

PARMAR SSC



1<sup>st</sup> EDITION / 2026 EDITION

ENGLISH MEDIUM

# PARMAR SSC CURRENT AFFAIR SHOT

★ ★ ★ **HELPFUL FOR ALL SSC EXAMINATIONS** ★ ★ ★



SCIENCE & TECHNOLOGY



REPORTS & RANKINGS



GOVERNMENT SCHEMES



APPOINTMENTS



SPORTS



AWARDS & HONOURS



UNION BUDGET 2026-27



DEFENCE



NATIONAL & STATE NEWS



INTERNATIONAL NEWS



★ **EXAM FOCUSED  
CONTENT**

★ **SUCCESS  
ORIENTED**

★ **RELEVANCE**

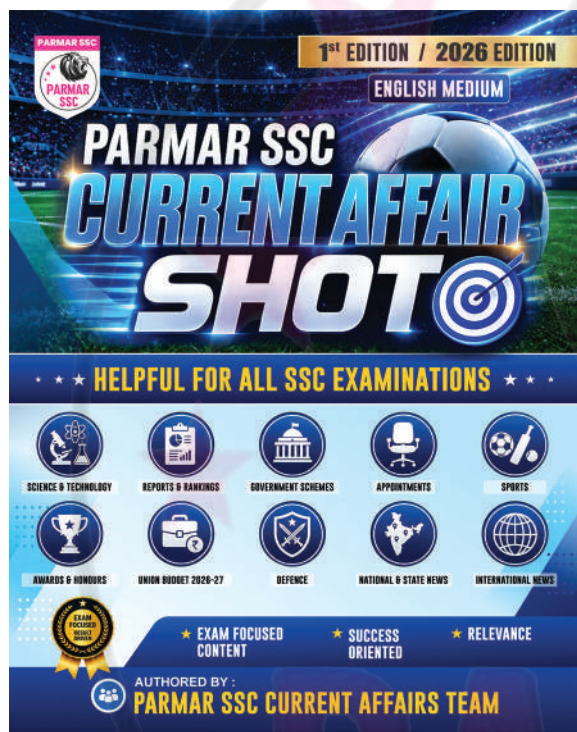


AUTHORED BY :

**PARMAR SSC CURRENT AFFAIRS TEAM**

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CURRENT AFFAIRS TEAM**



**First Edition : 2026**



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# INDIAN SPACE HISTORY



**1962:** The **Indian National Committee for Space Research (INCOSPAR)** is formed under the Department of Atomic Energy.



**1964:** NASA launches the **Syncom-3** satellite, facilitating the first live international television broadcast of the 1964 Tokyo Olympic Games.



**1967:** The **Experimental Satellite Communication Earth Station (ESCES)** becomes operational in Ahmedabad to train engineers and test satellite applications.



**1969:** The **Indian Space Research Organisation (ISRO)** officially established, superseding INCOSPAR.



**1972 (June) :** The Government of India establishes the **Space Commission and the Department of Space (DOS)** to oversee national space activities.



**1972 (September):** ISRO is formally brought under the administrative control of the **Department of Space (DOS)**.



**1975–1976:** The **Satellite Instructional Television Experiment (SITE)** is conducted, utilizing satellites to broadcast educational television programs to rural Indian villages.



**1977–1979:** The **Satellite Telecommunication Experiments Project (STEP)** is launched as a joint initiative between ISRO and the P&T Department, using the Franco-German Symphonie satellite to test domestic telecommunication systems.



**1994:** The first fully successful flight of the Polar Satellite Launch Vehicle was the **PSLV-D2** (4 stage), conducted on October 15, 1994. The mission successfully injected the **IRS-P2** remote sensing satellite into its intended sun-synchronous orbit.

“ *Dr. V. Narayanan assumed the charge of Secretary, Department of Space, Chairman, Space Commission and Chairman, ISRO on 13th January, 2025.* ”

# SPACE ORBITS

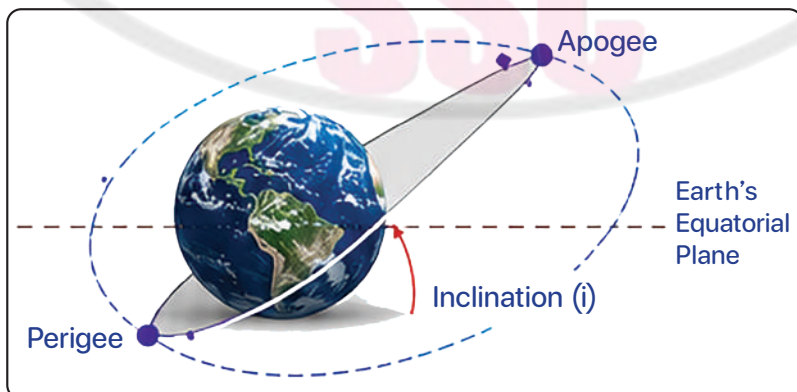
## SPACE ORBITS

-  **LEO (Low Earth Orbit):** Typically situated between 160 km and 2,000 km above Earth's surface. Used for the International Space Station (ISS) and most Earth observation satellites.
-  **MEO (Medium Earth Orbit):** Located between LEO and GEO, typically around 20,000 km. Used primarily for navigation satellite systems like GPS.
-  **GEO (Geostationary Orbit):** Located at approximately 35,786 km above the equator. The satellite moves in sync with Earth's rotation, appearing fixed to a specific point on the ground. Primarily used for telecommunications and weather satellites.
-  **GTO (Geosynchronous Transfer Orbit):** An elliptical orbit used as an intermediate step to transfer a satellite from a low-altitude parking orbit into a higher geostationary orbit.
-  **SSO (Sun-Synchronous Orbit):** A near-polar orbit that allows a satellite to pass over any given point on Earth at the same local solar time. Essential for imaging and weather monitoring.
-  **HEO (Highly Elliptical Orbit):** An orbit with a very high eccentricity (an elongated ellipse). This allows the satellite to spend most of its orbital period over a specific high-latitude region.
-  **Polar Orbit:** An orbit where the satellite passes above or near both poles of the planet. These are ideal for mapping and surveillance as the Earth rotates beneath the satellite's orbital plane.
-  **Lagrangian Points (L1–L5):** Specific points in space where the gravitational pull of two large bodies (like the Earth and the Sun) equals the force required for a small object to move with them. Often used for deep-space observatories (e.g., Aditya-L1).



