India's Space Endeavors

For Prelims: Indian Space Research Organisation, Gaganyaan , NavIC, Project NETRA, Weather forecasting, Bharatiya Antariksha Station.

For Mains: Potential Benefits of India's Growing Involvement in Space Activities, Roadblocks to India's Space Journey.

Source: TH

Why in News?

Recently, the Prime Minister of India has charted a visionary roadmap for the **Indian Space Research Organisation (ISRO)** during a review meeting for the **upcoming** Gaganyaan mission, which is set to be India's first manned mission to space.

What are the Key Aspects of the Roadmap for ISRO?

- One of the central objectives is the establishment of an **Indian-crafted, indigenous space station**, known as the **"Bharatiya Antariksha Station."** It will serve as a key asset in India's space infrastructure.
    - This monumental endeavor is expected to be realised by the year 2035.

Note

The **International Space Station**, currently managed by the US, Russia, Canada, Japan, and European space agencies, is anticipated to be **decommissioned by 2030.**

- Landing an **Indian astronaut on the Moon by the year 2040.** This lunar mission promises to be a historic achievement for the nation.
    - To realise this vision, the Department of Space will **develop a roadmap for Moon exploration** which will encompass Chandrayaan missions, development of a Next Generation Launch Vehicle (NGLV), construction of a new launch pad, setting up human-centric laboratories, and associated technologies.
- The Prime Minister has urged Indian scientists to expand their horizons further by working on **interplanetary missions.**
    - These include the development of a space vehicle for **orbiting Venus and another for landing on Mars**, indicating a broader commitment to exploring the solar system.

What are the Potential Benefits of India's Growing Involvement in Space Activities?

- **Economic Benefits:** India's space capabilities bring forth substantial economic benefits by

generating revenue through **commercial** satellite launch services**, creating jobs, stimulating technological advancements** with cross-industry applications.

- **Geopolitical Leverage:** India's space capabilities can serve as a **diplomatic tool in resolving international disputes peacefully.**
    - It can also provide India a **geopolitical leverage in international negotiations,** enabling the country to negotiate more favorable terms in **trade,** climate accords**, and global agreements.**
- **Enhanced Disaster Management:** India could significantly improve disaster management **by using space assets for real-time monitoring and response.**
    - Satellites can aid in predicting **natural disasters**, such as **earthquakes, tsunamis, and floods**, allowing for timely evacuation and resource allocation.
- **Agricultural Revolution:** Space-based technologies, including **satellite imagery and** weather forecasting, can lead to an agricultural revolution.
    - Farmers could receive **precise data on soil conditions, weather patterns, and crop health,** enabling them to optimize farming practices and increase yields.
- **Affordable Space Tourism**: India's **cost-effective space capabilities** could pave the way for affordable space tourism. With advancements in space technology, **suborbital and orbital space tourism might become more accessible to Indian citizens and visitors** from around the world, which can in turn generate massive revenue for the country.

What are the Roadblocks to India's Space Journey?

- **Technical Challenges:**
    - Despite significant strides made by the private sector in **India's space domain**, there remains a substantial journey ahead, posing a formidable challenge in developing **cutting-edge technology for space missions demands that require substantial investment.**
- **Financial Constraints:**
    - Balancing the **costs of space exploration with other national priorities**, such as healthcare and education, poses financial challenges.
    - Also, maintaining sustained investment in space initiatives requires careful planning and support from the government.
- **International Collaboration v/s Competition:**
    - India faces competition with established space powers like the **US, Russia, and China**, who have made significant strides in space exploration.
    - Striking a balance between **collaborating with international space agencies and competing** on the global stage is crucial.
- **Managing the Environmental Impact:**
    - The **environmental impact of space launches and operations** needs to be managed responsibly as increased space activities **contribute to** space debris**,** which poses risks to both operational satellites and future space missions.

Way Forward

- **Skill Development**: Investing in **space-related skill development programs** can create a workforce with the knowledge and expertise needed for innovative space projects.
    - Establishment of **Space Technology Incubation Centers** is a good step in this direction.
- **Infrastructure Development:** Upgrading space launch facilities and research centers ensures that India has the necessary infrastructure for more ambitious space missions.
    - The **Virtual Launch Control Center (VLCC)** at Vikram Sarabhai Space Centre is a good step in this direction.
- **Space Security:** Establishing robust cybersecurity measures is crucial to **safeguard space assets against potential** cyberattacks and data breaches.
- **Government-Industry Collaboration:** Collaborative efforts between government agencies and private enterprises can leverage the **strengths of both sectors to advance space exploration and technology.**
- **Promote Indigenous Technologies**: Encouraging the development of homegrown technologies ensures self-reliance and reduces dependence on external sources for space hardware.
    - NavIC **or the Indian Regional Navigation Satellite System (IRNSS)** and **Project**

NETRA are significant steps in this direction.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Q.1 What is India's plan to have its own space station and how will it benefit our space programme? **(2019)**

Q.2 Discuss India's achievements in the field of Space Science and Technology. How the application of this technology helped India in its socio-economic development? **(2016)**

Q.3 What is the main task of India's third mood mission which could not be achieved in its earlier mission? List the countries that have achieved this task. Introduce the subsystems in the spacecraft launched and explain the role of the 'Virtual Launch Control Centre' at the Vikram Sarabhai Space Centre which contributed to the successful launch from Sriharikota. **(2023)**