

# The Space Station

Tanvi Dilip Challirwar

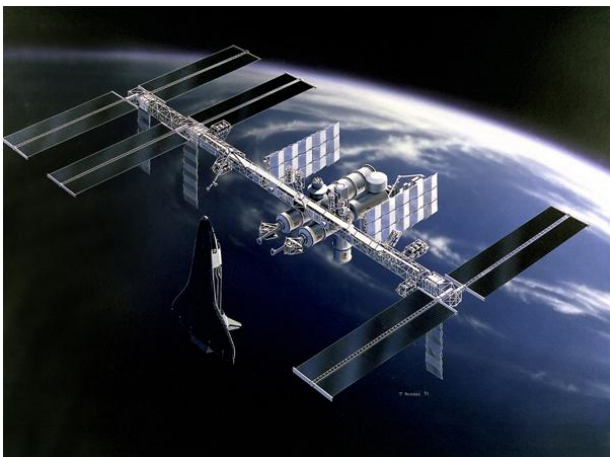
B. E. Mechanical, Gokhale education Society College of Engineering, Nashik, Maharashtra, India

**Abstract:** A space station, also known as orbital space station, is a spacecraft capable of supporting crewmembers, which is designed to remain in space (most commonly as an artificial satellite in low Earth orbit) for an extended period of time and for other spacecraft to dock. India's broadening spaceflight ambitions now include a longer-term presence in Earth's orbit. Indian Space Research Organization Chief K Sivan recently revealed plans to launch a space station around 2030. It will be a relatively small station where astronauts would only stay for 15 to 20 days, but that should be enough to allow microgravity experiments. Apart from the partner countries involved with the International Space Station, only China, Russia and the US have operated orbital homes away from home. It also shows that India intends to catch up on many aspects of space flight it fully intends on competing with spaceflight veterans. In this paper we summarize the development of Indian space station.

**Keywords:** Space station, Indian space station, artificial satellite, Almaz and Salyut series, Skylab, Mir, Tiangong 1, Tiangong 2.

## 1. Objectives

- To understand the concept of space station.
- To understand how the Indian space station is going to get build.
- To know the difference between the other space stations and the Indian space station.



## 2. Introduction

A **space station**, also known as an **orbital station** or an **orbital space station**. A space station is distinguished

from other spacecraft used for human spaceflight by lack of major propulsion or landing systems. Instead, other vehicles transport people and cargo to and from the station. As of 2018, one fully functioning space station is in Earth orbit: the International Space Station (operational and permanently inhabited). Previous stations include the Almaz and Salyut series, Skylab, Mir, Tiangong-1 and Tiangong-2.

Today's space stations are research platforms, used to study the effects of long-term space flight on the human body as well as to provide platforms for greater number and length of scientific studies than available on other space vehicles. Each crew member stays aboard the station for weeks or months, but rarely more than a year. Since the ill-fated flight of Soyuz 11 to Salyut 1, all human spaceflight duration records have been set aboard space stations. India is expected to conduct a human spaceflight through Gaganyaan program by 2021 and has announced to follow with a space station. The duration record for a single spaceflight is 437.75 days, set by Valeri Polyakov aboard *Mir* from 1994 to 1995. As of 2016, four cosmonauts have completed single missions of over a year, all aboard *Mir*. Space stations have also been used for both military and civilian purposes. The last military-use space station was Salyut 5, which was used by the Almaz program of the Soviet Union in 1976 and 1977.



Figure 1: The Space Station

Volume 8 Issue 8, August 2019

[www.ijsr.net](http://www.ijsr.net)

Licensed Under Creative Commons Attribution CC BY

### History

Space stations have been envisaged since at least as early as 1869 when Edward Everett Hale wrote "The Brick Moon". The first to give serious consideration to space stations were Konstantin Tsiolkovsky in the early 20th century and Hermann Oberth about two decades later. In 1929 Herman Potočnik's *The Problem of Space Travel* was published, the first to envision a "rotating wheel" space station to create artificial gravity. During the Second World War, German scientists researched the theoretical concept of an orbital weapon based on a space station. Pursuing Oberth's idea of a space-based weapon, the so-called "sun

gun" was a concept of a space station orbiting Earth at a height of 8,200 kilometres (5,100 mi), with a weapon that was to utilize the sun's energy.

## 3. The Four Space Stations

### 3.1 Almaz and Salyut series

#### (a) Almaz



Figure 2.1: (a) Almaz space station

The **Almaz** program was a highly secret Soviet military space station program, begun in the early 1960s. Three crewed military reconnaissance stations were launched between 1973 and 1976: Salyut 2, Salyut 3 and Salyut 5. To cover the military nature of the program the three launched Almaz stations were designated as civilian Salyut space stations. As part of the Almaz program, the Soviets developed several spacecraft for support roles—the VA

spacecraft, the Functional Cargo Block and the TKS spacecraft—which they planned to use in several combinations. The heritage of the Almaz program continues, with the ISS module Zarya being one example.

#### (b) Salyut series



Figure 2.1: (b) Salyut series

The **Salyut programme** was the first space station programme, undertaken by the Soviet Union. It involved a series of four crewed scientific research space stations and two crewed military reconnaissance space stations over a period of 15 years, from 1971 to 1986.

Two other Salyut launches failed. In one respect, Salyut had the task of carrying out long-term research into the problems of living in space and a variety of astronomical, biological and Earth-resources experiments, and on the other hand the

USSR used this civilian program as a cover for the highly secretive military Almaz stations, which flew under the Salyut designation. Salyut 1, the first station in the program, became the world's first crewed space station.