## FUNDAMENTALS OF KEPLERIAN ORBITAL ELEMENTS

-  **Perigee:** The point in an orbit closest to the Earth.
-  **Apogee:** The point in an orbit farthest from the Earth.
-  **Inclination (i):** The angle between the orbital plane of the satellite and the Earth's equatorial plane.
  - **0° inclination:** Equatorial orbit (directly above the equator).
  - **90° inclination:** Polar orbit (passes over the North and South Poles).



# LAUNCH VEHICLES

## Introduction



India has two main operational launch vehicles for deploying spacecraft into orbit: the Polar Satellite Launch Vehicle (**PSLV**) and the Geosynchronous Satellite Launch Vehicle (**GSLV**).



The Vikram Sarabhai Space Centre (**VSSC**) in Thiruvananthapuram designs and develops India's launch vehicles.



Liquid and cryogenic stages are developed by the Liquid Propulsion Systems Centre (**LPSC**) in **Valiamala** and the ISRO Propulsion Complex (**IPRC**) in **Mahendragiri**.



Integration and launching take place at India's spaceport, the Satish Dhawan Space Centre (**SDSC**) **SHAR**, which operates two launch pads for all PSLV and GSLV flights.



## TYPES

### RETIRED



- SLV-3
- ASLV

### OPERATIONAL



- PSLV
- SSLV
- GSLV
- GSLV Mk III
- Sounding Rockets

### UNDER-DEVELOPMENT



- HRLV
- RLV-TD
- Scramjet Engine-TD

## DESCRIPTION

1

### SATELLITE LAUNCH VEHICLE-3 (SLV-3)

- India's first experimental and indigenous launch vehicle used in 1980's Indian satellite.
- It was an all-solid, four-stage rocket standing 22 meters tall, weighing 17 tonnes, and capable of placing a 40 kg class payload into Low Earth Orbit (LEO).



2

### AUGMENTED SATELLITE LAUNCH VEHICLE (ASLV)

- The ASLV program tripled SLV-3's capacity, aiming to orbit 150 kg class satellites into 400 km circular Low Earth Orbits (LEO).
- Standing 24 meters tall with a 40-tonne liftoff weight, ASLV was configured as a five-stage, all-solid propellant vehicle.
- First successful flight in **1992** (ASLV-D3).

3

### POLAR SATELLITE LAUNCH VEHICLE (PSLV)

- The PSLV is India's third-generation launcher and its first to feature liquid stages.
- Since its maiden successful flight in October 1994, PSLV has served as India's highly reliable and versatile "workhorse" launch vehicle.

#### Configuration:

- Gross Weight (PSLV-XL): 320 tonnes
- 4 stage launch vehicle
- Variants: 4 (PSLV,CA,DL,QL,XL)
- Payload to Sun Synchronous Polar Orbit: 1,750 kg
- Payload to Sub-Geosynchronous Transfer Orbit: 1,425 kg

#### Latest PSLV launches:

- |                   |                    |                      |
|-------------------|--------------------|----------------------|
| ■ PSLV-C62/EOS-N1 | ■ PSLV-C60/SPADEX  | ■ PSLV-C58/XPoSAT    |
| ■ PSLV-C61/EOS-09 | ■ PSLV-C59/Proba-3 | ■ PSLV-C57/Aditya-L1 |



4

## GEOSYNCHRONOUS SATELLITE LAUNCH VEHICLE (GSLV)

- The GSLV Mk II is India's launch vehicle designed to deliver communication satellites into Geostationary Transfer Orbit (GTO).
- While early flights relied on Russian-supplied cryogenic third stages, India transitioned to its own indigenously developed cryogenic engine starting with the successful GSLV D5 mission in January 2014.
- First successful operational flight in 2004 (GSLV-F01).
- Configuration:
  - 3 stage launch vehicle
  - Lift-off mass: 420 tonnes
  - Payload to GTO: 2,250 kg
  - Payload to LEO: 6,000 kg
- Latest PSLV launches:
  - GSLV-F16/NISAR
  - GSLV-F15/NVS-02
  - GSLV-F14/INSAT-3DS
  - GSLV-F12/NVS-01



5

## GSLV MK III (LVM3)



- The **LVM3 (Launch Vehicle Mark-3)**, formerly known as the **GSLV Mk III**, is India's heaviest and most powerful operational launch vehicle.
- It features two solid strap-on motors (S200), a liquid core stage (L110), and a high-thrust cryogenic upper stage (C25).
- Powered by the fully indigenous CE20 high-thrust engine, the C25 cryogenic upper stage carries a propellant loading of 28 tons.
- Configuration:
  - 3 stage
  - Lift-off mass: 640 tonnes
  - Payload to GTO: 4,000 kg
  - Payload to LEO: 8,000 kg
- Latest LVM3 launches:
  - LVM3-M6/BlueBird Block-2
  - LVM3-M5/CMS-03
  - LVM3-M4-Chandrayaan-3
  - GSLV-Mk III - M1/Chandrayaan-2
- The **S200** is a solid rocket booster developed by the Indian Space Research Organisation (ISRO). It serves as the primary stage (first stage) for the **LVM3** (Launch Vehicle Mark-3).



