Types of Satellites Launched by ISRO

By Padmakshi Saraswat , MacroEdtech

Introduction

The Indian Space Research Organisation (ISRO) is India's national space agency. It develops and collects data for the development of India. It operates under the Department of Space and has one of the best capabilities in building satellites, launch vehicles, space applications, planetary exploration,and humans paceflight. India's space journey began with the greatest of all time, Dr. Vikram Sarabhai. He established INCOSPAR in the 1960s, and therefore in 1969, ISRO was established. India's space journey began with the greatest of all time, Dr. Vikram Sarabhai. He established INCOSPAR in the 1960s, and therefore in 1969, ISRO was established to consolidate India's growing space technology. With the launch of Aryabhata in 1975, India entered space exploration. Over the decades, it has continued its journey by exploring planets through Chandrayaan and MOM missions, and by preparing to send humans into space via the Gaganyaan mission.

Types of Satellites Launched by ISRO

Communication Satellites

What are communication satellites? How do they work?

Communication satellites are satellites used for transmitting radio, television, data, or phone signals. The fiber or Wi-Fi installed in homes also works with the help of these satellites. They first receive data from a particular location on Earth (uplink), change its frequency, amplify or process that data using transponders, and then send it back to Earth at a different location (downlink). According to ISRO's official data, these satellites come under the GSAT/INSAT series. The INSAT system is one of the largest communication systems in the Asia-Pacific region.

What is the GSAT series?

GSAT stands for Geosynchronous Satellite. This is the communication satellite series produced by ISRO. The GSAT series helps in tasks like telecommunication, signaling, radio, wave amplification, and frequency management

Some of the GSAT satellites are:

GSAT-7

1.Designed to study marine areas and wide ocean regions.
2. Supports multiband communication like voice, data, etc.
3. Used for important and special communication needs like the Navy.

GSAT-7A

1. Launched on 19 December 2018
2.Uses Ku-band transponders

GSAT-17

1.Launched with payloads in C band, extended C band, and S band
2.Provides data for rescue missions, search missions, and meteorological data relay

GSAT-18

1. Launched via Ariane-5
2. Carries 48 transponders including C band, extended C band, and Ku band

GSAT-19

A next-generation satellite with high-capacity transponders.

Significance of the GSAT series:

Strategic Autonomy:

Through the GSAT series, India develops its own communication system, reducing dependency on foreign suppliers.

Broadband & Digital Inclusion:

High-throughput GSATs (like GSAT-29, GSAT-N2) help provide broadband connectivity to rural and remote areas.

Defense & Security:

Satellites like GSAT-7, GSAT-7A, and GSAT-7R are used for military communication, especially naval and over-the-horizon coverage.

Navigation Augmentation:

GSAT-8 (and others) supports GAGAN, improving GPS-based navigation accuracy over India.

Long Life & Reliability:

Many GSATs are designed for 10+ years of life, ensuring continuity of services.

Earth Observation Satellites (e.g., Cartosat, Resourcesat)

What are EO satellites?

EO satellites monitor the Earth's surface and collect physical, chemical, and biological data.
ISRO's EO satellites are used for urban planning, resource management, water monitoring, forestry, meteorology, and many other applications.
Cartosat and Resourcesat are key EO satellite series.

1. Cartosat Series

Cartosat is India's satellite series mainly used for mapping and imaging.

Purpose and applications:

1.Provides detailed images for mapping, infrastructure planning, urban & rural development, coastal monitoring, GIS, and land-use change detection.
2.Due to high spatial resolution, they support large-scale mapping

2. Resourcesat Series

These satellites collect data about India's natural resources.

Primary purpose:

To monitor resources like water, land, soil, and roads.

Applications:

1.Provides multispectral data
2.Helps determine vegetation health, water bodies, soil moisture, etc.

Challenges of EO satellites:

Large data storage requirements; e.g., Resourcesat has two large recorders.

Orbit management: Many are in Sun-Synchronous Polar Orbits for consistent imaging.

Navigation Satellites (NAVIC / IRNSS)

What is NAVIC/IRNSS?

NAVIC stands for Navigation with Indian Constellation. Earlier it was known as IRNSS (Indian Regional Navigation Satellite System).

These satellites provide accurate terrestrial, aerial, and marine navigation data.

