

India's Human Spaceflight Journey

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India's Human Spaceflight Journey: From Axiom-4 to Gaganyaan

Context:

India marked a historic milestone in human spaceflight with **Group Captain Shubhanshu Shukla** becoming the **first Indian in 41 years** to travel to outer space after **Rakesh Sharma's mission in 1984**. Shukla piloted the **Axiom-4 mission** aboard **SpaceX's Dragon capsule**, which launched from **Kennedy Space Center, Florida**.

This mission reflects India's emergence as a serious player in global human spaceflight and comes at a time when India is preparing for its own indigenous mission, **Gaganyaan**.

Significance of the Axiom-4 Mission

- **Group Captain Shubhanshu Shukla** crossed the **Kármán line** (defined at **100 km** above sea level), marking the boundary between the Earth's atmosphere and outer space.
 - This is the **first instance since 1984** of an Indian crossing into outer space.
 - **Prime Minister Narendra Modi** congratulated Shukla and referred to him as the **first Indian en route to the International Space Station (ISS)**.
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India's Participation in Axiom-4

- India was not just a passenger contributor; a large team from **ISRO**, including **Chairman V. Narayanan**, played an active role in **planning, coordination, and mission support**.
- This reflects a shift from India's traditional role as a launch service provider to a **collaborative partner in international human spaceflight missions**.

Gaganyaan and India's Human Spaceflight Programme

- The **Gaganyaan mission**, although delayed from its **original 2022 target**, has gained momentum with enhanced institutional focus.
- Gaganyaan aims to send **India's first crewed spacecraft into low-Earth orbit by 2027**.
- The mission is part of a broader strategic vision that includes:
 - Establishing a **dedicated Indian space station**
 - Launching **Indian astronauts to the Moon by 2040**

Strategic Importance of Human Spaceflight

- Human spaceflight is no longer just a scientific pursuit but a **strategic capability** for:
 - **Scientific advancement**
 - **Commercial partnerships**
 - **Geopolitical leverage**
- In an era where space exploration risks becoming exclusionary, India's growing presence ensures it remains part of the **global space dialogue**.

India's Position in the Global Space Economy

- India is considered a **top global space power** in terms of cost-effective missions and technological reliability.
- However, its contribution to the **global space economy** is currently **only around 2%**, indicating **significant scope for growth**.

- Areas for improvement include:
 - **Commercialisation of space services**
 - **Support for private space startups**
 - **Attracting foreign investment**
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Space as a Future Technology Frontier

- Along with **AI, quantum computing, and clean energy**, **space technology** is expected to dominate global technological progress.
 - Unlike in other high-tech domains where India is still catching up, in space, **India is among the front-runners**.
 - Sustaining this lead requires:
 - **Continued innovation**
 - **Stronger international partnerships**
 - **Policy support for the private sector**
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Human Spaceflight as a Tool for Inspiration and Innovation

- Human space missions can **inspire the youth, promote STEM education, and drive innovation** across sectors.
- It can contribute to:
 - **Skill development**
 - **High-tech job creation**

- **Entrepreneurship in aerospace and allied sectors**
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Conclusion: Leveraging the Momentum

- **Shubhanshu Shukla's mission** must be viewed not just as a symbolic achievement but as a **foundation for India's future in human space exploration**.
- The insights and experience gained should feed directly into strengthening **Gaganyaan** and shaping India's role in the **global space ecosystem**.
- With focused investment, institutional backing, and strategic planning, India can transform itself into a **leader in human spaceflight and the space economy**.



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