### LVM3 HIGHLIGHTS

3  
STAGE640  
TONNES4,000 kg  
TO GTO8,000 kg  
TO LEO

6

## SMALL SATELLITE LAUNCH VEHICLE (SSLV)



- 3 stage Launch Vehicle configured with three Solid Propulsion Stages and liquid propulsion based Velocity Trimming Module (VTM) as a terminal stage.
- Configuration:
  - **Lift-off mass:** 120 tonnes
  - **Payload Capabilities (500 km Planar Orbit):**
  - **Single Satellite:** Up to 500 kg
  - **Multiple Satellites:** 10 kg to 300 kg each

### SSLV AT A GLANCE

3  
STAGE120  
TONNESUP TO 500 kg  
SINGLE SATELLITE

7

## SOUNDING ROCKETS

- Sounding rockets are one- or two-stage solid propellant vehicles used to probe the upper atmosphere for space research.
- The establishment of the Thumba Equatorial Rocket Launching Station in 1963, strategically located near the magnetic equator, significantly advanced India's atmospheric and aeronomy research.
- This initiative officially launched the Indian space program with the successful firing of the first sounding rocket from Thumba, Kerala, on November 21, 1963.
- The first rockets were two-stage rockets imported from Russia (M-100) and France (Centaure).



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## REUSABLE LAUNCH VEHICLE – TECHNOLOGY DEMONSTRATOR (RLV-TD)

- ISRO's RLV-TD develops critical technologies for low-cost space access.
- The vehicle features a fuselage, nose cap, double delta wings, twin vertical tails, and active control surfaces.
- During testing, a low-burn-rate HS9 solid booster accelerated the craft to Mach 5.
- ISRO successfully flight-tested RLV-TD on 23 May 2016 from SDSC SHAR, Sriharikota.



9

## SCRAMJET ENGINE-TD

- ISRO's scramjet engine uses hydrogen as fuel and extracts oxygen directly from the atmospheric air as its oxidizer.
- ISRO successfully conducted its first experimental scramjet engine test on August 28, 2016, from Sriharikota's Satish Dhawan Space Centre.
- Advancing air-breathing propulsion technology, the vehicle flew for approximately 300 seconds before splashing down in the Bay of Bengal, 320 km downrange.



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## HRLV (HUMAN RATED LAUNCH VEHICLE)

- The HRLV is the human-rated version of ISRO's LVM3 (Launch Vehicle Mark 3), specifically modified to ensure the safety of crew members for India's Gaganyaan (human spaceflight) mission.
- It is the vehicle tasked with launching Indian astronauts into Low Earth Orbit (LEO).



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## NEXT GENERATION LAUNCH VEHICLE (NGLV)

- The Next Generation Launch Vehicle (NGLV) is ISRO's upcoming heavy-lift, partially reusable launch vehicle family, designed to replace ageing systems like PSLV and supplement/supersede GSLV/LVM3 for future national and commercial missions.
- Three-stage, partially reusable launch vehicle family.
- Up to 30 tonnes to Low Earth Orbit (LEO) in the largest configuration.
- Around 10 tonnes to Geostationary Transfer Orbit (GTO).
- This is roughly 3 times the present payload capability compared to LVM3, with about 1.5 times the cost.
- Semi-cryogenic stages using refined kerosene (fuel) + liquid oxygen (LOX, oxidiser) for booster stages.
- Total approved fund: ₹8,240 crore



## INDIAN SATELLITES

- **Aryabhata (1975):** India's first satellite, launched on 19 April 1975 from Kapustin Yar (USSR) using a Soviet rocket. Russia also enabled India's first human spaceflight milestone when Wing Commander Rakesh Sharma travelled to space aboard Soyuz T-11 in 1984.
- **Bhaskara-I and Bhaskara-II (1979, 1981):** First experimental remote sensing satellites built in India, dedicated to Earth observation and hydrology.
- **Rohini Series (1979–1983):** Rohini Technology Payload (1979) and Rohini RS-1 (1980) were the first satellites launched by an Indian-built launch vehicle (SLV-3).
- **INSAT Series:** INSAT-1B (1983) and subsequent INSAT satellites established India's national satellite communication and broadcasting system.
- **GSAT Series:** Advanced communication satellites like GSAT-8, GSAT-11, GSAT-29, and GSAT-31 increased high-throughput capacity for broadband, DTH, and defense communications.
- **Cartosat and IRS Series:** CARTOSAT-1 (2005) and later Cartosat-2 series (2007 onwards) provided high-resolution imagery for urban planning, agriculture, and resource management. IRS (Indian Remote Sensing) series was started with IRS-1A in 1988.
- **RISAT, HysIS, and Microsat**
  - **RISAT-1** (2012) is India's first radar imaging satellite, enabling all-weather, day-night Earth observation.
  - **HysIS** (2018) is a hyperspectral imaging satellite for detailed land, water, and vegetation studies.
  - **Microsat-R** (2019) and **EMISAT** (2019) support defense imaging and electromagnetic intelligence, respectively.
- **Regional Navigation Satellite System (NavIC):** India's own regional navigation system, IRNSS (Indian Regional Navigation Satellite System), now called NavIC, began with IRNSS-1A (2013).
- **2017: PSLV-XL launched 104 satellites** in a single mission – largest number of satellites launched by a single rocket.

## INDIAN SPACE MISSIONS

### India's Major Space Milestones



### GSAT-7R (CMS-03)

- India's launch vehicle successfully launched the CMS-03 multiband communication satellite in its 5th operational flight (LVM3-M5) on November 02, 2025.
- Launching station: Satish Dhawan Space Centre, Sriharikota
- The satellite is India's heaviest communication satellite till date, weighing approximately 4,400 kg, launched to Geosynchronous Transfer Orbit (GTO).
- Primary beneficiary: Indian Navy
- It is a replacement for the aging GSAT-7 (Rukmini) satellite launched in 2013.

