

NISAR Satellite - A Landmark NASA-ISRO Collaboration for Earth Observation

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NISAR Satellite Latest News

- The Indian Space Research Organisation (ISRO) is planning to launch the NISAR satellite from Sriharikota onboard a GSLV Mk-II rocket.

Introduction

- India and the United States are set to launch their most ambitious joint space mission to date, the **NASA-ISRO Synthetic Aperture Radar (NISAR)** satellite.
- Scheduled for lift-off on **July 30 from Sriharikota** onboard a **GSLV Mk-II**, the Rs. 12,000-crore mission has been over a decade in the making and is being considered as one of the world's most advanced Earth observation missions.
- NISAR will provide real-time, high-resolution radar data on land deformation, biomass, disaster impact, crop patterns, and climate-related changes, not just for India but globally.

- It combines NASA's strength in long-range radar systems with ISRO's spaceflight engineering and S-band radar technology.

About NISAR Satellite

- **First Dual-Band Radar Satellite for Earth Observation**

- NISAR is the world's **first Earth-observing satellite with dual-frequency synthetic aperture radar (SAR)**.
- **L-band radar** (1.257 GHz) from NASA can penetrate dense forests and soil layers to detect ground deformation and subsurface movement.
- **S-band radar** (3.2 GHz) from ISRO is optimised for surface-level changes like crop growth, biomass estimates, and water levels.
- This dual-frequency advantage allows for all-weather, day-and-night imaging, even through clouds, smoke, or vegetation cover.

- **Wide Swath and High Resolution**

- NISAR's **radar swath width is 240 km**, allowing it to scan large areas in one go.
- It offers a spatial resolution of **3-10 metres** and vertical displacement mapping accuracy down to **centimetres**, enabling early detection of phenomena like **land subsidence in cities**.
- Every spot on Earth will be revisited **once every 12 days**, providing consistent monitoring.

Scientific and Societal Applications

- NISAR is designed to support research and operations across **six broad themes**:

- **Solid Earth Processes** – Tracking earthquakes, landslides, and land deformation.
- **Ecosystems** – Monitoring forests, woody biomass, and biodiversity.
- **Ice and Snow Dynamics** – Measuring glacial movements and polar ice thickness.
- **Coastal and Ocean Monitoring** – Tracking shoreline erosion, oil spills, and storm surges.
- **Disaster Response** – Providing near-real-time damage maps after floods, quakes, or cyclones.
- **Agriculture and Infrastructure** – Supporting food security and monitoring subsidence near dams, roads, and reservoirs.

- During natural disasters, NISAR can provide **damage proxy maps within five hours**, crucial for emergency relief planning and response.

India-Specific Enhancements

- While NISAR will operate globally at the L-band, ISRO will routinely operate the **S-band radar over Indian territory**, enabling:
 - Enhanced biomass and soil moisture mapping
 - Improved agricultural forecasting
 - Ionospheric noise correction for high-precision imagery
- All of this aligns with India's national needs in **agriculture, disaster management, forestry, and rural development**.

Technical Design and Deployment

- Once launched, NISAR will be placed in a **sun-synchronous polar orbit** at an altitude of 747 km.
- It features a massive **12-metre mesh radar antenna** and a **9-metre boom** to support deployment and scanning.
- To overcome size constraints in space, the SAR system mimics a large antenna by collecting radar pulses over time and combining them through complex processing, hence the term “synthetic aperture.”
- Its advanced **SweepSAR mode** allows electronic steering of radar beams, providing consistent swath coverage without compromising resolution.

Data Access and Ground Infrastructure

- NISAR’s open-data policy ensures that data is freely available to all users, typically **within a few hours** of acquisition.
- **NASA’s Near Earth Network** (in Alaska, Norway, and Chile) will handle most global data downlinks (up to 3 TB/day).
- **ISRO’s Ground Stations** in Shadnagar and Antarctica will manage India’s data needs.
- **India’s National Remote Sensing Centre (NRSC)** will process and distribute NISAR products for domestic use.

India-U.S. Contributions

- The mission exemplifies balanced international collaboration:
 - **ISRO** contributed the spacecraft bus, the entire S-band radar system, Ka-band telemetry systems, and launch support via GSLV Mk-II.
 - **NASA** provided the L-band radar, radar structure, antenna, onboard avionics, and high-capacity data systems.
- The satellite was integrated and tested in Bengaluru, symbolising “Made-in-India” ownership of a global science instrument.

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