

# GAGANYAAN: THE MISSION TO SEND INDIANS TO SPACE IS ON TRACK

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The crew module of the Gaganyaan mission.

The target to launch the Gaganyaan mission and send a “son or a daughter of India to space from Indian soil by an Indian vehicle by 2022 to mark the 75th year of Indian independence”, as envisioned by Prime Minister Narendra Modi in his 2018 Independence Day speech might have not seen the light of the day.

Various factors ranging from difficulties in the realisation of complex technologies to COVID-19 and disruptions in global supply chains due to the Russia-Ukraine conflict have upset the plans.

Nonetheless, the Indian Space Research Organisation (ISRO), over the last three and half years, has developed and realised various technologies towards making India the fourth country in the world to launch a human space flight mission after the US, Russia and China.

The Gaganyaan mission aims to demonstrate the capability to launch human beings (three crew members) to low earth orbit and bring them back safely to earth by landing them in either the Bay of Bengal or the Arabian Sea.

For the Gaganyaan mission, four astronauts who have been selected have completed the first semester of crew training and are undergoing Gaganyaan Mission-specific training at the Astronaut Training Facility in Bengaluru.

According to the ISRO, the first semester of the crew training and 39 weeks of training activities have so far been successfully completed.

The astronauts, who were selected from a pool of Indian Air Force test pilots, have been given 218 lectures by both the ISRO and the Indian Institute of Science faculty, and have also undergone 75 physical training sessions. Besides, two flying practices, comprising 12 hours have been completed along with medical and course evaluations.

Between early 2020 and mid-2021, they underwent generic space flight training at Gagarin Cosmonaut Training Centre in Russia.

The Launch Vehicle Mark-3 (LVM3) is the launch vehicle for the Gaganyaan mission. According

to the ISRO, all systems in the LVM3 launch vehicle are reconfigured to meet human rating requirements and named Human Rated LVM3 (HLVM3).

“HLVM3 consists of Crew Escape System (CES) powered by a set of quick acting, high burn rate solid motors which ensures that Crew Module along with the crew is taken to a safe distance in case of any emergency either at launch pad or during ascent phase,” states the space agency on the rocket chosen for the mission.

According to the Department of Space annual report 2022-2023, the launch vehicle structures have been redesigned to meet the required human rating factor. Solid motor segments required for the static test were realised, and successful static testing of the HS200 motor was completed.

On April 6, a major milestone was completed as the final long-duration hot test of the human-rated L110-G Vikas Engine was successfully accomplished.

“The successful completion of this test marks a major milestone in the human space flight programme, Gaganyaan, of ISRO. With this test, all the planned qualification tests of the engine are completed successfully,” the ISRO said.

Prior to the first crewed flight, three test vehicles (TV) flights have been planned TV-1, TV-2 and TV-3, which, according to ISRO, are envisaged to demonstrate and validate the characteristics and performance of the Crew Escape System and parachute-based deceleration systems. The ISRO has already completed the mission design for the first test vehicle mission.

“This year-end, we are planning an unmanned test, and at the beginning of next year, one more unnamed flight will carry the humanoid VyomMitra. Subsequently, we will go for the manned flight,” said an ISRO Official.

In the Gaganyaan mission, the Orbiter Module will orbit the Earth, and it consists of Crew Module (CM) and Service Module (SM). It is designed to keep the crew safe during ascent, orbital phase, and re-entry.

“The CM is the habitable space with the Earth-like environment in space for the crew. It houses crew interfaces, human-centric products, life support systems, avionics and deceleration systems. It is also designed for re-entry to ensure the safety of the crew during descent till touchdown. SM will be used to provide the necessary support to CM while in orbit. It is an unpressurized structure containing thermal system, propulsion system, power systems, avionics systems and deployment mechanisms,” states ISRO.

The design of various systems of CM and SM have been completed.

On April 5, the space agency successfully completed the System Demonstration Model tests for Crew Module Propulsion System for the Gaganyaan programme.

“Completing this test is a major step in qualifying the Crew Module Propulsion System for the Gaganyaan programme,” the space agency said.

Besides, the ISRO has received the crew module structure simulated assembly for the Integrated Air-Drop Test (IADT) meant for validating the sequence and performance of parachute systems in the Gaganyaan mission.

In February, along with the Indian Navy, the ISRO carried out initial recovery trials of the Crew

Module. The trials were part of the preparation for crew module recovery operations for the Gaganyaan mission that will be carried out in Indian waters.

The Gaganyaan mission also requires the support of ground stations from around the world for telemetry, tracking and command operations.

The Department of Space annual report 2022-2023 said that a detailed Mission Requirements Document describing the overall requirements of Gaganyaan regarding Direct-to-Ground communications support from European Space Agency ground stations has been finalised.

“Technical Implementation Plan is in progress. The requirement for Ship Borne Terminals for the ascent phase and orbit circularisation has been firmed up. A requirement note on Ship Borne Terminal and Transportable Terminal requirements for the Gaganyaan mission comprising of Transportable LEA deck with CES avionics Terminals in Ships, Cocos island and Helical Antennas and associated communication equipment, including VSAT terminals etc., are generated,” states the report.

It said that an implementation arrangement between ISRO and the Australian Space Agency has been signed by both parties for establishing and operating the Transportable Terminal at Cocos Island.

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