## BlueBird Block-2 Mission

- Indian Space Research Organisation (ISRO) launched a next-generation US communication satellite BlueBird Block-2 onboard its heaviest vehicle LVM3-M6 from Sriharikota in Andhra Pradesh.
- It is part of a global LEO (Low Earth Orbit) constellation to provide direct-to-mobile connectivity through satellite.
- Mass (Weight): 6,100 kg per satellite
- The mission was undertaken as part of the commercial agreement signed between NewSpace India Ltd (NSIL) and US-based AST SpaceMobile.



## India's Space Vision 2047

|  | Achievement                                                    | Target Year |
|--|----------------------------------------------------------------|-------------|
|  | Establishment of BAS 1st module                                | 2028        |
|  | Bharatiya Antariksh Station (BAS)                              | 2035        |
|  | Landing of an Indian on Moon                                   | 2040        |
|  | Development of Next Generation Satellite Launch Vehicle (NGLV) | 2032        |
|  | Chandrayaan-4                                                  | 2027-28     |
|  | Venus Orbiter Mission (VOM)                                    | 2028        |

## SpaDeX (Space Docking Experiment)

- The SpaDeX (Space Docking Experiment) mission is ISRO's cost-effective technology demonstrator to validate in-space rendezvous, docking, and undocking using two small spacecraft, **SDX01 (Chaser)** and **SDX02 (Target)**, each weighing about 220 kg, launched into a **470 km low-Earth orbit** at 55° inclination.
- Launch:** December 30, 2024, **PSLV-C60** deploys satellites with initial 10-20 km separation; drift arrest achieves far rendezvous.
- Docking:** **January 16, 2025**, precise maneuvers from 15 m to capture, retraction, rigidization, and integrated control.
- Payload:** PS4-Orbital Experiment Module, designated as **POEM**, refers to the usage of the spent fourth stage of the Polar Synchronous Launch Vehicle (PSLV).
- India** became the **4th country** to do so after the USA, Russia and China.



## Aditya L1 Mission

- Aditya-L1 is India's first space-based solar observatory mission, launched by ISRO on **September 2, 2023**, using **PSLV-C57** from Satish Dhawan Space Centre. The 1,500 kg spacecraft carries seven indigenously developed payloads to study the Sun's photosphere, chromosphere, corona, solar winds, and space weather dynamics. Positioned in a halo orbit around the **Sun-Earth L1 Lagrange point, 1.5 million km from Earth**.
- **Payloads:** VELC, SUIT, SoLEXS, HELIOS, ASPEX, PAPA and a Magnetometer.
- Aditya-L1 reached L1 on **January 6, 2024**, after a **110-day journey** involving multiple Earth-bound orbits. It has captured solar flares, Coronal Mass Ejections (CMEs), high-energy X-rays, and full-disk UV images during transit. **SUIT detected solar flare 'kernels'** linking plasma heating, while VELC observed CMEs; the mission prepares for peak solar activity in 2026.



## Axiom Mission 4

- Axiom Mission 4 (Ax-4) was a private crewed spaceflight to the International Space Station (ISS), operated by Axiom Space with SpaceX and NASA partners. It was launched on **June 25, 2025**, from **Kennedy Space Center**.
- **Commander:** Peggy Whitson (Axiom Space, USA; fifth spaceflight).
- **Pilot:** **Shubhanshu Shukla** (ISRO, India; first spaceflight).
- **Other crew members:** Slawosz Uznanski-Wisniewski (Poland) & Tibor Kapu (Hungary)
- **Rocket:** Falcon 9
- The crew conducted over 60 experiments from 31 countries in microgravity, focusing on human physiology, Earth observation, life sciences, and materials.
- It tested **Crew Dragon Grace**, the final capsule built, and supported future missions like lunar/Mars exploration.



## NISAR Mission

- The NASA-ISRO Synthetic Aperture Radar (NISAR) mission is a historic joint satellite project between **NASA** and the Indian Space Research Organisation (**ISRO**), launched on **July 30, 2025**, from ISRO's **Satish Dhawan Space Centre**.
- It is the first Earth observation satellite to carry a dual-frequency radar system, featuring L-band (24 cm wavelength) and S-band (12 cm wavelength) **Synthetic Aperture Radar (SAR)** instruments.
- Weight: 2392 kg
- Rocket launcher: GSLV Mk II (GSLV-F16)
- NISAR operates in a **sun-synchronous orbit** at an altitude of **747 km** with an **orbital period of 100 minutes (12 day repeat cycle)**.
- The mission's key objectives include measuring and monitoring changes in ecosystems, land deformation, ice masses, sea level rise, natural hazards (earthquakes, volcanoes, landslides), soil moisture, and groundwater resources.
- The NISAR spacecraft is built around the I-3K Structure (Lift-off mass: 2400 kg), which serves as the heritage spacecraft bus.
- Mission Life: 5 Years



### Some Components of NISAR

| Name                                       | Details              | Space agency associated |
|--------------------------------------------|----------------------|-------------------------|
| L-Band SAR                                 | Frequency - 1.25 GHz | NASA                    |
| S-Band SAR                                 | Frequency - 3.2 GHz  | ISRO                    |
| 12 metre deployable mesh reflector antenna |                      | NASA                    |
| 9 metre deployable boom                    |                      | NASA                    |
| High speed downlink system                 |                      | ISRO                    |

### NISAR LAUNCHES

| Aspect         | 100th Launch (GSLV-F15/NVS-02)      | 101st Launch (PSLV-C61/EOS-09)     |
|----------------|-------------------------------------|------------------------------------|
| Date           | Jan 29, 2025                        | May 18, 2025                       |
| Launch Vehicle | GSLV Mk II                          | PSLV                               |
| Payload        | NVS-02 (NavIC navigation)           | EOS-09 (SAR Earth observation)     |
| Orbit          | GTO (Geosynchronous Transfer Orbit) | SSPO (Sun Synchronous Polar Orbit) |
| Lift-off mass  | 420 tonnes                          | 321 tonnes                         |
| Launch mass    | 2250 kg                             | 1696 kg                            |

