

A SPACE FOR SCIENCE, EXPERIMENTS AND UNITY

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The International Space Station (ISS) is a landmark of international cooperation. For over 20 years, it has seen intense collaboration between the U.S., Russia, the EU, Japan and Canada, and has played host to people from 19 countries since its launch in 1998. This scenario appears to be coming to an end, as Russian space agency Roscosmos's chief has declared that Russia is ready to build its own space station and launch it by 2030 if President Vladimir Putin would give the go ahead. Further, in an interview to Russian TV, Deputy Prime minister Yuri Borisov said Russia would give notice and leave the ISS by 2025.

The idea of the ISS was born in 1984 when Ronald Reagan, then the US President, announced it in a State of the Union address. "Our progress in space, taking giant steps for all mankind, is a tribute to American teamwork and excellence. Our finest minds in government, industry and academia have all pulled together. And we can be proud to say: We are first; we are the best; and we are so because we're free," he said. In his speech, he outlined the idea of international cooperation in this venture, as he announced: "A space station will permit quantum leaps in our research in science, communications, and in metals and lifesaving medicines which could be manufactured only in space. We want our friends to help us meet these challenges and share in their benefits. NASA will invite other countries to participate so we can strengthen peace, build prosperity, and expand freedom for all who share our goals."

Since then, the ISS project saw a collaboration grow between several countries, mainly the following space agencies: NASA (U.S.), Roscosmos (Russia), ESA (Europe), JAXA (Japan) and CSA (Canada). Though the programme began in 1993, the construction of the station started only in 1998.

The ISS has been assembled section by section over several years. The first segment was launched on November 20, 1998 in a Russian proton rocket named Zarya (which means 'sunrise'). The first human expedition to the station was launched in a Soyuz TM 31 rocket from Baikonur Cosmodrome in Kazakhstan. This crew became the very first to inhabit the ISS — these were NASA astronaut Bill Shepard and Yuri Gidzenko and Sergei Krikalev from Roscosmos, who reached the station on November 2, 2000 and stayed for several months.

The assembling of the ISS has been a complex undertaking in itself. It took over 10 years and over 30 missions to bring it to its present form. Though the basic unit was launched in 1998, a photograph of the station taken in September 2000 from spaceship Atlantis looked markedly different from a picture taken in October 2018 by Expedition 56 members after undocking in a Soyuz spacecraft. Installation of different parts took place on close to 40 different occasions from 1998 to 2020.

Human presence

One of the most spectacular achievements of the ISS is that ever since November 2, 2000, it has seen the steady presence of human beings. So far, 240 individuals from 19 countries have visited the ISS, including from Malaysia and the UAE. Most have been from the U.S., numbering 151; Russia has sent 48 people; Japan 9; Canada 8 and so on. In the realm of science fiction, the sight of the ISS hurtling through space at a speed of 28,000 km per hour is something that can be watched from the Earth and wondered at. According to Niruj Mohan Ramanujan, a radio-astronomer who is with Indian Institute of Astrophysics, "If the ISS flies over your location a bit before sunrise or a bit after sunset, for those few minutes, it is usually the brightest object in the

sky.” There are apps that indicate where exactly it is in the sky at any time.

The length of the ISS is just about a metre short of the length of an American football field at 109 m. It has a habitable volume of 388 cu. m. and includes six sleeping quarters, two toilets and a gym. It weighs 419,725 kg, which to give a perspective, is the weight of 1,090 cows.

The ISS, at a height of about 402 km above the Earth, orbits it 16 times every day, once every 90 minutes. Over a period of 24 hours, the people inhabiting the ISS see 16 sunrises and sunsets.

The ISS’s recent tweet celebrated the conclusion of the 64th expedition that began in October 2020 and ended on Friday April 23, after approximately six months. It said: “There was a change of guard this week onboard the station. Expedition 64 concluded their mission and returned to Earth, and the Crew-2 astronauts docked with the station on Saturday.” With the ending of Expedition 64, NASA astronaut Kate Rubins and Roscosmos cosmonauts Sergei Rhyzikov and Sergey Kud-Sverchokov returned to Earth on a Soyuz MS-17 spacecraft. Crew-2 members, NASA’s Shane Kimbrough, Megan McArthur, JAXA’s Akihiko Hoshide and ESA’s Thomas Pesquet joined the others in the ISS and until the Crew-1 astronauts, NASA’s Shannon Walker, Michael Hopkins, Victor Glover and Jaxa’s Soichi Noguchi return, there will be 11 crew members onboard the ISS.

The first experiments were those that studied the dynamics of cells under microgravity. Some of the experiments being conducted by the latest expeditions include a study of how muscles work under long-term stay under low-gravity conditions. This is an experiment by ESA and observes biochemical properties of muscles under long-term exposure to spaceflight. This can help in developing rehabilitation both on Earth and in Space. Another experiment mimics the way geckos attach themselves to surfaces, using an adhesive that has been shown to work in space. This can help devise methods for robots to attach themselves to surfaces and then to detach just the way geckos do.

Physics experiments

Some of the early physical sciences experiments related to crystal growth. The newer ones study the behaviour of free-flying soccer balls in microgravity. More exotic sounding subjects include Janus particles, or particles that have two ‘faces’ with distinct properties — one side is hydrophobic and avoids water, while the other is hydrophilic and loves water. Studying these in microgravity reveals the fundamental physics behind microparticle self- assembly and the kinds of colloidal structures that can be fabricated.

Do these experiments justify the amount of money that is spent on the ISS? There is a debate. It costs NASA about \$3 billion to \$4 billion a year just to maintain the station, and the total spending had gone up to \$100 billion in 2018 itself. Would it be more fruitful to invest in space-based telescopes or missions other than the ISS? Under the Donald Trump administration, the U.S. reached out to private firms to participate in the space expeditions. American space research had been a governmental activity until this development. This showed NASA the way to cut the huge payments it had been making to Russia to ferry astronauts back and forth. The commercial equation was disrupted once again.

For over 20 years, the ISS has remained an ideal of global unity and peace, at least in the realms of space. Will there be another such expensive investment in the areas of science and technology? There is no answer now, but, so far, the ISS is unique in being one such ideal.

In Focus

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