They are used for:

Navigation

Location-based services

Disaster management

Time synchronization

Strategic/defense applications

Scientific Satellites

Astrosat

1.India's first multi-wavelength space observatory

2.Launched in 2015 on PSLV-C30

3.Studies black holes, white dwarfs, neutron stars, binary star systems, star formation, and supernova remnants

Aditya-L1

1.India's first mission dedicated to studying the Sun

2.Positioned at Lagrange Point 1, about 1.5 million km from Earth

3.Studies corona, flares, coronal mass ejections, solar wind, and magnetic fields

Meteorological Satellites

INSAT series

India's weather observation and communication satellites

Provide multispectral imaging, atmospheric temperature & humidity profiles, cloud motion vector data, cyclone monitoring, and meteorological data (used by IMD)

Small Satellites / Student Satellites

This category covers Microsats, Nanosats, and Cubesats.

Their main purpose is capacity-building, low-cost missions, and new payload testing.

Technology Demonstration / Experimental Satellites

Rohini Technology Payload (RTP) – 1979

India's first experimental satellite launched by SLV-3

GSAT-4 (Tech Demo)

Hosted ion propulsion experiment and Ka-band payload (did not reach intended orbit)

Microsat Series

Tested new Earth observation cameras and technologies

GSAT-6 / GSAT-6A
Demonstrated large unfurlable S-band antenna technology

IRNSS-1I / NVS-01
Serve operational and tech-improvement roles

ISRO Nano Satellite (INS) Series
INS-1A, INS-1B carried experimental payloads

SRE-1
Tested re-entry and recovery systems

POEM (PSLV Orbital Experiment Module)
PSLV stage used as an experimental orbital platform

List of Satellites and Associated Launch Vehicles

Satellite Name	Satellite Type	Launch Vehicle (as per ISRO)
Astrosat	Scientific / space observatory	PSLV-C30
Aditya L1	Scientific / Solar Mission	PSLV-C57
IRNSS1E	Navigation	PSLV-C31
IRNSS1F	Navigation	PSLV-C32
INSAT 3DS	Meteorological / Earth Observation	GSLV-F14
INSAT 3D	Meteorological / Earth Observation	Ariane-5 VA-214
RESOURCESAT 1	Earth Observation	PSLV-C5
CARTOSAT 2	Earth Observation	PSLV-C7
EOS 2	Earth Observation	SSLV-D1
AzaadiSAT	Student / Cubesat	SSLV-D1

How ISRO Chooses the Rocket for Each Satellite Type

Step 1: Know the mass of the satellite

Rocket	Lift Capability	Used For
PSLV	Up to ~1.75 tons to LEO	Medium-weight EO, scientific missions
GSLV	~2–2.5 tons to GTO	Heavier communication & navigation satellites
GSLV Mk III / LVM3	Up to ~4 tons to GTO	Heavy communication satellites, deep-space missions
SSLV	Up to 500 kg to LEO	Small, student, experimental satellites

Heavier satellites need GSLV, while small satellites can use PSLV and SSLV.

Step 2: Know the orbit

Orbit	Typical Satellites	Preferred Rockets
LEO	Microsats, student sats, some EO satellites	SSLV, PSLV
SSO	Cartosat, Resourcesat, RISAT	PSLV
GTO	INSAT, GSAT	GSLV, LVM3
GEO	Some weather satellites	GSLV
Lunar/Interplanetary	Chandrayaan, Mangalyaan	PSLV (earlier), LVM3 (now)

Step 3: Complexity
Some missions need co-passenger satellites.
PSLV: Known for launching multiple satellites
LVM3: Used for crew missions, large spacecraft, complex trajectories

Importance of Satellites & ISRO's Contribution to India's Space Growth

What is the importance of satellites in our life, you might ask?

The phone or laptop you are using now to read this might not work if there weren't any communication satellites. The map you use to travel from one place to another might not work.

The television you watch would not work, the Wi-Fi you use wouldn't work, the FM you play would not work. Like this, there are multiple things,I just listed a few which would affect your daily life in many

ISRO's contribution to India's space growth has not been less in any aspect. From carrying components on bullock carts and cycles to launching India's first satellite, to launching MOM: Mars Orbital Mission (marking history by reaching Mars on the first try), to reaching the Moon's far side, and now about to send humans to space via the Gaganyaan mission ISRO is making every Indian feel proud of his or her own country. It is motivating the young youth to come forward and support our country by launching programs like YUVIKA so that you don't have to be an adult to take part.