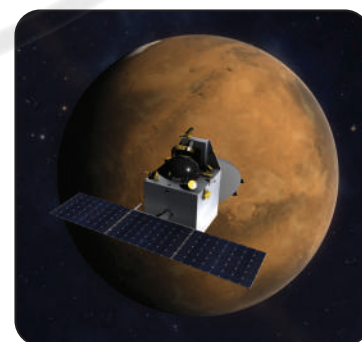
### Samudrayaan Mission

- Samudrayaan Mission is aimed to develop a self propelled manned submersible to carry **3 human beings** to a water depth of **6000 meters** in the ocean with a suite of scientific sensors and tools for deep ocean exploration.
- It has an endurance of **12 hours** of operational period and **96 hours** in case of emergency.
- The projected timeline is five years for the period **2020-2021 to 2025-2026**.
- National Institute of Ocean Technology (NIOT), Chennai**, an autonomous institute under MoES, has developed a 6000m depth rated Remotely Operated Vehicle (ROV), named **ROSUB-6000**.
- India is set to launch its first human underwater submersible **MATSYA 6000** as a part of deep ocean mission (Samudrayaan).



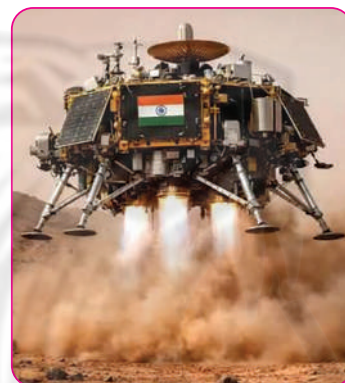
### Mars Orbiter Mission

- India's Mars Orbiter Mission (MOM), known as Mangalyaan, launched on **November 5, 2013**, via **PSLV-C25** from Sriharikota and entered Mars orbit on **September 24, 2014**, after a **298-day journey**, marking ISRO's first interplanetary success on the initial attempt.
- Originally designed for a six-month mission, Mangalyaan remained operational for more than eight years, far exceeding expectations.
- Payloads :**
  - Mars Colour Camera (MCC)**
  - Methane Sensor for Mars (MSM)**
  - Thermal Infrared Imaging Spectrometer (TIS)**
  - Mars Exospheric Neutral Composition Analyser (MENCA)**
  - Lyman Alpha Photometer (LAP)**



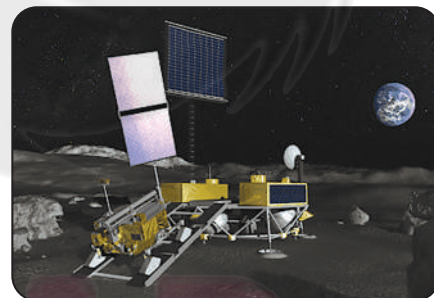
## Mars Lander Mission (MLM) - Mangalyaan 2

- **Primary Objective:** To achieve a soft landing on Mars and deploy a rover and an aerial vehicle to conduct in-situ scientific research.
- The mission received formal approval from the Space Commission on **February 21, 2025**.
- It is currently in the development phase, with completion targeted for the **2028–2030** timeframe.
- Total spacecraft mass is estimated at around **4,500 kg**, to be launched by an **LVM3** (GSLV Mk III) rocket.
- The revised mission (MLM) will consist of **two main modules**:
  - Cruise Stage (Orbiter Module)
  - Descent Stage (Lander Module)
- **Orbiting Payloads:**
  - Mars Orbit Dust Experiment (MODEX)
  - Radio Occultation (RO) Experiment
  - Energetic Ion Spectrometer (EIS)
  - Langmuir Probe and Electric Field Experiment (LPEX)
  - PRISM (Polarisation sensitive Infrared Spectroscopy of Mars)
  - PREM (Plasma AnalyseR for the Environment of Mars)



## LUPEX Mission

- The Lunar Polar Exploration (LUPEX) mission, also known as Chandrayaan-5, is a collaborative effort between **ISRO (India) and JAXA (Japan)** to investigate water resources in the Moon's south polar region.
- ISRO provides the lander and select instruments, while JAXA supplies the 350 kg rover, **H3-24L launch vehicle**, and additional instruments; contributions come from NASA and ESA.



## AstroSat

- India's Polar Satellite Launch Vehicle (PSLV-C30) successfully launched the AstroSat multi-wavelength observatory in its 31st flight on September 28, 2015.
- **Satellite Details:** The satellite is India's first dedicated space observatory, weighing approximately 1,513 kg, launched into a 650 km near-equatorial Low Earth Orbit (LEO).
- It is designed to simultaneously study celestial objects in a wide range of the electromagnetic spectrum, from visible light and ultraviolet to X-rays, making it a unique space-based observatory.



## XPoSat (X-ray Polarimeter Satellite)

- India's Polar Satellite Launch Vehicle (PSLV-C58) successfully launched the XPoSat satellite in its 60th flight on January 1, 2024.
- The satellite is India's first dedicated polarimetry observatory, weighing approximately 469 kg, launched into Low Earth Orbit (LEO).
- It is India's first, and only the world's second, dedicated mission to study the polarization of X-rays from celestial sources.
- It aims to investigate the physics of extreme objects like black holes and neutron stars by adding a new dimension to X-ray astronomy.



- Mission Objectives
  - POLIX (Polarimeter Instrument in X-rays) Payload: Measures the polarisation of X-rays (8-30 keV) from ~50 cosmic sources using Thomson scattering.
  - XSPECT (X-ray Spectroscopy and Timing) Payload: Conducts long-term spectral and temporal studies of X-ray sources (0.8-15 keV).

