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CHANDRAYAAN-4 Mission

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Why in news?

The Union Cabinet approved **anew moon mission 'Chandrayaan-4'**.

- The aim is to develop and demonstrate the technologies to **come back to Earth after successfully landing on the Moon and also collect moon samples** and analyze them on Earth.

Chandrayaan-4 Mission

- **Following the success of Chandrayaan-3, ISRO** is now turning its attention to Chandrayaan-4, a lunar sample-return mission.
- This **ambitious project aims to achieve a soft landing on the Moon**, collect lunar rock samples, and return them to Earth.
- If successful, **India would join the ranks of the United States, Russia, and China** in accomplishing this challenging feat.

Key Objectives of the Mission

- Achieving **a safe and gentle landing** on the lunar surface.
- Collecting and **storing lunar samples**.
- **Lifting off from the Moon's surface**.
- **Docking and undocking** in lunar orbit.
- **Transferring samples between** spacecraft modules.
- **Returning the collected samples** safely to Earth.

Detailed Payloads

- **Lunar Propulsion Module: Transports the Lunar Lander and Ascender stages to the Moon**, similar to the propulsion module used in Chandrayaan-3.
- **Lunar Lander: Touches down on the Moon**, carrying instruments to support the Ascender stage and soil sampling equipment.
- **Lunar Module Ascender: After collecting samples, it detaches from the Lander, ascends to lunar orbit, and prepares for docking.**
- **Transfer Module: Transfers the samples from the Ascender to the Re-entry Module**, propelling them back to Earth.
- **Re-entry Module: Designed to safely return to Earth** with the lunar samples.

Dual Rocket Launch Strategy

- Chandrayaan-4 will utilize two different rockets:
- **Launch Vehicle Mark-3 (LMV-3):** The heavy lifter will carry the propulsion, descender, and ascender modules.

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- **Polar Satellite Launch Vehicle (PSLV):** The workhorse will transport the transfer and re-entry modules to their designated lunar orbits. These rockets will be launched on different dates, with the earliest launch not expected before 2028.

Advanced Technology and Space Docking Experiment (SPADEX)

- The mission's success will hinge on the **successful docking of the Ascender Module with the Transfer Module in lunar orbit**, a process that relies on the completion of the **Space Docking Experiment (SPADEX)**.
- This experiment, developed by ISRO, **involves two spacecraft** and aims to advance technologies for **orbital rendezvous, docking, and formation flying**, which are crucial for the Chandrayaan-4 mission.
- By leveraging these sophisticated technologies and innovative strategies, **ISRO aims to advance India's capabilities in lunar exploration and bring back samples from the Moon**, marking another significant milestone in the country's space exploration journey.