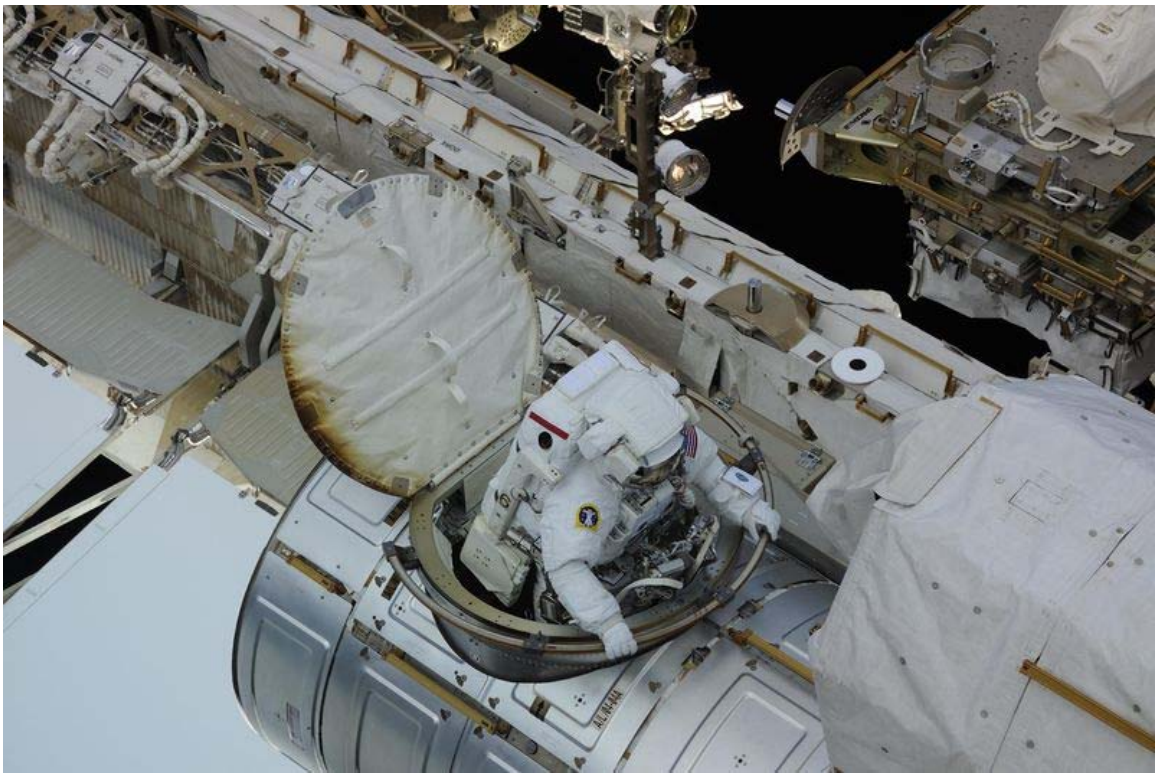
A failure in the docking ring on the Mini-Research Module 2 (MRM2) Poisk, caused a delay in the planned landing of the Soyuz TMA-18 spacecraft. Soyuz TMA-18 was originally planned to undock and land on 24 September 2010, but instead undocked less than 24 hours later on 25 September 2010. The failure is believed to be due to a faulty indication from a micro-switch on the hatch between the Soyuz and MRM2. A drive gear,

which is related to the docking mechanism was also found to have two broken teeth, and is believed to be related to the problem as well.

Spacewalks



Shannon Walker is pictured near the robotic workstation in the Destiny laboratory during the EVA 2 on 7 August 2010.



Wheelock egresses the Quest Airlock hatch on the ISS during the EVA 3 on 11 August 2010.

Three spacewalks, one in Orlan space suits and two in U.S. Extravehicular Mobility Units (EMUs) were originally planned for Expedition 24. However, additional spacewalking tasks were added to remove and replace a failed ammonia pump module.