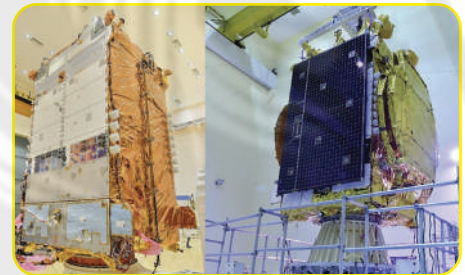
### PSLV-C62 Mission

- Launch location: First Launch Pad at Satish Dhawan Space Centre, Sriharikota.
- Primary payload: Earth Observation Satellite - N1 (EOS-N1) also named as 'Anvesha'.
- Characteristics of PSLV-C62 Vehicle:
  - Lift off Mass: 260 tonnes
  - Stages: 4
  - The PSLV-C62 mission encountered an anomaly during the end of the PS3 stage.



### GSAT-N2 (also known as GSAT-20)

- High-throughput communication satellite developed by the Indian Space Research Organisation (ISRO) for **NewSpace India Limited (NSIL)**.
- It operates primarily in Ka-Ka band frequency band to provide broadband and in-flight connectivity.
- **Launch Vehicle:** SpaceX **Falcon 9**
- **Mission Life:** 14 years.
- **Orbital Slot:** Geostationary Orbit (GSO) at 68° East longitude.
- **Mass:** 4,700 kg
- **Bus:** Built on the standard **I4K bus** (Carbon Fiber Reinforced Polymer structure).



### SSLV-D3 Mission

- The **SSLV-D3** mission was the third and final developmental flight of ISRO's Small Satellite Launch Vehicle (SSLV).
- **Launch date:** August 16, 2024
- **Primary Payload:** EOS-08, an Earth Observation Satellite designed for microsatellite-based research.
- **Secondary Payload:** SR-0 DEMOSAT, a passenger satellite developed by Space Kidz India.
- **Orbit:** Both satellites were successfully injected into a circular Low Earth Orbit (LEO) at an altitude of 475 km with an inclination of 37.4°.



### RLV-LEX Series

- **RLV LEX** (Reusable Launch Vehicle – Landing Experiment) is ISRO's series of test flights to demonstrate autonomous runway landing of a winged space vehicle.
- Purpose: To validate technologies for a winged, reusable launch vehicle that can:
  - Deliver satellites to orbit
  - Return from space
  - Glide and land horizontally on a runway like an aircraft, rather than vertically like Falcon 9.
- The vehicle used in LEX tests is called **"Pushpak"**.
- An **Indian Air Force Chinook helicopter** carries the RLV as an underslung load.



- **RLV-LEX 03 details:**

- Launch date: 23 June 2024
- The **RLV-LEX-03** (Reusable Launch Vehicle Landing Experiment-03) was the third and final test in ISRO's series of landing experiments for its reusable space plane, **Pushpak**.
- The test pushed the boundaries by releasing the vehicle with a **500-meter cross-range deviation** (compared to 150m in LEX-02) under more severe wind conditions, which the vehicle autonomously corrected to perform a precise centerline landing.

### GSLV-F14/INSAT-3DS Mission

- The mission was ISRO's launch of India's third-generation meteorological satellite, **INSAT-3DS**, using the **Geosynchronous Satellite Launch Vehicle (GSLV)** to improve weather forecasting, environmental monitoring, and disaster warning capabilities.
- **Launch date:** 17 February 2024
- **Launch site:** Satish Dhawan Space Centre (SDSC-SHAR), Sriharikota, from the Second Launch Pad.
- **Launch vehicle:** GSLV-F14, a three-stage GSLV Mk.II with an indigenous cryogenic upper stage (CE-7.5).
- **Mission type:** Meteorological satellite deployment into Geosynchronous Transfer Orbit (GTO), followed by orbit-raising to place the satellite in a geostationary orbit at about 74° E longitude, 35,786 km altitude.
- **INSAT-3DS** was successfully separated about 19 minutes after launch and later stabilized in its operational geostationary slot.
- **Primary payloads:** Imager, Sounder, Data Relay Transponder (DRT) and Satellite-Aided Search and Rescue (SAS&R) transponder.
- **Structure:** I-2k platform



### Gaganyaan

- Gaganyaan is **India's first human spaceflight program** by ISRO, aiming to launch a crew of **three astronauts** to a 400 km **low Earth orbit** for a **three-day mission**.
- The mission demonstrates indigenous human spaceflight capability using the human-rated **LVM3 (HLVM3)** launch vehicle.
- ISRO conducted its first **Integrated Air Drop Test (IADT-1)** for the Gaganyaan mission on **Aug. 24, 2025**.
- In October 2024, the scope of Gaganyaan programme was revised from three missions (G1, G2, H1) to eight missions. It includes three uncrewed missions G1, G2, G3 followed by two crewed missions (H1 & H2) followed by a docking mission to any space station (G4), launch of BAS-01 and docking mission to BAS-01 (G5).



### Chandrayaan Programme

- The **Chandrayaan Programme** is India's flagship lunar exploration series managed by ISRO. Starting from a basic orbital map in 2008, the series has evolved into highly complex sample-return and polar exploration missions.

| Mission       | Launch Vehicle | Launch Date  | Landing / Impact Date            | Configuration                     | Key Achievement / Status                                                                                         | Note                                                                 |
|---------------|----------------|--------------|----------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| Chandrayaan-1 | PSLV-C11       | Oct 22, 2008 | <b>Nov 14, 2008</b> (MIP Impact) | Orbiter + Moon Impact Probe (MIP) | <b>Major Discovery:</b> Intentionally crashed the MIP at the South Pole to confirm surface water molecules (HO). | Operated for about 310 days; communication lost on 28–29 August 2009 |