### 2.2 Skylab space station



**Figure 2.2:** Skylab space station

**Skylab** was the first space station launched and operated by NASA, occupied for about 24 weeks between May 1973 and February 1974. It was the only space station that the United States has operated exclusively. It fell back to Earth amid worldwide media attention in 1979. Skylab included a workshop, a solar observatory, and several hundred life science and physical science experiments.

Skylab included the Apollo Telescope Mount (a multi-spectral solar observatory), a multiple docking adapter with two docking ports, an airlock module with extravehicular activity (EVA) hatches, and the orbital workshop, the main habitable space inside Skylab. Electrical power came from solar arrays and fuel cells in the docked Apollo CSM. The rear of the station included a large waste tank, propellant tanks for manoeuvring jets, and a heat radiator. Astronauts conducted numerous experiments aboard Skylab during its operational life.

### 2.3 Mir space station



**Figure 2.3:** Mir space station

**Mir** was a space station that operated in low Earth orbit from 1986 to 2001, operated by the Soviet Union and later by Russia. Mir was the first modular space station and was assembled in orbit from 1986 to 1996. It had a greater mass than any previous spacecraft. At the time it was the largest artificial satellite in orbit, succeeded by the International Space Station (ISS) after Mir's orbit decayed. The station

served as a microgravity research laboratory in which crews conducted experiments in biology, human biology, physics, astronomy, meteorology, and spacecraft systems with a goal of developing technologies required for permanent occupation of space.

Mir was the first continuously inhabited long-term research station in orbit and held the record for the longest continuous human presence in space at 3,644 days, until it was surpassed by the ISS on 23 October 2010. It holds the record for the longest single human spaceflight, with Valeri Polyakov spending 437 days and 18 hours on the station between 1994 and 1995. Mir was occupied for a total of twelve and a half years out of its fifteen-year lifespan, having the capacity to support a resident crew of three, or larger crews for short visits.

### 2.4 Tiangong 1 space station



**Figure 2.4:** Tiangong 1 space station

**Tiangong-1** was China's first prototype space station. It orbited Earth from September 2011 to April 2018, serving as both a manned laboratory and an experimental testbed to demonstrate orbital rendezvous and docking capabilities during its two years of active operational life.

Launched unmanned aboard a Long March 2F/G rocket on 29 September 2011, it was the first operational component of the Tiangong program, which aims to place a larger, modular station into orbit by 2023. Tiangong-1 was initially projected to be deorbited in 2013,<sup>1</sup> to be replaced over the following decade by the larger Tiangong-2 and Tiangong-3 modules, but it orbited until 2 April 2018.

On 21 March 2016, after a lifespan extended by two years, the China Manned Space Engineering Office announced that Tiangong-1 had officially ended its service. They went on to state that the telemetry link with Tiangong-1 had been lost. A couple of months later, amateur satellite trackers watching Tiangong-1 found that China's space agency had lost control of the station.

### 2.5. Tiangong 2 space station



**Figure 2.5:** Tiangong 2 space station

Tiangong-2 was originally expected to be launched by the China National Space Agency by 2015 to replace the prototype module Tiangong-1, which was launched in September 2011. In March 2011, Chinese officials stated that Tiangong-2 was scheduled to be launched by 2015. An uncrewed cargo spacecraft will dock with the station, allowing for resupply. In September 2014, its launch was postponed to September 2016. Plans for visits in October

2016 by the crewed mission Shenzhou 11 and the uncrewed resupply craft Tianzhou were made public. The station was successfully launched from Jiuquan aboard a Long March 2F rocket on 15 September 2016. Shenzhou 11 successfully docked with Tiangong-2 on 19 October 2016.

## 2.6. Indian space station



**Figure 2.6:** Indian space station

In one of the most ambitious projects ever undertaken by India, the country is planning to launch its own space station. India is targeting 2030 as the date to launch a 20 tonne space station, which will most likely be used to conduct microgravity experiments. The preliminary plan for the space station is to accommodate astronauts for upto 15-20 days in space, but specific details will emerge after the maiden manned mission, Gaganyaan, is complete.

ISRO says there will be no collaboration with any other country for this project. The only countries that have had space stations so far are the US, Russia, China and a consortium of nations that own the International Space Station.

The space station project will be an extension of the Gaganyaan mission.

"We have to sustain the Gaganyaan programme after the launch of (the) human space mission. In this context, India is planning to have its own space station," Mr Sivan the chief of ISRO told reporters in New Delhi.

The government has already cleared a budget of Rs. 10,000 crore for the Gaganyaan mission. There would be two flights from Andhra Pradesh's Sriharikota without the crew before the maiden flight with crew sometime in 2022.

### 3. Conclusion

In this paper we define the concept of various space stations, its various parts, their function. The space station storied history is vast and well documented. Understanding the design and operations of this unique and complex structure is not confined to the study of one program, but of many. It touches on only a handful of the lessons that were learned through the various supersonic and hypersonic research programs that laid the space station.

### References

- [1] Mann, Adam (January 25, 2012). "Strange Forgotten Space Station Concepts That Never Flew". Wired. Retrieved January 22, 2018
- [2] "Space Settlements: A Design Study". NASA. 1975. Retrieved 10 February 2018
- [3] "India eying an indigenous station in space". The Hindu Business Line. June 13, 2019. Retrieved June 13, 2019
- [4] "India's own space station to come up in 5-7 years: Isro chief - Times of India". The Times of India. Retrieved 2019-06-13