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
Expedition 24 EVA 1 ‡	Mikhail Korniyenko Fyodor Yurchikhin	27 July 2010 04:11	27 July 2010 10:53	6 hours 42 minutes
	Korniyrnko and Yurchikhin ran three data cables between Rassvet and the Zvezda module, routing them along the Zarya module. The pair then installed cables between Rassvet and Zarya. They next moved onto relocate a camera already on Rassvet's exterior, from the zenith or space-facing side to the nadir or Earth-facing side. As their final task, Yurchikhin and Kornienko replaced a camera used for docking European Automated Transfer Vehicles to the station.			
Expedition 24 EVA 2	Douglas Wheelock Tracy Caldwell Dyson	7 August 2010 11:19	7 August 2010 19:22	8 hours 3 minutes
	Wheelock and Caldwell-Dyson disconnected electrical and fluid connectors. The spacewalkers did not complete all of the planned tasks due to a quick disconnect that got stuck and would not release. The pair had to complete a "bake-out" in order to ensure there was no ammonia on their suits before re-			

	entering the Space Station.			
Expedition 24 EVA 3	Douglas Wheelock Tracy Caldwell Dyson	11 August 2010 12:27	11 August 2010 19:53	7 hours 26 minutes
	Wheelock successfully closed the quick disconnect valve for the fourth and final fluid connector for the failed pump, and detached the final fluid line from the failed pump. Caldwell-Dyson demated five electrical and data cables while Wheelock broke torque and removed four bolts from the old pump. The pump was extracted from the truss through the use of a grapple bar and installed on a payload bracket on the Mobile Base System on the station's truss. Caldwell-Dyson then prepared the spare pump for future installation, disconnecting three of five electrical cables and reconfiguring insulation.			
Expedition 24 EVA 4	Douglas Wheelock Tracy Caldwell Dyson	16 August 2010 10:20	16 August 2010 17:40	7 hours 20 minutes
	Wheelock removed the spare pump module from an external stowage platform. The pump module was successfully installed on the S1 Truss after Wheelock attached four bolts and Caldwell Dyson mated five electrical connectors.			

‡ denotes spacewalks performed from the *Pirs* docking compartment in Russian Orlan suits.

Chapter- 14

Expedition 25 & Expedition 26

Expedition 25

Expedition 25

Mission insignia

Number of crew	6
Launch site	Baikonur Cosmodrome, Kazakhstan
Launch craft	Soyuz TMA-19, Soyuz TMA-01M
Start	25 September 2010 02:02 UTC
End	26 November 2010 04:46 UTC

(l-r) Skripochka, Kaleri, Kelly, Wheelock, Walker and Yurchikhin

Previous expedition	Next expedition
Expedition 24	Expedition 26

Expedition 25 was the twenty-fifth long-duration mission to the International Space Station (ISS). Expedition 25 began with the Soyuz TMA-18 undocking on 25 September 2010. Three new crewmembers (Scott Kelly, Alexander Kaleri and Oleg Skripochka) arrived aboard the ISS October 2010 on Soyuz TMA-01M to join Douglas Wheelock, Fyodor Yurchikhin, and Shannon Walker and formed the full six member crew of Expedition 25. NASA astronaut Doug Wheelock accepted command of Expedition 25 on 22 September 2010, taking over from Russia's Aleksandr Skvortsov. The departure of Wheelock, Walker and Yurchikhin on 25 November 2010 marked the official end of Expedition 25.

During Expedition 25 Progress M-08M spacecraft visited the ISS. Progress M-08M docked with the space station on 30 October 2010 bringing 2.5 tons of cargo supplies. Space shuttle Discovery on STS-133 mission was scheduled to arrive at the ISS on 3 November 2010 but was re-scheduled for launch on 3 February 2011. The 10th anniversary of human life, work and research on the ISS fell during Expedition 25. On 2 November 2000, Expedition 1 Commander William Shepherd and Flight Engineers Sergei Krikalev and Yuri Gidzenko became the first residents of the space station. Expedition 25 ended on November 26th.

Crew

Position	First Part (September 2010)	Second Part (October 2010 to November 2010)
Commander	Douglas H. Wheelock, NASA Second spaceflight	
Flight Engineer 1	Shannon Walker, NASA	

	First spaceflight
Flight Engineer 2	Fyodor Yurchikhin, RSA Third spaceflight
Flight Engineer 3	Scott J. Kelly, NASA Third spaceflight
Flight Engineer 4	Aleksandr Kaleri, RSA Fifth spaceflight
Flight Engineer 5	Oleg Skripochka, RSA First spaceflight

Source

NASA

Backup crew

- Andrei Borisenko - Commander
- Paolo Nespoli
- Catherine Coleman
- Anatoli Ivanishin
- Sergei Revin
- Ronald J. Garan, Jr.