|                       |                                       |                   |                                          |                                                   |                                                                                                                                 |                                                                                  |
|-----------------------|---------------------------------------|-------------------|------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Chandrayaan-2         | GSLV-Mk III / LVM3                    | Jul 22, 2019      | <b>Sep 07, 2019</b><br>(Landing Attempt) | Orbiter + Vikram Lander + Pragyan Rover           | <b>Partial Success:</b> The orbiter remains safely operational in lunar orbit, but the lander crashed during its final descent. | Orbiter mass: ~2,379 kg;<br>Despite failure, its orbiter continues to send data  |
| Chandrayaan-3         | GSLV-Mk III / LVM3                    | Jul 14, 2023      | <b>Aug 23, 2023</b><br>(Soft Landing)    | Propulsion Module + Vikram Lander + Pragyan Rover | <b>Historic Success:</b> Achieved the world's first successful soft-landing near the Lunar South Pole (Shiv Shakti).            | <b>Fourth nation overall</b> to land on the Moon (US, Russia, China, then India) |
| Chandrayaan-4         | Two <b>LVM3 (GSLV Mk III)</b> rockets | 2027-28 (Planned) | —                                        | 5-Module Stack (2x LVM3 launches)                 | <b>Sample Return:</b> Planned to land at the Mons Mouton region to collect and return lunar soil back to Earth.                 | Chandrayaan-4 will consist of five modules split into two spacecraft stacks      |
| Chandrayaan-5 (LUPEX) | —                                     | 2028-29 (Planned) | —                                        | Joint ISRO-JAXA Lander & Rover                    | <b>Ice Analysis:</b> Polar exploration mission with Japan to drill and analyze subsurface water ice quantity.                   | JAXA (Japan) – responsible for the launch vehicle (H3-24L) and the lunar rover   |

### Chandrayaan-3

- Chandrayaan-3 was India's historic mission to demonstrate end-to-end capability in safe landing and roving on the lunar surface.
- Mission Profile:**
  - The LVM3 M4 rocket, nicknamed Bahubali or Fatboy, placed the module into an Elliptic Parking Orbit of 170 by 36500 km.
  - This was the 4th operational flight of India's heaviest and most capable launch vehicle.
  - Launch Date: July 14, 2023.
  - Launch Site: Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota.
  - Landing Date: August 23, 2023.
  - Landing Site: Near the lunar South Pole (69.37°S, 32.32°E).
- Spacecraft Modules:**
  - Propulsion Module (2,148 kg): Transported the craft to lunar orbit; carried the SHAPE payload.
  - Lander (Vikram - 1,752 kg): Executed a soft landing; featured ChaSTE (thermal) and ILSA (seismic) payloads.
  - Rover (Pragyan - 26 kg): Conducted in-situ soil analysis using LIBS and APXS.
- Mission Goal: Designed for one lunar day (14 Earth days) to demonstrate safe landing, robotic roving, and lunar surface experiments.
- Significance: India became the fourth nation to achieve a soft lunar landing and the first to land near the lunar South Pole, successfully overcoming the challenges faced by Chandrayaan-2.



### Shukrayaan-1

- The Venus Orbiter Mission (VOM), colloquially known as Shukrayaan-1, is India's maiden interplanetary mission to Venus.
- The mission was formally approved by the Union Cabinet on September 18, 2024, with a budget of ₹1,236 crore.
- Launch Date: March 29, 2028 (Planned)
- Transit Duration: 112-day journey (reaching Venusian orbit on July 19, 2028)
- Launch Vehicle: Upgraded LVM3 (Launch Vehicle Mark 3)
- Mission Life: 4 years
- Target Orbit: A 200 km × 600 km polar science orbit (achieved gradually from an initial elliptical orbit via aerobraking).



# MAJOR MISSIONS & SATELLITES



| Mission / System    | Description                                                                                                                                                | Key Details / Status                                                                                                                                                                                                                                                                          |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TRISHNA</b>      | <b>Thermal InfraRed Imaging Satellite for High-resolution Natural Resource Assessment.</b> Jointly developed by ISRO and CNES.                             | <b>Launch:</b> Scheduled in 2027.<br><b>Capability:</b> High-resolution thermal imaging of land/coastal regions.                                                                                                                                                                              |
| <b>NavIC (NDSS)</b> | <b>India's indigenous satellite navigation system.</b> Provides accurate positioning, navigation, and timing (PVT) across India and up to 1,500 km beyond. | <b>Strategy:</b> Reduces dependence on foreign systems.<br><b>Constellation:</b> 2nd gen satellites (NVS-01 to NVS-05).<br><b>Launches:</b> NVS-01 (May 2023), NVS-02 (Jan 2025).<br><b>Adoption:</b> Integrated in chipsets (e.g., Qualcomm); Ref. station in South Africa (2025 agreement). |
| <b>GAGAN</b>        | <b>GPS Aided GEO Augmented Navigation.</b> Satellite-Based Augmentation System (SBAS) by ISRO and AAI.                                                     | <b>Status:</b> Fully operational since 2015.<br><b>Milestone (2026):</b> DGCA conducted India's first satellite-based landing approach on a commercial jet.                                                                                                                                   |
| <b>POEM-4</b>       | <b>PSLV Orbital Experimental Module.</b> Used PSLV's 4th stage (PS4) as an orbital platform.                                                               | <b>Payloads:</b> 24 total (10 from non-govt, 14 from ISRO).<br><b>Milestone:</b> Completed <b>1,000 orbits</b> on March 4, 2025.                                                                                                                                                              |
| <b>CROPS-1</b>      | Compact Research Module for Orbital Plant Studies. Unmanned module for growing plants in space.                                                            | <b>Mission:</b> Flew on POEM-4 (PSLV-C60).<br><b>Goal:</b> Seed germination up to two-leaf stage.<br><b>Duration:</b> 5-7 days in orbit.<br><b>Seed:</b> Cowpea selected after ground tests.                                                                                                  |
| <b>Chang'e 4</b>    | China's lunar mission                                                                                                                                      | First nation to land a rover on the <b>far side</b> of the Moon (Von Karman crater)                                                                                                                                                                                                           |

