



Bhartiya Antriksh Station, Moon & Venus Mission and NGLV

For Prelims: [Indian Space Research Organisation \(ISRO\)](#), [Chandrayaan-4](#), Venus Orbiter Mission (VOM), [Bhartiya Antriksh Station \(BAS\)](#), Next Generation Launch Vehicle (NGLV), [Launch Vehicle Mk III](#), [Venus](#), [International Space Station](#), [Tiangong](#), [Low Earth Orbit \(LEO\)](#), [PSLV](#), [GSLV](#), [SSLV](#), [Geo-Synchronous Transfer Orbit \(GTO\)](#), [Gaganyaan mission](#).

For Mains: ISRO's planned missions and their relevance.

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Why in News?

Recently, the [Union Cabinet](#) approved **four space projects** to be undertaken by [Indian Space Research Organisation \(ISRO\)](#).

- Newly approved space projects include [Chandrayaan-4](#), **Venus Orbiter Mission (VOM)**, **Bhartiya Antriksh Station (BAS)** and **Next Generation Launch Vehicle (NGLV)**.

What are the Newly Approved Space Projects?

- **Chandrayaan-4:** The mission is designed to **land on the lunar surface, collect samples**, store them in a vacuum container, and **bring them back** to earth.
 - It will involve spacecraft development, two different [Launch Vehicle Mk III](#) launches, deep space network support, and special tests.
 - It will also see **docking and undocking** — two spacecraft aligning and coming together in orbit — that India hasn't attempted so far.
 - It will help India become **self-sufficient** in technologies for [manned missions](#). India plans to send humans to the moon by 2040.
- **Venus Orbiter Mission (VOM):** It aims to orbit [Venus](#) to study the planet's surface, subsurface, atmospheric processes, and the Sun's impact on its atmosphere by probing its thick atmosphere.
 - Studying **Venus** is important because it is believed to **have once been habitable like Earth**.
 - The mission is scheduled to launch in **March 2028** when Earth and Venus are at their closest.
 - This will be **India's second interplanetary mission**, after the [Mars Orbiter Mission](#) in 2014.
- **Bhartiya Antriksh Station (BAS):** [BAS](#) will be India's **own space station** for scientific research.
 - India will launch its own space station by **2028**, plans to operationalise it by **2035** and achieve a **crewed lunar mission by 2040**.
 - Currently, the only two functioning space stations are the [International Space Station](#).

and **China's [Tiangong](#)**.

- **Next Generation Launch Vehicle (NGLV):** The government also approved the development of a **next-generation launch vehicle (NGLV)**.
 - NGLV will offer three times the current payload capacity of the **LVM3, at 1.5 times the cost**.
 - It is designed to carry up to **30 tonnes** to **[Low Earth Orbit \(LEO\)](#)**.
 - India's existing launch vehicles, including **[SSLV](#), [PSLV](#), [GSLV](#) and [LVM3](#)** which have **payload capacity** ranging from **500 kg** to **10,000 kg** to **LEO** and **4,000 kg** to **[Geo-Synchronous Transfer Orbit \(GTO\)](#)**.

Note: The Union Cabinet also approved the **continuation** of the **[Gaganyaan mission](#)**.

- It will have **eight missions**, including **four** needed to build the **space station**.
- This will be in addition to the **two uncrewed and one crewed missions** that have already been approved for the first **human spaceflight** under the Gaganyaan mission.

How will the Space Station Benefit India?

- **Microgravity Experiments:** A space station would provide a platform for conducting unique scientific experiments in **microgravity**, which could lead to breakthroughs in **materials science, biology, and medicine**.
- **Innovation:** Developing and operating a **space station** would drive technological advancements and foster innovation in areas such as **life support systems, robotics, and space habitats**.
 - **Chinese cabbage** grown on the **ISS** in the **Veggie growth system** showed reduced **biomass**.
- **Leadership and Prestige:** Having its own space station would enhance India's position as a **global leader** in space exploration, showcasing its **technological prowess** and strengthening international partnerships.
 - It will provide Indian companies larger access to **satellite manufacturing, servicing** and boost the **aerospace sector**.
- **Human Spaceflight Experience:** Building on the success of the **Gaganyaan mission**, a space station would offer extended opportunities for Indian astronauts to gain experience and contribute to **long-duration missions**.

What are the Challenges in Building and Operating Space Stations?

- **Design and Engineering:** Space stations require **advanced engineering** to ensure they can support life in a **harsh environment**. Challenges include ensuring structural integrity, **[radiation protection](#)**, and maintaining a stable environment for scientific experiments.
- **Life Support Systems:** Developing reliable systems for **air, water, and waste management** is crucial. These systems must function autonomously for extended periods, which is technically demanding.
- **Affordability for India:** Building a space station involves substantial **financial investment**. Costs include the construction of modules, launch expenses, and the development of life support and scientific equipment.
 - For instance, the **ISS**, shared by multiple countries, has cost over **USD 150 billion**. A smaller, national space station could cost between **USD 10-30 billion**.
 - **ISRO's budget** for 2024-25 is about **USD 1.95 billion**. In contrast, **[NASA](#)** operates with a much larger budget of around **USD 25 billion**.
 - **The USSR** abandoned its **Mir space station** because the costs of operating and maintaining it became increasingly unsustainable.
- **Space Race:** Engaging with **established space powers** for collaboration could be **complicated** by **competition for leadership** in space technology, particularly with countries like the **US, Russia, and China**.
- **Crew Health and Safety:** Ensuring the physical and psychological well-being of astronauts is critical. Prolonged exposure to **microgravity and isolation** can have adverse effects on health.

- **Prolonged exposure** to microgravity can cause astronauts to **lose up to 1% of bone mass per month**.
- Changes in **fluid distribution in the body** can lead to **increased intracranial pressure**, causing **vision-related issues**.
- **Supply Chain Management:** Regular resupply missions are essential for maintaining the station, including delivering food, equipment, and scientific samples. This requires meticulous planning and coordination.
 - E.g., India lacks a fleet of **reusable rockets** which can be used multiple times for **transporting supplies** to a space station.

Conclusion

India's **visionary space programme** encompasses the development of a space station, a Chandrayaan-4 Moon mission with sample return, and a Venus exploration mission. These initiatives will advance scientific research, enhance understanding of lunar samples, and provide insights into Venus's conditions, potentially revealing **parallels to Earth's future**. This ambitious plan underscores India's growing prominence in space exploration.

Drishti Mains Question:

Q. How ISRO's planned space missions will contribute to scientific research, technological advancement, and international collaboration?

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Consider the following statements: (2016)

The Mangalyaan launched by ISRO

1. is also called the Mars Orbiter Mission
2. made India the second country to have a spacecraft orbit the Mars after USA
3. made India the only country to be successful in making its spacecraft orbit the Mars in its very first attempt

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (c)

Mains

Q. What is the main task of India's third moon 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)

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

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