Preflight preparations

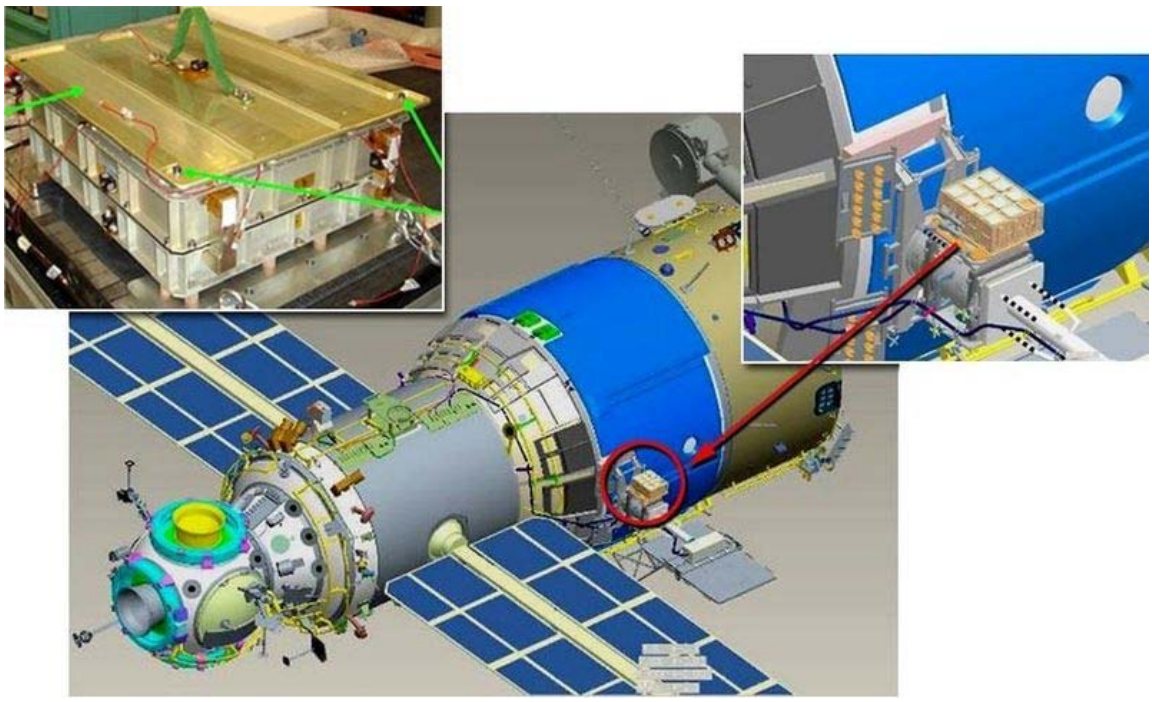
At the Baikonur Cosmodrome in Kazakhstan, Expedition 25 Soyuz Commander Alexander Kaleri, NASA Flight Engineer Scott Kelly and Russian Flight Engineer Oleg Skripochka participated in a variety of activities from 26 September to 4 October 2010 as they prepared for their launch on 8 October 2010 (7 October 2010 U.S. Eastern time) in their Soyuz TMA-01M spacecraft to the International Space Station. The footage includes the crew's arrival in Baikonur, their suited and unsuited fit checks in their Soyuz spacecraft, the raising of flags outside their Cosmonaut Hotel crew quarters and other traditional activities. The Soyuz TMA-01M spacecraft was mated to its booster in a processing facility for its rollout to the launch pad in Baikonur 5 October 2010.

The Soyuz TMA-01M spacecraft and booster rocket were moved to Launch Complex 5 (Complex 17P32-5) at Baikonur Cosmodrome on a rail-car 5 October 2010 for final preparations prior to launch.

The Soyuz TMA-01M spacecraft is rolled out by train to the launch pad.

The Soyuz TMA-01M rocket launches from the Baikonur Cosmodrome in Kazakhstan at 7:10 p.m. EDT on Thursday, October 7, 2010.

Experiments



EXPOSE-R payload.

Russian Federal Space Agency revealed that during Expedition 25 and 26, 504 sessions of 41 experiments (34 experiments from previous Expeditions and seven new experiments) are planned to be implemented. The new experiments include, Molniya-Gamma, Sprut-2, UHF-radiometry, SLS, VIRU, Test and Colon Crystal.