## LATEST INFRASTRUCTURE & LAUNCH VEHICLES



| Project / Vehicle             | Description                                                  | Capacity / Status                                                                                                                                                                                          |
|-------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Third Launch Pad (TLP)</b> | New launch infrastructure at <b>SDSC SHAR</b> , Sriharikota. | <b>Purpose:</b> Supports <b>NGLV</b> and heavy-lift rockets; standby for existing pads.<br><b>Investment:</b> ₹4,000 Crores (approved by Union Cabinet).<br><b>Target:</b> Operational by <b>2029-30</b> . |

|                           |                                                                                   |                                                                                                                                                                                                                                                                                                |
|---------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NGLV</b>               | <b>Next Generation Launch Vehicle.</b><br>Heavy-lift, partially reusable vehicle. | <b>Payload:</b> ~30t to LEO; ~10t to GTO.<br><b>Features:</b> Reusable first stage, semi-cryogenic engines, modular design.<br><b>Goal:</b> Supports Space Station, Gaganyaan, and commercial launches.<br><b>Budget:</b> ~₹8,240 Crores.                                                      |
| <b>SSLV</b>               | Small Satellite Launch Vehicle.                                                   | <b>Tech Transfer:</b> Transferred to <b>HAL</b> (Sep 2025).<br><b>Launch Complex:</b> Dedicated complex being established at <b>Kulasekarapattinam</b> , Tamil Nadu.                                                                                                                           |
| <b>Vikram-1 (Skyroot)</b> | Private launch vehicle by Skyroot Aerospace.                                      | <b>Test:</b> First static test of Kalam-1200 motor (Aug 8, 2025).                                                                                                                                                                                                                              |
| <b>Agnibaan SOrTeD</b>    | Suborbital demonstrator by <b>Agnikul Cosmos</b> (IIT Madras spin-off).           | <b>Launch Date:</b> May 30, 2024.<br><b>Place:</b> Agnikul's private launchpad ("Dhanush") at SDSC-SHAR.<br><b>Engine:</b> "Agnilet" – world's first single-piece, 3D-printed semi-cryogenic engine.<br><b>Firsts:</b> First private Indian launchpad launch; first Linux-based Indian flight. |
| <b>CE20</b>               | Cryogenic engine for LVM3.                                                        | <b>Status:</b> Key ground test demonstrated higher thrust capability.                                                                                                                                                                                                                          |

## TECHNOLOGY & INNOVATION (MAKE-IN-INDIA)

| Component                           | Description                                                                 | Significance                                                                                                                                                                    |
|-------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>VIKRAM 3201</b>                  | First fully Make-in-India <b>32-bit microprocessor</b> for launch vehicles. | <b>Tech:</b> 180nm CMOS plant (Semi-Conductor Lab).<br><b>Upgrade:</b> Improved version of VIKRAM 1601 (used since 2009).<br><b>Env:</b> Qualified for harsh launch conditions. |
| <b>KALPANA 3201</b>                 | 32-bit <b>SPARC V8 RISC microprocessor</b> .                                | <b>Tech:</b> IEEE 1754 ISA; supports open-source tools.<br><b>Test:</b> Tested with real flight software.                                                                       |
| <b>APSARA-U</b>                     | <b>Apsara-Upgraded</b> research reactor by BARC                             | <b>Fuel:</b> First Indian research reactor using <b>Low Enriched Uranium (LEU)</b> .<br><b>Criticality:</b> Achieved on Sept 10, 2018                                           |
| <b>Bharat Forecast System (BFS)</b> | India's first high-resolution weather model.                                | <b>Resolution:</b> 6 km x 6 km.<br>Developed by IITM, Pune; operationalised by IMD                                                                                              |
| <b>PARAS-2</b>                      | Spectrograph at PRL, Mount Abu Observatory.                                 | <b>Discovery:</b> Confirmed exoplanet <b>TOI-6038A b</b> (sub-Saturn size, 78.5 Earth masses).                                                                                  |



## INTERNATIONAL COOPERATION & EVENTS

| Event / Initiative              | Details                                                                                                                                                                         |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>GLEX 2025</b>                | <b>Global Space Exploration Conference.</b><br><b>Host:</b> New Delhi (May 7-9, 2025).<br><b>Theme:</b> “Reaching New Worlds: A Space Exploration Renaissance”.                 |
| <b>IAC 2025</b>                 | <b>76th International Astronautical Congress.</b><br><b>Host:</b> Sydney (Sep 29 – Oct 3, 2025).<br><b>Activity:</b> ISRO & IN-SPACe established India Space Pavilion.          |
| <b>SMOPS-2026</b>               | <b>Spacecraft Mission Operations Conference.</b><br><b>Host:</b> Bangalore (Apr 8-10, 2026).<br><b>Theme:</b> Innovative Operations for Smart & Sustainable Mission Management. |
| <b>Future Hosting (2026)</b>    | India will host:<br>1. ICG (International Committee on GNSS).<br>2. BRICS Heads of Space Agencies.<br>3. International Planetary Data Alliance.                                 |
| <b>NASA Exoplanet Milestone</b> | Confirmed <b>6,000 exoplanets</b> beyond our solar system                                                                                                                       |

## OUTREACH PROGRAMS

### NE SPARKS

- The North East Students’ Programme for Awareness, Reach, and Knowledge on Space (NE-SPARKS) is a pioneering initiative aimed at igniting curiosity and fostering awareness about space science and technology among students from the North Eastern Region (NER) of India.
- This program seeks to bridge geographical and informational gaps by providing students with an immersive experience of India’s advancements in space research and exploration through visits to ISRO Centres in Bengaluru.



### UNISpace Nanosatellite Assembly & Training by ISRO (UNNATI)

- India announced this programme in 2018 in Vienna during the Symposium to commemorate the 50th Anniversary of the First United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50).
- ISRO, Department of Space, Govt. of India offers a training programme on nanosatellite assembly and building, UNNATI (UNISpace Nanosatellite Assembly & Training by ISRO). Foreign Engineers/Scientists/Officials are eligible to get trained.

