

PARLIAMENT QUESTION: APPLICATIONS OF SPACE TECHNOLOGY

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The major satellite missions launched during the last three years are given below:

- **Chandrayaan-3**, launched on 14th July 2023, achieved the first-ever soft landing near the Moon's south polar region on 23rd August 2023, and demonstrated safe landing, rover navigation, Sulphur detection and lunar soil temperature measurements.
- **Aditya-L1**, launched on 2nd September 2023, is India's first space-based solar observatory, placed in Halo orbit around Sun-Earth L1 in January 2024 to study the solar corona, photosphere and chromosphere.
- **XPoSat**, launched on 1st January 2024, is India's first dedicated X-ray polarimetry mission to study bright astronomical X-ray sources, including pulsars and black holes, under extreme conditions.
- **SPADEX** (Space Docking Experiment), launched on 30th December 2024, demonstrated autonomous docking/undocking, power transfer and circumnavigation, making India the 4th country to demonstrate space docking technology for future lunar and human space missions.
- **NISAR**, launched on 30th July 2025, is the first dual-frequency (L & S Band) radar Earth observation satellite, jointly developed by NASA and ISRO for global microwave imaging using fully polarimetric and interferometric data.
- **GSAT-7R (CMS-03)** is India's most advanced indigenously developed military communications satellite, designed to enhance the strategic communication capabilities of the Indian Navy.

Major applications of space technology undertaken during last three years by ISRO/DoS are:

- **Agriculture:** Satellite-based crop area/yield estimation, crop monitoring and soil-moisture products supported national programmes and PMFBY across major crops and States; GeoCREST, Potato Crop Monitoring System and VEDAS-based geospatial yield estimation were operationalised.
- **Disaster Management:** Near-real-time satellite-based monitoring of floods, landslides, cyclones, forest fires, GLOFs and droughts supported disaster response; over 890 flood products and alerts for more than 11 major landslide events were disseminated through MHA, NDMA, States, BHUVAN and NDEM.

Landslide Atlas of India was developed and techniques for landslide alerts using susceptibility, InSAR-based slope movement and rainfall thresholds are being developed; flood early warning and forest-fire alert services are operational, including eight daily observations with <30 min turnaround time.

- **Governance:**

1. Geospatial technologies supported planning and monitoring of MGNREGA, WDC-PMKSY, Panchayat assets and disaster management through Yuktdhara, Bhuvan Panchayat and

NDEM; about 6.93 crore MGNREGA and 6.89 lakh watershed activities have been geotagged.

- ii. National Database for Emergency Management (NDEM 5.0), released in June 2024, provides sub-metre satellite data, multilingual data labels and near-real-time disaster alerts, forming a core geospatial solution for the Integrated Control Room for Emergency Response (ICR-ER).
- iii. Space technology supported Urban Frame Survey, Green Cover Index for National Highways, UIDAI navigation, property-tax mapping, urban water management, AMRUT 2.0, disaster management, telecom services and Digital Postal Address (DIGIPIN) initiatives.

- **Satellite Communication:** Space technology supports BharatNet and Digital India by extending connectivity to rural areas and enabling broadband, secure government and strategic communications, DTH, VSAT, in-flight/maritime connectivity, tele-education, tele-medicine and disaster management.

Further, IN-SPACe, through its various initiatives and schemes, is collaborating with Non-Government Entities (NGEs) to develop innovative applications of space technology across key sectors such as agriculture, disaster management, and governance. To promote the development of advanced, technology-driven solutions, the following high-impact use cases have been identified for implementation by NGEs:

- a. Pest and disease forecasting and early detection systems for major crops across India.
- b. AI/ML-based systems for crop acreage estimation, yield assessment, and production forecasting.
- c. Development of crop insurance support and weather advisory systems.
- d. SAR-based agricultural applications leveraging NISAR data for irrigation planning and management.
- e. Reservoir rim slope stability monitoring to mitigate dam failure risks and associated disasters.
- f. Glacial Lake Outburst Flood (GLOF) monitoring and Early Warning Systems.
- g. Development of Maritime Domain Awareness (MDA) solutions.
- h. Decision Support Systems (DSS) for power sector infrastructure monitoring and Right-of-Way (RoW) management.
- a. Urban infrastructure information systems and smart governance solutions.

ISRO's major upcoming missions include the Gaganyaan, Venus Orbiter Mission, Chandrayaan-4 mission and Lunar Polar Exploration Mission / Chandrayaan-5.

- **Gaganyaan:** India's first human spaceflight programme, aimed at demonstrating human spaceflight capability by carrying Indian astronauts to Low Earth Orbit and safely returning them to Earth.
- **Venus Orbiter Mission:** India's first dedicated mission to study the atmosphere, surface, and geological environment of Venus.
- **Chandrayaan-4 Mission:** A lunar lander and lunar sample return mission. The major objective of Chandrayaan-4 mission is to successfully land on lunar surface, extract lunar sample through robotic arm, ascent from lunar surface and bring back the collected lunar regolith to Earth.
- **Lunar Polar Exploration (LUPEX) / Chandrayaan-5 Mission:** The Chandrayaan-5 is a joint collaborative mission between ISRO and JAXA. The mission will deploy a lander and rover to conduct in-situ studies of lunar surface and subsurface resources, supporting future sustained lunar exploration.

This information was given by Union Minister of State for Prime Minister's office and Personnel, Public Grievances and Pensions, Atomic Energy and Space, Dr. Jitendra Singh, in a written reply in the Rajya Sabha today.

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