Experiments to be carried out include:

Field	Experiment	Notes
Life science	Sonocard, Pilot, Vzaimodeystviye, Tipologia, Pneumocard, Sprut-2, Biorisk	The Biorisk experiment aims to study the effects of microbial bacteria and fungus on structural materials used in spacecraft construction.
Geophysical research	Relaxation, Uragan, Impulse, Vsplesk, Shadow-Beacon, Molniya-Gamma	The Molniya-Gamma experiment measures gamma splashes and optical radiation during terrestrial lightning and thunder conditions.
Remote sensing	MW-radiometry, Rusalka, Zeiner, Econ	The Rusalka experiment is a test of procedures for remote determination of Methane and Carbon Dioxide content in the Earth's atmosphere.
Space	Lactolen, Biotrek,	

biotechnology	Biodegradatsia, Zhinseng-2, Structure, Constanta	
Technical research	Vektor-T, Izgib, Identification, Veterok, SLS, Sreda-MKS, Contur, VIRU, Bar, Test, RadioSkaf	
Contract activities	EXPOSE-R	Expose-R experiment is a European Space Agency (ESA) experiment designed to expose organic material to the extreme environment of space.
Study of cosmic rays	BTN-Neutron, Matryoshka-R	
Educational and humanitarian projects	MAI-75, Colon Crystal	
Space technology and material science	Crystallizator, Plasma crystal	

Mission highlights

Expedition 25 commander Douglas Wheelock in the Cupola.

Progress M-05M undocking

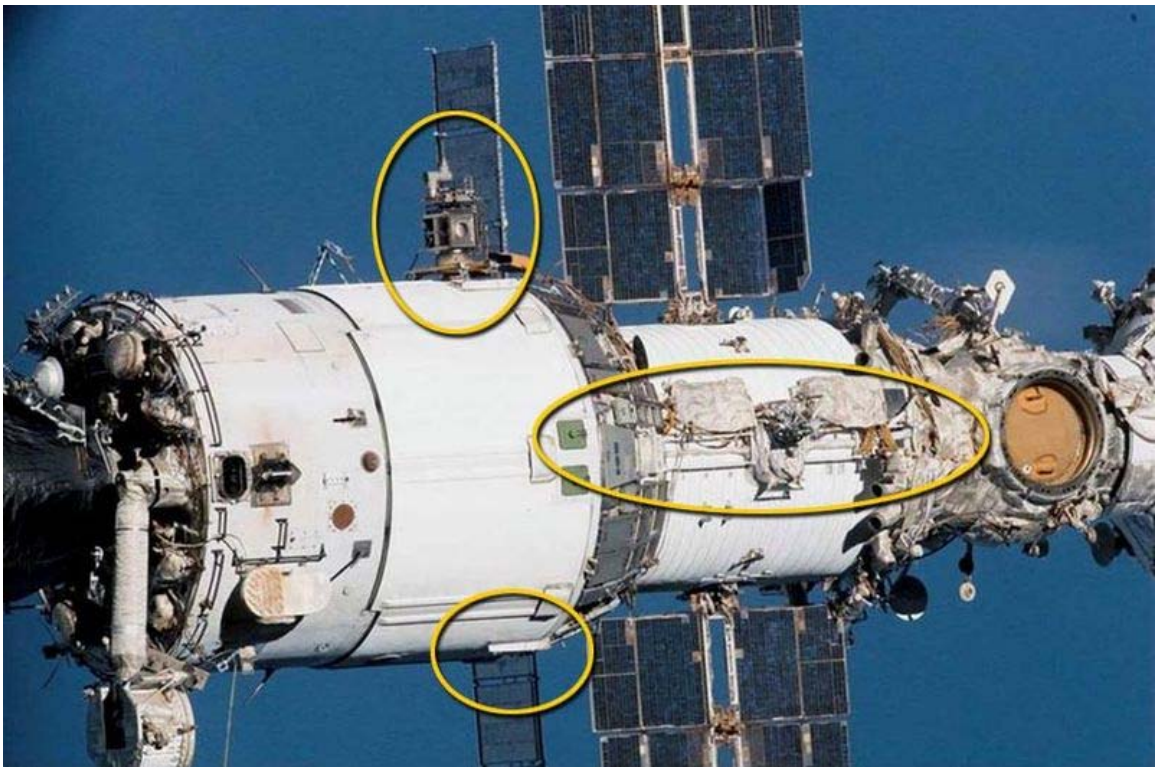
The Russian resupply spacecraft Progress M-05M, which came to the station in May 2010, was undocked on 25 October 2010 to make room for another resupply spacecraft - Progress M-08M.

