# 7. India's Space Programme In 2025- Science & Technology

Year-ender 2025- India's space programme in 2025- Technology, diplomacy and the road to Space Vision 2047. The Department of Space's 2025 review highlights a strategic transition from routine satellite launches to mastering advanced capabilities like space docking (SPADEX), human spaceflight (Axiom-04/Gaganyaan), and space biology. This shift, supported by indigenous technological breakthroughs and private sector growth, lays the foundation for India's long-term Space Vision 2047.

## Introduction- A Year of Strategic Shift

The year 2025 marked a pivotal evolution for India's space sector. The focus expanded beyond satellite launches to mastering the complex technologies required for-

1. Human spaceflight.
2. Future space stations (Bharatiya Antariksh Station).
3. Building a globally competitive commercial ecosystem.

## Technological Milestones- Docking & Space Biology

**The SPADEX Mission (Space Docking Experiment)**

1. Launch Vehicle- Launched aboard PSLV-C60.
2. Core Achievement- Successfully demonstrated the docking and undocking of two spacecraft in orbit.
3. Strategic Importance- This technology is the cornerstone for constructing future space stations and executing complex crewed missions (transferring humans between spacecraft).

**Space Biology Breakthroughs (CROPS-1)**

1. Platform- Conducted on the POEM-4 (PSLV Orbital Experimental Module) platform.
2. Experiment Details- India's initial space biology experiment involved growing Cowpea seeds.
3. Result- The seeds successfully germinated and reached the two-leaf stage in microgravity.
4. Significance- Provided critical data on plant growth systems necessary for food security during long-duration human space missions.

**POEM-4 Platform Utility**

1. **Milestone-** The platform completed 1,000 orbits.
2. **Capacity-** It hosted 24 diverse payloads from both ISRO and private entities, serving as a low-cost orbital testbed.

## Scientific Exploration- Solar & Earth Observation

**Aditya-L1 (Solar Observatory)**

**Position-** Stationed at the Sun-Earth Lagrange Point 1 (L1).

**Achievement-** ISRO released the first scientific datasets to the global community.

**Insights Gained-** The data provided detailed observations of the Sun's photosphere, chromosphere, and corona.

**Impact-** Strengthened India's global standing in solar physics and space weather research.

**NISAR (NASA-ISRO Synthetic Aperture Radar)**

**Collaboration-** A joint satellite mission between ISRO and NASA.

**Launch-** Launched later in the year, enhancing global capabilities in monitoring Earth's ecosystems, ice mass, and natural hazards.

## Launch Infrastructure & Propulsion

**Infrastructure Expansion**

**New Approval-** The Union Cabinet approved the construction of the Third Launch Pad at Sriharikota.

**Objective-** To support Next-Generation Launch Vehicles (NGLV) and increased frequency for human spaceflight missions.

**Operational Milestones**

**Historic Launch-** ISRO celebrated its 100th launch from Sriharikota with the GSLV-F15 mission.

**Propulsion-** Significant advancements were recorded in propulsion technologies necessary for heavier payloads.

## Human Spaceflight (Gaganyaan & Beyond)

**Gaganyaan Mission Progress**

**Safety Test-** Successfully conducted the first integrated air drop test of the crew module parachute **system**, a critical safety requirement for astronaut recovery.

**Manned Mission (Axiom-04)**

1. Astronaut- Indian astronaut Shubhanshu Shukla participated in the mission.
2. Destination- Flew to the International Space Station (ISS).
3. Duration & Work- Spent 18 days in orbit conducting microgravity experiments, gaining operational experience for India's domestic human spaceflight program.

**Space Medicine & Training Ecosystem**

**Analog Missions-** Conducted in Ladakh's Tso Kar Valley, utilizing the harsh terrain to simulate extraterrestrial environments for training and equipment testing.

**Medical Research-** Signed a framework agreement with Sree Chitra Tirunal Institute for Medical Sciences & Technology (SCTIMST) to advance research in astronaut health and biomedical engineering.

## Indigenization & Industry Participation

**Indigenous Microprocessors**

**Development-** Created in collaboration with Semi-Conductor Laboratory (SCL), Chandigarh.

**Products-** Delivered India's first fully indigenous 32-bit space-grade microprocessors VIKRAM3201, KALPANA3201

**Significance-** A major step towards self-reliance (Atmanirbhar Bharat) in critical avionics and electronics.

**Commercialization & Startups**

**SSLV Transfer-** ISRO signed a Technology Transfer Agreement to commercialize the Small Satellite Launch Vehicle (SSLV), effectively handing over routine small launches to the industry.

**Startup Success-** A private startup successfully conducted a static test of the KALAM-1200 solid rocket motor, signaling the maturity of private defense/space manufacturing.

## Global Engagement & Future Vision

**International Leadership**

**Disaster Management-** India assumed the leadership role in the International Charter on Space and Major Disasters.

**Conferences-** Hosted the Global Space Exploration Conference (GLEX) 2025.

Strategic Planning (Space Vision 2047)

**Event- Chintan Shivir 2025** was held to strategize the long-term roadmap.

**Vision Targets-** Expanded human presence in space. Stronger private/commercial participation. Advanced interplanetary scientific missions.

## Conclusion

The year 2025 served as a defining phase for the Department of Space. By combining high-end technology demonstrations (SPADEX), operational human spaceflight experience (Axiom-04), and robust private sector integration, India has laid the groundwork to achieve the ambitious goals of Space Vision 2047, transitioning from a launch provider to a comprehensive global space power.

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