



Mains Practice Question

Q. Analyze the remarkable accomplishments and challenges faced in India's pursuit of space leadership. (250 words)

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Approach

- Start the answer with a discussion that sets a context for the question.
- Discuss the remarkable accomplishments of India in the space sector.
- Discuss the challenges faced by India in pursuit of space leadership.
- Suggest measures and conclude suitably.

Introduction

When India began its space program in the 1960s, it was a developing country with limited resources, and it focused on using space to push its social and economic development agenda. However, the space program has expanded over the past decade and the Indian Space Research Organisation (ISRO) has achieved several milestones that have garnered global attention and acclaim.

Body

Some recent milestones in the Indian space program include:

- **Chandrayaan 3 mission:** Chandrayaan-3's exploration of the lunar south pole signifies a new era in India's space endeavors. India's successful soft landing near the Moon's south pole is a moment of national pride, establishing the country as the first to achieve this remarkable feat of landing a spacecraft in such proximity to the lunar south pole
- **Mars Orbiter Mission (Mangalyaan):** The mission made India the first Asian country, and the fourth in the world after Roscosmos, NASA (National Aeronautics and Space Administration), and the European Space Agency, to get to the planet.
- **Aditya-L1:** It is the first space-based observatory class Indian solar mission to study the Sun from a substantial distance of 1.5 million kilometers.
- **Launch Vehicle Development Programme:** Polar Satellite Launch Vehicle (PSLV), Geosynchronous Satellite Launch Vehicle (GSLV), and next-generation GSLV Mark-III launch vehicle missions are part of the launch vehicle development programme
- **The Earth Observation Programme:** It includes cutting-edge Indian remote sensing (IRS) satellites such as Resourcesat, Cartosat, Oceansat, Radar Imaging Satellite, Geo-Imaging Satellite, and weather/climate satellites such as INSAT-3DR missions.
- **IN-SPACE:** It was launched to provide a level playing field for private companies to use Indian space infrastructure.
- **NewSpace India Limited (NSIL):** It is ISRO's commercial arm, and its major purpose is to enable Indian enterprises to engage in high-technology space-related operations.
- **Future Space Programme of ISRO :**
 - **Chandrayaan-4:** Navigating the Path of Lunar Evolution
 - **LUPEX:** Lunar Polar Exploration (LUPEX) mission, a collaborative effort between ISRO and JAXA(Japan), is poised to explore the Moon's polar regions..

- **XPoSat (X-ray Polarimeter Satellite):** It is India's first dedicated polarimetry mission to study various dynamics of bright astronomical X-ray sources in extreme conditions.
- **NASA-ISRO SAR (NISAR):** NISAR will map the entire globe in 12 days and provide spatially and temporally consistent data for understanding changes in Earth's ecosystems.
- **Gaganyaan:** This mission aims to send humans to space and return them safely to Earth.
- **Shukrayaan 1:** It is a planned mission to send an orbiter to Venus, the second planet from the Sun.

The Key Challenges in the Indian Space Programme Mission :

- **Limited Budget allocation:** The Indian space program operates on a relatively modest budget compared to other major space-faring nations.
 - India's space budget is only 0.05% of its GDP. In contrast, the US allocates 0.25% of its GDP to space activities.
- **Technological Challenges:** India stands at No. 7 globally in terms of satellites operated. It lags behind the US and China, the top two spacefaring powers.
 - India relies on the West for critical components for launch vehicles, spacecraft, and satellites.
- **Commercialization and Market Access:** India has a limited presence in space manufacturing, human space transport, space tourism, and high-altitude platforms. India's share of the world space economy is barely 2.6%.
- **Space Policy and Legislation:** Developing comprehensive space policies and legislation that address the evolving needs of the space sector is crucial. The delay in the passing of the Space Policy is becoming a big drag.
- **Geopolitical Realignment:** India's participation in the Artemis Accords with the USA has been viewed as a counter to China in the changing geopolitical landscape.
- **Space Applications for Societal Benefits:** Maximizing the societal benefits of space applications, such as remote sensing and satellite communication, requires effective integration with various sectors like agriculture, disaster management, and environmental monitoring.

Several measures can be considered as a way forward :

- **Substantial Investment:** A shift from "frugal engineering" to more substantial investments and ambitious projects is necessary. There has been a constant urge from the science community to enhance the budgetary allocations to the department to push for bigger missions.
- **Gain Expertise in Human Spaceflight:** India must invest in human spaceflight programs, astronaut training, and the development of necessary infrastructure for crewed missions.
- **Private Sector Participation:** Involving the private sector is crucial, aligning with the global trend where commerce plays a significant role in space programs.
- **Geopolitical Negotiations:** With great power rivalry extending to space, India must navigate negotiations and collaborations strategically, especially considering its relationship with China.
- **Legal Framework:** As space activities increase, India needs comprehensive domestic and international laws to regulate and promote space business. Global governance reforms are necessary to address evolving challenges.
- **Rekindling Spirit of International Collaboration:** Collaboration with other countries is essential for India's space aspirations. India needs to rekindle the spirit of cooperation and ensure that outer space remains a shared domain for all of humanity
- **Public Support:** The government will have to engage in outreach and education to build public awareness and enthusiasm for its space program.

Conclusion

India's space program requires strategic financial planning and active international collaborations along with public engagement initiatives to propel India's space program to new heights.