Progress M-08M

Progress M-08M spacecraft delivered about 2.5 tons of cargo supplies including water, air, fuel and hardware for the Russian Molniya-Gamma and Coulomb Crystal experiments to the station.

The Soyuz-U carrier rocket with Progress M-08M, identified by NASA as Progress 40 or 40P, was launched from the Baikonur's Gagarin's launch pad at 15:11:50 UTC on 27 October 2010. After three days of autonomous flight, at 16:36 UTC on 30 October 2010 Progress M-08M docked with the Pirs module nadir port. A problem during Progress' approach to the space station forced cosmonauts on the station to intervene. During station-keeping as part of the rendezvous operations, flight controllers in Moscow instructed cosmonaut Alexander Kaleri to activate the TORU manual docking equipment and take over the piloting tasks from the Progress' autonomous KURS system. The switch to manual mode was decided at range of 194 m. Kaleri worked inside the space station's Zvezda module to fly Progress M-08M remotely using television views and a pair of joysticks and guided it to the successful docking.

Spacewalks



Russian EVA 26 worksites.

Multipurpose workstation on Zvezda module.

Fyodor Yurchikhin (Red stripes) and Oleg Skripochka (Blue stripes) participate in the spacewalk.

Mission	Spacewalkers	Start (UTC)	End (UTC)	Duration
Expedition 25 EVA 1 ‡	Fyodor Yurchikhin Oleg Skripochka	15 November 2010 14:55	15 November 2010 21:22	6 hours and 27 minutes
	Yurchikhin and Skripochka installed a portable multipurpose workstation in Plane IV in the Zvezda large diameter and installed struts between Poisk module and Zvezda module and Poisk module and Zarya module. They performed an experiment called Test, which was aimed at verifying the existence of micro organisms or contamination underneath insulation on the Russian segment of the ISS. Yurchikhin and Skripochka photographed and installed the protective cover and disconnected and removed the Plasma Pulse Injector Science hardware from the portable multipurpose workstation in Plane II of the Zvezda. They cleaned the Kontur science hardware (ROKVISS) with dry towels and then disconnected and then removed it. Yurchikhin and Skripochka also installed the protective cover and disconnected and removed the Expose-R scientific experiment from the portable multipurpose workstation in Plane II of the Zvezda module. The Kontur experiment studied remote object control capability for robotic arms and the Expose-R experiment is a European Space Agency experiment designed to expose organic material to the extreme environment of space. Yurchikhin and Skripochka installed a oft hand-rail on Pirs docking module and installed the SKK #1-M2 cassette on Poisk module. The cosmonauts also removed a television camera from the Rassvet module, however they were unsuccessful in relocating the camera due to interference with insulation where it was to be installed.			

‡ denotes spacewalks performed from the *Pirs* docking compartment in Russian Orlan suits.

Expedition 26

Expedition 26

Mission insignia

Number of crew	6
Launch craft	Soyuz TMA-01M, Soyuz TMA-20
Start	26 November 2010 04:46 UTC
End	March 2011

(l-r) Skripochka, Kaleri, Kondratyev, Nespoli, Coleman and Kelly

Previous expedition	**Next expedition**
Expedition 25	Expedition 27

The **Expedition 26** is the current mission to the International Space Station. The mission launched with one US astronaut and two Russian cosmonauts on November 26, 2010 with half of the crew of Expedition 25 coming back to Earth on board of Soyuz TMA-19.

The rest of the Expedition 26 crew - one US astronaut, one Russian cosmonaut and one ESA astronaut - joined the trio already onboard when their Soyuz TMA-20 spacecraft docked with the station on December 17, 2010. The Expedition 25 commander Douglas Wheelock handed over the station's command to Expedition 26 commander Scott Kelly on November 24, 2010.

The ESA astronaut Paolo Nespoli's mission to the space station is also named MagISStra. The name combines the word magistra, meaning "female teacher" in Latin, with the acronym ISS, as suggested by Antonella Pezzani of Italy.

The Soyuz TMA-20 spacecraft is rolled out by train on its way to the launch pad at the Baikonur Cosmodrome in Kazakhstan.

The Soyuz TMA-20 spacecraft is seen shortly after arrival to the launch pad.

