

2. GSAT-7R (CMS -03) – Science & Technology

ISRO's LVM3 rocket launches GSAT-7R, the Navy's most advanced communication satellite
ISRO successfully launched the GSAT-7R (CMS-03) communication satellite for the Indian Navy using its LVM-3 rocket. This mission signifies India's self-reliance in launching its heaviest payloads (4,400 kg) from Indian soil, reducing dependence on foreign providers.

ISRO's Successful LVM-3 Launch

The Indian Space Research Organisation (ISRO) has successfully launched the GSAT-7R (CMS-03) communication satellite. This satellite is specifically designated for use by the Indian Navy. The launch vehicle used was the LVM-3 M5 (Launch Vehicle Mark-3). This mission follows the LVM3's previous historic launch of the Chandrayaan-3 mission, which made India the first nation to successfully land near the lunar south pole.

About GSAT-7R (CMS-03)

Core Mission & Design

Satellite Series – It is a part of India's advanced GSAT-7 defence communication satellite series.

Purpose – It serves as a replacement for the ageing GSAT-7 (launched in 2013).

Primary Goal – To strengthen and secure the Indian Navy's communication network over the crucial Indian Ocean Region (IOR).

Operational Life – The satellite is designed for a 15-year service life.

Launch & Orbit Details

Launch Vehicle – Launch Vehicle Mark 3 (LVM3).

Launch Site – Satish Dhawan Space Centre (SDSC-SHAR) in Sriharikota.

Initial Orbit (GTO) – The satellite was first placed into a Geosynchronous Transfer Orbit (GTO). A GTO is an elliptical orbit used as an intermediate step to transfer a satellite from Low Earth Orbit (LEO) to a final Geostationary Orbit (GEO). This specific GTO was an elliptical orbit with an approximate perigee (closest point) of 250 km and an apogee (farthest point) of 29,970 km.

Final Orbit (GEO) – From the GTO, the satellite will use its onboard propulsion system to gradually raise its orbit. Its final destination is a Geostationary Orbit (GEO), located approximately 35,786 kilometers above the Earth.

Satellite Specifications

Weight – Approximately 4,400 kg.

Significance of Weight – This makes it the heaviest communication satellite ever launched from Indian soil.

For context – The GSAT-11 (launched in 2018) was heavier at over 5,800 kg, but it was launched from Europe using the Ariane-5 rocket.

Payload Features – Equipped with advanced multiband transponders. These transponders support voice, video, and data services, ensuring high-bandwidth connectivity.

Coverage – Provides real-time, encrypted communication services over the entire Indian landmass and its adjoining maritime zones.

Applications – Facilitates secure, real-time communication for naval operations. Aids in disaster management coordination. Provides critical support for naval and coastal security operations.

Significance of the CMS-03 Launch

1. Indigenous Capability for Heavy Satellites

The Shift – This launch marks India's significant transition towards self-reliance (Atmanirbhar Bharat) in deploying heavy satellites.

Previous Reliance – Until now, India relied on foreign launch providers for its heaviest satellites –

GSAT-11 (5,854 kg) and **GSAT-24 (4,181 kg)** were launched by ArianeSpace (Europe).

GSAT-20 (4,700 kg) was launched by SpaceX (USA).

Strategic Autonomy – This success reduces India's dependency on foreign launchers, particularly for satellites weighing more than 3,000 kg.

2. Orbit Optimization & Mission Planning

The Challenge – The 4,410 kg payload was slightly heavier than the LVM3's standard GTO capacity (which typically targets a 36,000 km apogee).

The Solution – ISRO demonstrated adaptive mission planning by adjusting the GTO. They intentionally targeted a lower apogee of 29,970 km to successfully accommodate the heavier payload, leaving the satellite to cover the remaining distance using its own propulsion.

The Result – This flexibility maximizes the rocket's payload capacity.

3. Platform for Future Missions

Proven Reliability – The success of the LVM3 vehicle family continues to build confidence in the rocket.

Gaganyaan's Vehicle – The LVM3 is the chosen launch vehicle for Gaganyaan, India's first crewed space mission.

Strategic and Economic Implications

Strategic Autonomy – Greatly reduces India's dependence on foreign nations for launching critical heavy-lift communication and defence satellites.

Economic Competitiveness – Positions India as a strong competitor in the global commercial launch market. This market is currently dominated by major players like SpaceX, Arianespace, and China.

Human Spaceflight Capability – This mission is another successful step that paves the way for more complex missions, including Gaganyaan and future space station modules.

Technological Innovation – The launch drives forward India's advances in key space technologies, which are essential for long-term competitiveness –

1. Cryogenic propulsion
2. Semi-cryogenic engines
3. Reusable launch systems

Launch Vehicle Mark-3 (Lvm3)

Overview – The LVM3, nicknamed "Bahubali", is India's most powerful operational rocket.

Developer – Developed by ISRO.

Primary Use – Designed for launching heavy communication satellites to GEO and for interplanetary missions.

Former Name – It was previously known as the Geosynchronous Satellite Launch Vehicle Mark-III (GSLV Mk-III).

Capability – It is designed to carry communication, navigation, and deep-space missions (such as the Chandrayaan and Gaganyaan programs).

Rocket Type – A three-stage rocket that uses a combination of solid, liquid, and cryogenic fuel engines.

LVM3 Stages

1. **Stage 1 (Solid Propellant)** – Consists of two large strap-on boosters (S200) that provide the massive thrust required for liftoff.
2. **Stage 2 (Liquid Propellant)** – The L110 liquid stage (core stage) ignites after the boosters separate to provide continued thrust.
3. **Stage 3 (Cryogenic)** – The C25 cryogenic upper stage, which uses a high-efficiency mixture of Liquid Hydrogen (LH2) and Liquid Oxygen (LOX), provides the final thrust to inject the satellite precisely into its intended orbit.

Payload Capacity

To Low Earth Orbit (LEO) – Can carry up to 8,000 kg (approx. 2,000 km altitude).

To Geosynchronous Orbit (GEO) – Can carry up to 4,000 kg (approx. 36,000 km altitude).

Major Achievements

Chandrayaan-2 (2019) – Successfully launched India's second lunar mission.

Chandrayaan-3 (2023) – Successfully launched the historic lunar landing mission.

Crew Module Atmospheric Re-entry Test (2014) – A critical test (CARE) that validated the systems for the Gaganyaan crew module.

OneWeb Missions (2022–2023) – Conducted commercial launches for OneWeb, deploying their LEO satellites after the Russia-Ukraine war disrupted OneWeb's original launch plans.

Rebranding

From GSLV Mk-III to LVM3 – The rocket was renamed LVM3 to signify its versatility beyond just GEO missions.

Demonstrated Versatility – Its ability to launch the OneWeb missions (e.g., carrying a 5,700 kg payload to a 450 km orbit) proved it was a capable vehicle for a wide range of orbits, not just geosynchronous ones.

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