Astronaut Selection for India's Gaganyaan Mission

Mains: *GS-III – Science & Technology | Space*

Why in news?

As India prepares for its first human spaceflight mission, developing indigenous expertise in astronaut selection and training is strengthening long-term space capabilities while advancing bioastronautics, the study of human health and behaviour in space.

Why have space agencies traditionally selected test pilots as astronauts?

- **Karman line** – It is an imaginary line 100 km above sea level and is widely regarded as the boundary at which space begins, and anyone who crosses it is considered an astronaut.
- **Early astronauts** – Historically, space agencies have sent military test pilots as the first astronauts because they are highly skilled persons who fly newly developed, modified or experimental aircraft to evaluate performance.
- They routinely interact with aerospace engineers and help in identifying any design flaws in the aircraft.
- **Test pilots** – They are known for their ability to stay calm, make quick decisions, and have undergone very rigorous training to survive exigencies like high acceleration conditions or sudden cabin depressurisation.

How does one become a spacefarer?

- **Anyone can fly** – Once a space agency has proven a launch system and matured it through test flights, it selects scientists, doctors, and engineers as mission specialists.
- With proper training and safety preparation, civilians and private citizens can fly to space, too.
- **No criteria** – There are no universal criteria to become a spacefarer. However, there are certain requirements regarding their age, height, weight, medical condition, and fitness, although they may also vary from one agency to the next.
- **Health & fitness requirements** – There is no weight limit, but some agencies require a healthy body mass index and compatible body measurements.
- In fact, good health, psychological stability, relevant education, technical skills, and professional experience are essential.
- **Varied age criteria** – The upper and lower age limits also differ; NASA has not specified a formal age restriction, but other agencies may do so.
- The youngest person so far to go to space is the Dutch pilot Oliver Daemen, who was 18 years old at the time of his feat in 2021.

- The oldest spacefarer was U.S. astronaut Ed Dwight, at 90 years old in 2024. Both flights were suborbital missions operated by U.S. aerospace company Blue Origin.

How did ISRO pick astronauts for Gaganyaan?

- **Rigorous selection process** – The selection process, executed by the Indian Space Research Organisation (ISRO) and the Indian Air Force (IAF), was multi-tiered and highly rigorous.
- **Role of IAM** – The Institute of Aerospace Medicine (IAM), Bengaluru, handled the evaluation, as its researchers have experience dealing with the human body when it is subjected to extreme physiological and psychological stress.
- The IAF also selected Wg. Cdr. Rakesh Sharma for the Soyuz T-11 mission in April 1984.
- **Multi-stage screening** – The sequence of activities undertaken to select the final four astronauts started with short-listing candidates from a pool of test pilots after detailed evaluation of their dossiers, followed by exhaustive psychological, physical, and clinical evaluations by medical experts from IAM.
- **4 astronaut-designates for Gaganyaan** – Group Captains Prasanth Balakrishnan Nair, Ajit Krishnan, and Angad Pratap and Wing Commander Shubanshu Shukla.
- **Training at Russia's Cosmonaut Centre** – The astronauts underwent basic training at the Yuri Gagarin Cosmonaut Training Centre in Russia.
- The programme included centrifuge training, weightlessness simulations in parabolic aircraft flight, and harsh winter and sea survival drills to help in case of any unforeseen anomalous landings.
- **Training at NASA** – Mr Shukla and Mr Balakrishnan Nair also underwent some training at the Johnson Space Centre under NASA in the U.S., ahead of the Axiom-4 mission.
- **Mission-specific training in India** – All four are undergoing further training specific to Gaganyaan at the Astronaut Training Centre in Bengaluru.
- **Simulator training** – Training in simulators is an important part of crew workout.
    - **Simulator** – It is an advanced hardware-software system that replicates spacecraft environments where astronaut-candidates can master operations and handle emergencies during ground-based training.
- All conceivable nominal and off-nominal conditions have to be simulated, and the crew has to be trained to handle such situations.
- **Different types of training simulators** – Apart from full-scale fixed and motion-base simulators, there are
    - Part-task subsystem trainers — i.e. focused simulators designed to train on operating specific spacecraft systems or procedures rather than the entire vehicle — and
    - Immersive virtual/augmented reality systems to simulate crew operations in flight.

Why are astronauts quarantined pre-flight?

- **Pre-flight quarantine** – The quarantine is part of a structured isolation protocol implemented roughly two weeks before launch to protect astronauts from catching any

infectious illnesses.

- **Protecting health** – The small, sealed crew module, where the astronauts will reside for the course of the mission, can cause any germs to spread rapidly, severely compromising the crew's health and the mission's safety.
- **Preventing in-flight medical emergencies** – It is also mandatory to maintain strict health protocols and isolation to prevent in-flight medical emergencies and to ensure a hassle-free mission.
- **Lesson from the past** – The unprecedented medical evacuation from the International Space Station in January 2026 was triggered by an unexpected health issue with one of the U.S. astronauts — the first such instance in the 26-year history of the International Space Station.

What lies ahead?

- As India embarks on its first human spaceflight mission, developing indigenous capabilities in crew selection and training not only lays the foundation for sustained Indian human space activities but also gives an impetus to the nascent discipline of bioastronautics in the country.
    - **Bioastronautics** – The study of biological, behavioural, and medical aspects of humans living and working in space.

Reference

The Hindu | How did ISRO pick astronaut candidates for the Gaganyaan mission?