Crew

Position	First Part (November 2010)	Second Part (December 2010 to March 2011)
Commander	Scott J. Kelly, NASA Third spaceflight	
Flight Engineer 1	Aleksandr Kaleri, RSA Fifth spaceflight	
Flight Engineer 2	Oleg Skripochka, RSA First spaceflight	

Flight Engineer 3	Dmitri Kondratyev, RSA First spaceflight
Flight Engineer 4	Catherine Coleman, NASA Third spaceflight
Flight Engineer 5	Paolo Nespoli, ESA Second spaceflight

Source

NASA

Backup crew

- Ronald Garan, for Kelly
- Anatoli Ivanishin, for Kondratyev
- Sergei Revin, for Skripochka
- Anton Shkaplerov, for Borisenko

Spacewalks

Two Russian spacewalks are scheduled for Expedition 26. The first, Russian EVA-27, was conducted Friday, January 21, 2011. The second spacewalk, Russian EVA-28, was conducted on 16 February 2011. Cosmonauts Oleg Skripochka and Dmitri Kondratyev conducted the two spacewalks.

Chapter- 15

Planned and Completed Expeditions to the International Space Station

Expedition 27

Expedition 27

Mission insignia

Number of crew	6 (planned)
Launch site	Baikonur Cosmondrome, Kazakhstan
Launch craft	Soyuz TMA-20, Soyuz TMA-21
Start	March 2011 (UTC)

(l-r) Garan, Nespoli, Samokutyayev, Coleman, Borisenko and Kondratyev

Previous expedition	Next expedition
Expedition 26	Expedition 28

Expedition 27 is scheduled to be the 27th expedition to the International Space Station, planned to start in March 2011.

Crew

Position	First Part (March 2011)	Second Part (April 2011 to May 2011)
Commander	Dmitri Kondratyev, RSA First spaceflight	
Flight Engineer 1	Catherine Coleman, NASA Third spaceflight	
Flight Engineer 2	Paolo Nespoli, ESA Second spaceflight	
Flight Engineer 3	Andrei Borisenko, RSA First spaceflight	
Flight Engineer 4	Aleksandr Samokutyayev,RSA First spaceflight	
Flight Engineer 5	Ron Garan, NASA Second spaceflight	

Expedition 28

Expedition 28

Mission insignia

Number of crew	6 (planned)
Launch site	Baikonur Cosmodrome, Kazakhstan
Launch craft	Soyuz TMA-21, Soyuz TMA-02M
Start	May 2011 (UTC)

(l-r) Furukawa, Fossum, Garan, Samokutyayev, Volkov and Borisenko

Previous expedition	**Next expedition**
Expedition 27	Expedition 29

Expedition 28 is scheduled to be the 28th expedition to the International Space Station, planned for launch in May 2011.

Crew

Position	First Part (May 2011)	Second Part (June 2011 to September 2011)
Commander	Andrei Borisenko, RSA First spaceflight	
Flight Engineer 1	Aleksandr Samokutyayev,RSA First spaceflight	
Flight Engineer 2	Ron Garan , NASA Second spaceflight	
Flight Engineer 3		Sergei Volkov,RSA Second spaceflight
Flight Engineer 4		Mike Fossum, NASA Third spaceflight
Flight Engineer 5		Satoshi Furukawa , JAXA First spaceflight

Source
NASA

Expedition 29

Expedition 29	
Number of crew	6 (planned)
Launch site	Baikonur Cosmodrome, Kazakhstan
Launch craft	Soyuz TMA-02M, Soyuz TMA-22
Start	September 2011 (UTC)

Previous expedition	Next expedition
Expedition 28	Expedition 30

Expedition 29 is scheduled to be the 29th expedition to the International Space Station, planned for launch in September 2011.

Crew

Position	First Part	Second Part

	(September 2011)	(September 2011 to December 2011)
Commander	Mike Fossum, NASA Third spaceflight	
Flight Engineer 1	Satoshi Furukawa, JAXA First spaceflight	
Flight Engineer 2	Sergei Volkov, RSA Second spaceflight	
Flight Engineer 3		Anton Shkaplerov,RSA First spaceflight
Flight Engineer 4		Sergei Revin, RSA First spaceflight
Flight Engineer 5		Dan Burbank, NASA Third spaceflight

Source
NASA

Expedition 30

Expedition 30	
Number of crew	6 (planned)
Launch site	Baikonur Cosmodrome, Kazakhstan
Launch craft	Soyuz TMA-22, Soyuz TMA-03M
Start	December 2011 (UTC)

Previous expedition	Next expedition
Expedition 29	Expedition 31

Expedition 30 is scheduled to be the 30th expedition to the International Space Station with a start date of December 2011.

