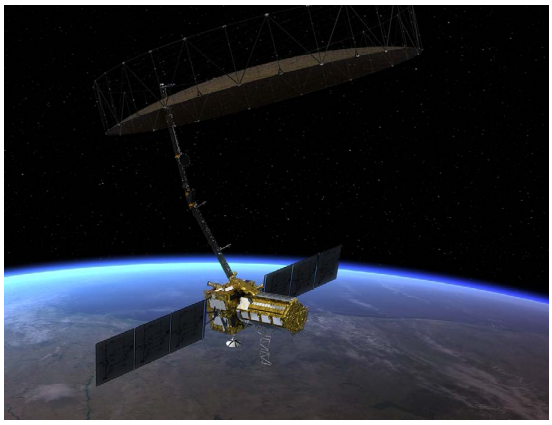
NASAfacts

NISAR
NASA-ISRO Synthetic Aperture Radar

Capturing Earth's Land and Ice in Unprecedented Detail

Earth's surface is constantly changing in subtle and not-so-subtle ways. Landslides and earthquakes can open huge scars on the landscape, while landmasses can slowly subside as groundwater is depleted. The NASA-ISRO Synthetic Aperture Radar (NISAR) mission is designed to measure these changes to the planet's land and ice surfaces down to fractions of an inch.

Led by NASA and the Indian Space Research Organisation (ISRO), NISAR data will help researchers monitor a wide range of changes in unprecedented detail. This includes spotting warning signs of imminent volcanic eruptions, helping to monitor the effects of groundwater use such as land subsidence, tracking the melt rate of ice sheets tied to sea level rise, and observing shifts in the distribution of vegetation around the world. The data will inform humanity's responses to urgent challenges posed by natural disasters and climate change, and help communities prepare for and manage hazards.



This illustration shows the NISAR satellite in orbit above Earth, where it will observe changes in the planet's land and ice surfaces.

Expected Mission Timeline

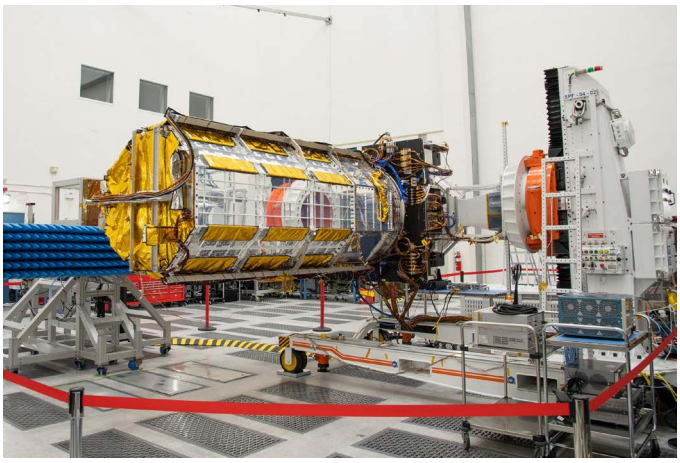
- **No earlier than January 2024:** NISAR launches from the Satish Dhawan Space Centre near Chennai, India, aboard an ISRO Geosynchronous Satellite Launch Vehicle Mark-II.
- **Three years:** Duration of the prime mission, when NISAR will survey all of Earth's land and ice-covered surfaces every 12 days. This starts after a 90-day satellite commissioning period.

Key Objectives

- Understand the movements of earthquakes, volcanoes, landslides, and land subsidence – and the hazards they may pose to society.
- Understand the dynamics of carbon storage and uptake in wooded, agricultural, wetland, and permafrost ecosystems.
- Understand the response of ice sheets to climate change, the interaction of sea ice and climate, and impacts on sea level rise worldwide.

Science Instruments

- **Synthetic aperture radar instruments (SAR):** NISAR has two instruments that will send and receive radar signals to and from Earth's surface to measure how it changes over time. Each instrument bounces a specific frequency of microwave signal off of the planet's surface and records how long it takes the signal to return to the satellite sensors. (Microwave frequency ranges are indicated by specific letters, in this case "L" and "S.") The instruments also measure the strength of that return signal. This enables researchers to calculate the distance from the spacecraft to Earth's surface and thereby determine how the land or ice is moving. It also gives



NISAR's scientific instrument payload sits in a JPL clean room prior to some final testing before being shipped to India.

researchers insight into how moisture in vegetation and the soil surface is changing.

- **L-band synthetic aperture radar (L-band SAR):** The "L" denotes the wavelength of the signal, which is around 9 inches (24 centimeters). The L-band SAR can see through clouds and the leaves of a forest canopy that can obstruct the view of other types of instruments.
- **S-band synthetic aperture radar (S-band SAR):** The "S" denotes a signal wavelength of nearly 4 inches (9 centimeters). The S-band SAR is able to see through clouds and light plant cover, although it is not able to penetrate as far into dense vegetation as an L-band SAR signal.

- **Antenna reflector:** Shaped like a drum and mounted on a 30-foot-long (9-meter-long) boom, the antenna reflector – the largest ever deployed in space by NASA – is nearly 40 feet (12 meters) in diameter. The reflector, made of gold-plated wire mesh, focuses the signals sent and received by the synthetic aperture radars. When transmitting, a radar signal is sent to the reflector and then bounced down to Earth at an angle. The signal covers a 150-mile (240-kilometer) swath of the planet's surface. During the receiving phase, the radar signal bounces off of Earth's surface to the reflector, which focuses it onto the radars for processing.

NISAR Spacecraft

The SUV-size satellite has a mass of roughly 6,200 pounds (2,800 kilograms). It will be powered by two solar arrays – each a little over 18 feet (5.5 meters) long – that will provide about 4 kilowatts of power. Nearly 6 feet (2 meters) tall, the spacecraft bus will contain the command and communications systems for the instrument payload, which houses the two SAR instruments. The bus will also support the radar antenna reflector and its boom. There is enough fuel aboard to support at least five years of operations.

Mission Partners

NISAR is the first joint Earth-observing mission between NASA and the Indian Space Research Organisation. NASA's Jet Propulsion Laboratory, which is managed for the agency by Caltech in Pasadena, leads the U.S. component of the project and is providing the mission's L-band SAR. NASA is also providing the radar antenna reflector, the deployable boom, a high-rate communication subsystem for science data, GPS receivers, a solid-state recorder, and payload data subsystem. ISRO is providing the spacecraft bus, the S-band SAR, the launch vehicle, and associated launch services and mission operations.

Mission Websites

For more information about the NISAR mission, visit:

https://nisar.jpl.nasa.gov/

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www.nasa.gov