

ISRO's Milestones in 2024

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ISRO's Milestones in 2024: A Year of Groundbreaking Space Missions

Context : In 2024, the **Indian Space Research Organisation (ISRO)** completed a busy year with **15 successful missions**, marking major milestones in India's space exploration journey. The year concluded with the **PSLV C60 mission**, which was a significant achievement for ISRO.

Key Missions of ISRO in 2024

1. PSLV C58 Mission

- **XPoSat**, a space observatory, was launched using the **PSLV C58 mission**.
- The **PSLV Orbital Experimental Module-3 (POEM-3)** experiment was also carried out with the **PS4 stage** of PSLV C58.

2. Aditya L1 Solar Mission

- In **January 2024**, India's first solar mission, **Aditya-L1**, successfully entered its final orbit around the **first Sun-Earth Lagrangian point (L1)**.
- This mission will help us understand the Sun's behavior and its impact on Earth.

3. INSAT-3DS Mission

- The **INSAT-3DS** meteorological satellite was launched using **GSLV-F14**.
- It was placed in the **Geosynchronous Transfer Orbit (GTO)** to enhance weather monitoring in India.

4. ABPS (Air Breathing Propulsion Technology)

- ISRO successfully conducted the **second experimental flight** for the **Air Breathing Propulsion Technology** to improve rocket engines.

5. Reusable Launch Vehicle (RLV)

- **RLV LEX-02 and LEX-03** demonstrated the **autonomous landing** of the **Reusable Launch Vehicle** under challenging conditions.
- **Pushpak**, a reusable test vehicle, was also tested.

6. HLVM 3 (Human-Rated Launch Vehicle Mark 3)

- In **December 2024**, ISRO began assembling the **HLVM-3** for its **first uncrewed mission** as part of the **Gaganyaan** series.
- The **G1 mission** will test the **orbital module (OM-1)** with no crew on board.

7. Axiom-4 Mission

- **Shubhanshu Shukla** and **Prasanth Balakrishnan Nair** were selected as the first Indian crew members for the **Axiom-4 mission**, a private spaceflight to the **International Space Station (ISS)**.

8. PSLV C59 Mission

- The **PSLV C59 mission** successfully launched the **European Space Agency's Proba-3** spacecrafts into a **highly elliptical orbit**.

PSLV C60 Mission: A Major Milestone

The **PSLV C60 mission** was an important mission with two key components:

1. SpaDeX (Space Docking Experiment)

- SpaDeX is a precursor to future ISRO missions, such as **Bharatiya Antariksh Station (BAS)** and **Chandrayaan-4**.
- It aims to demonstrate **in-orbit docking**, which is crucial for space station missions.

2. POEM-4 (PSLV Orbital Experimental Module-4)

- **POEM-4** included **24 payload experiments**. These experiments are crucial for future space missions and space technology advancements.

Key Payloads of POEM-4

- **Walking Robotic Arm**: A robotic arm developed by ISRO's **Inertial Systems Unit (IISU)**. It will demonstrate the **inch-worm walking technique** to move to defined targets.
- **Debris Capture Robotic Manipulator**: Developed by **Vikram Sarabhai Space Centre (VSSC)**, it aims to capture space debris using robotic technology.
- **Compact Research Module**: Studied the growth of **cowpea seeds** in space.
- **Amity Plant Experimental Module in Space (APEMS)**: Investigates the growth of **spinach plants** in microgravity.
- **RVSat-1**: Measures the growth of a gut bacterium, helping us understand human physiology in space.
- **Multi-Sensor Inertial Reference System (MIRS)**: Demonstrates the performance of miniaturized **inertial sensors** in space.
- **Electron Temperature Analyser (ETA)**: Measures **electron temperature** and **density** in planetary ionospheres.
- **Swetchasat**: Demonstrates the operational ability of a **UHF transmitter** for communication with the ISRO ground station.

- **MOI-TD: A technology demonstrator** for AI experiments in space.
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Upcoming ISRO Missions in 2025

1. Uncrewed HLVM 3 Mission

- The **Human-rated Launch Vehicle Mark 3** will be tested for the **Gaganyaan mission** to send humans into space in the future.

2. NISAR Mission (NASA-ISRO Synthetic Aperture Radar)

- **Launch in March 2025:** The **NISAR mission** will be the world's most expensive Earth-imaging satellite, which will help monitor **global environmental changes**.
- It will scan **land and ice** every **12 days**.

3. Advanced NVS-02 Satellite

- This satellite is part of **India's NavIC system** (Navigation with Indian Constellation) and will improve **India's satellite navigation capabilities**.

4. Vyommitra (Indian Humanoid Robot)

- **Vyommitra**, India's **first humanoid robot**, will be launched with the **uncrewed test mission** for **Gaganyaan**. It will be a key step towards the **first human spaceflight**.
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Conclusion

ISRO's achievements in 2024 have set the stage for India's future in space exploration. From the successful launch of missions like **Aditya L1** and **INSAT-3DS** to experimental technologies like **SpaDeX** and **RLV**, ISRO is steadily advancing its space capabilities. With upcoming missions like **NISAR** and the **Gaganyaan human spaceflight**, India is on track to further enhance its presence in the global space arena.