Crew

Position	First Part (December 2011)	Second Part (December 2011 to March 2012)
Commander	Dan Burbank, NASA Third spaceflight	

Flight Engineer 1	Anton Shkaplerov, RSA First spaceflight
Flight Engineer 2	Sergei Revin, RSA First spaceflight
Flight Engineer 3	Oleg Kononenko,RSA Second spaceflight
Flight Engineer 4	André Kuipers, ESA Second spaceflight
Flight Engineer 5	Don Pettit, NASA Third spaceflight

Source
NASA

Expedition 31

Expedition 31	
Number of crew	6 (planned)
Launch site	Baikonur Cosmodrome, Kazakhstan
Start	March 2012 (UTC)

Previous expedition	**Next expedition**
Expedition 30	Expedition 32

Expedition 31 is scheduled to be the thirty-first expedition to the International Space Station.

Crew

Position	**First Part (March 2012)**	**Second Part (March 2012 to May 2012)**

Commander	Oleg Kononenko, RSA Second spaceflight
Flight Engineer 1	André Kuipers, ESA Second spaceflight
Flight Engineer 2	Don Pettit, NASA Third spaceflight
Flight Engineer 3	Joseph M. Acaba, NASA Second spaceflight
Flight Engineer 4	Gennady Padalka, RSA Fourth spaceflight
Flight Engineer 5	Konstantin Valkov, RSA First spaceflight

Source
NASA

Expedition 32

Expedition 32	
Number of crew	6 (planned)
Launch site	Baikonur Cosmodrome, Kazakhstan
Start	May 2012 (UTC)

Previous expedition	**Next expedition**
Expedition 31	Expedition 33

Expedition 32 is scheduled to be the thirty-second expedition to the International Space Station.

Crew

Position	First Part (May 2012)	Second Part (May 2012 to September 2012)
Commander	Gennady Padalka, RSA Fourth spaceflight	
Flight Engineer 1	Joseph M. Acaba, NASA Second spaceflight	
Flight Engineer 2	Konstantin Valkov, RSA First spaceflight	
Flight Engineer 3		Sunita Williams, NASA Second spaceflight
Flight Engineer 4		Yuri Malenchenko, RSA Fifth spaceflight
Flight Engineer 5		Akihiko Hoshide, JAXA Second spaceflight

Source
NASA

Expedition 33

Expedition 33	
Number of crew	6 (planned)
Launch	September 2012
Launch site	Baikonur Cosmodrome, Kazakhstan

Previous expedition	Next expedition
Expedition 32	Expedition 34

Expedition 33 is scheduled to be the thirty-third expedition to the International Space Station.

Crew

Position	First Part (September 2012)	Second Part (September 2012 to November 2012)
Commander	Sunita Williams, NASA Second spaceflight	
Flight Engineer 1	Yuri Malenchenko, RSA	

	Fifth spaceflight
Flight Engineer 2	Akihiko Hoshide, JAXA Second spaceflight
Flight Engineer 3	Kevin A. Ford, NASA Second spaceflight
Flight Engineer 4	Oleg Novitskiy, RSA First spaceflight
Flight Engineer 5	Evgeny Tarelkin, RSA First spaceflight

Source
NASA

Expedition 34

Expedition 34	
Number of crew	6 (planned)
Launch	November 2012
Launch site	Baikonur Cosmodrome, Kazakhstan

Previous expedition	**Next expedition**
Expedition 33	Expedition 35

Expedition 34 is scheduled to be the thirty-fourth expedition to the International Space Station.

Crew

Position	**First Part** **(November 2012)**	**Second Part** **(November 2012 to March 2013)**
Commander	Kevin A. Ford, NASA Second spaceflight	
Flight Engineer 1	Oleg Novitskiy, RSA First spaceflight	
Flight Engineer 2	Evgeny Tarelkin, RSA First spaceflight	
Flight Engineer 3	Thomas Marshburn, NASA Second spaceflight	

Flight Engineer 4	Chris Hadfield, CSA Third spaceflight
Flight Engineer 5	Roman Romanenko, RSA Second spaceflight

Source
NASA

Expedition 35

Expedition 35	
Number of crew	6 (planned)
Launch site	Baikonur Cosmodrome, Kazakhstan
Start	March 2013

Previous expedition	Next expedition
Expedition 34	Expedition 36

Expedition 35 is the 35th long duration mission to the International Space Station (ISS). The expedition will start in March 2013, when the Expedition 34 crew departs from the ISS. This will mark the first time a Canadian astronaut - Colonel Chris Hadfield - will be in command of the Station.

Crew

Position	First Part (March 2013)	Second Part (March 2013 to May 2013)
Commander	Chris Hadfield, CSA Third spaceflight	
Flight Engineer 1	Thomas Marshburn, NASA Second spaceflight	
Flight Engineer 2	Roman Romanenko, RSA Second spaceflight	
Flight Engineer 3	Christopher Cassidy, NASA Second spaceflight	
Flight Engineer 4	Pavel Vinogradov, RSA Fourth spaceflight	
Flight Engineer 5	Aleksandr Misurkin, RSA	

First spaceflight

Source

NASA

Expedition 36

Expedition 36	
Number of crew	6 (planned)
Launch	May 2013
Launch site	Baikonur Cosmodrome, Kazakhstan

Previous expedition	Next expedition
Expedition 35	Expedition 37

Expedition 36 is scheduled to be the thirty-sixth expedition to the International Space Station.

Crew

Position	First Part (May 2013)	Second Part (May 2013 to September 2013)
Commander	Pavel Vinogradov, RSA Fourth spaceflight	
Flight Engineer 1	Aleksandr Misurkin, RSA First spaceflight	
Flight Engineer 2	Chris Cassidy, NASA Second spaceflight	
Flight Engineer 3		Karen L. Nyberg, NASA Second spaceflight
Flight Engineer 4		Maksim Surayev, RSA Second spaceflight
Flight Engineer 5		Luca Parmitano, ESA First spaceflight

Sources

NASA

Expedition 37

Expedition 37	
Number of crew	6 (planned)
Launch	September 2013
Launch site	Baikonur Cosmodrome, Kazakhstan

Previous expedition	Next expedition
Expedition 36	Expedition 38

Expedition 37 is scheduled to be the thirty-seventh expedition to the International Space Station.

Crew

Position	First Part (September 2013)	Second Part (September 2013 to November 2013)
Commander	Maksim Surayev, RSA Second spaceflight	
Flight Engineer 1	Karen L. Nyberg, NASA Second spaceflight	
Flight Engineer 2	Luca Parmitano, ESA First spaceflight	
Flight Engineer 3		Oleg Kotov, RSA Third spaceflight
Flight Engineer 4		Sergey Ryazansky, RSA First spaceflight
Flight Engineer 5		Michael S. Hopkins, NASA First spaceflight

Sources

NASA , ESA

Expedition 38

Expedition 38	
Number of crew	6 (planned)
Launch	November 2013
Launch site	Baikonur Cosmodrome, Kazakhstan

Previous expedition	Next expedition
Expedition 37	Expedition 39

Expedition 38 is scheduled to be the thirty-eighth expedition to the International Space Station.

Crew

Position	First Part (November 2013)	Second Part (November 2013 to March 2014)
Commander	Oleg Kotov, RSA Third spaceflight	
Flight Engineer 1	Sergey Ryazansky, RSA First spaceflight	
Flight Engineer 2	Michael S. Hopkins, NASA First spaceflight	
Flight Engineer 3		Koichi Wakata, JAXA Fourth spaceflight
Flight Engineer 4		Richard Mastracchio, NASA Fourth spaceflight
Flight Engineer 5		TBD

Sources

JAXA , NASA , ESA

Expedition 39

Expedition 39	
Number of crew	6 (planned)
Launch	March 2014
Launch site	Baikonur Cosmodrome, Kazakhstan

Previous expedition	Next expedition
Expedition 38	Expedition 40

Expedition 39 is scheduled to be the thirty-ninth expedition to the International Space Station.

Crew

Position	First Part (March 2014)	Second Part (March 2014 to May 2014)
Commander	Koichi Wakata, JAXA Fourth spaceflight	
Flight Engineer 1	Richard Mastracchio, NASA Fourth spaceflight	
Flight Engineer 2	TBD	
Flight Engineer 3		TBD
Flight Engineer 4		TBD
Flight Engineer 5		TBD

Source

JAXA , NASA