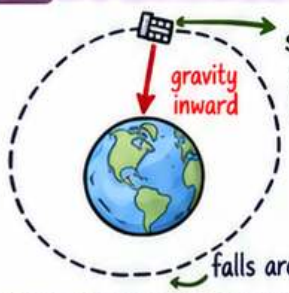
01 ORBIT = CONTINUOUS FREE FALL

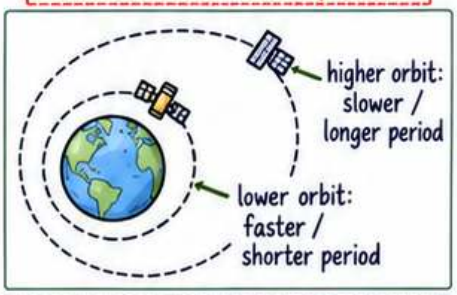


Rocket: above thick air + sideways speed → orbit

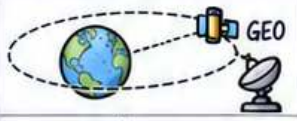
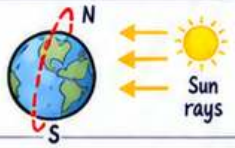
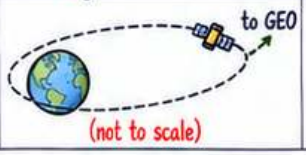


Low-orbit speed
≈ 7.8 km/s
≈ 28,000 km/h

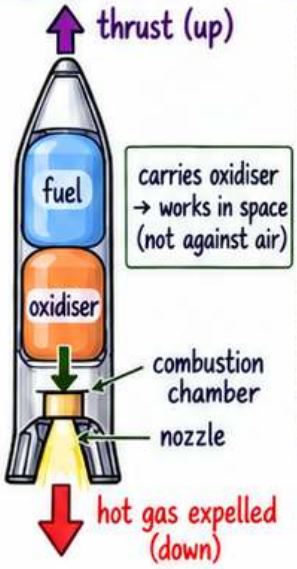
for circular-orbit comparision

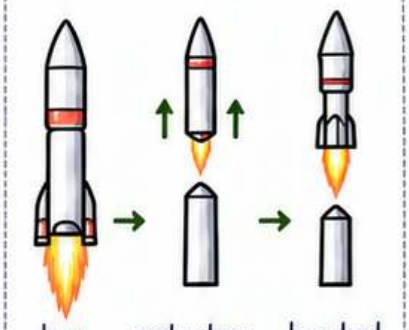


02 CHOOSE THE ORBIT BY THE JOB

Type (abbrev)	Height (approx.)	Key features / job	Diagram	Notes
LEO (Low Earth Orbit)	≈ 160 – 2,000 km	• close imaging • space stations • fast pass → brief local coverage		≈ 90 min at lower LEO
MEO (Medium Earth Orbit)	≈ 2,000 – 35,786 km	• navigation e.g. GPS • wide-area visibility		
GEO (Geostationary Orbit)	35,786 km	• circular • equatorial • Earth's rotation direction • TV / telecom / weather		period ≈ 24h → appears fixed fixed relative to ground
SSO (Sun-Synchronous Orbit)	near-polar; typical ≈ 600 – 800 km	• same local solar time on repeat passes → comparable illumination • mapping / change detection		SSO describes geometry/ timing; it can lie within LEO
GTO (Geostationary Transfer Orbit)	elliptical (varies)	• elliptical transfer → engine burn → circular GEO • transfer route, not final operating orbit		GTO ≠ GEO orbit ≠ launch vehicle

03 THRUST + STAGING





04 THREE PROPULSION TYPES

SOLID



- solid propellant
- simple • strong initial thrust
- once lit: not readily throttled / stopped
- first stages / side boosters

LIQUID



- liquid fuel + oxidiser pumped to chamber
- flow control → control / shutdown
- Vikas: India's workhorse liquid engine

CRYOGENIC

(Indian upper-stage example)



- cold storage + pumping difficult
- efficient upper stage
- India's indigenous Cryogenic Upper Stage

Cryogenic is a liquid-propellant type

05 CRYOGENIC SELF-RELIANCE

1991: Glavkosmos deal → 1992: US sanctions citing MTCR → Russia: finished engines, technology withheld → Jan 2014: indigenous cryogenic flight success

technology denial → domestic capability

AP LINK — SRIHARIKOTA



- ≈ 13.7°N
- eastward launch → Earth's spin boost ≈ 450 m/s
- Bay of Bengal → safer downrange path

bloom. APPSC GROUP 2 | SPACE • 02

Launchers • services • Andhra links

01 MATCH THE LAUNCHER TO THE TASK

launch vehicle → satellite → service on Earth

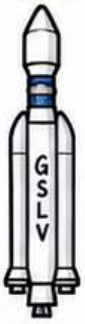
Same launchers can serve different destinations.

PSLV
Polar Satellite Launch Vehicle



- polar / Sun-synchronous missions
- workhorse
- 2017: 104 satellites in one flight — record at the time
- Also launched Chandrayaan-1, MOM, Aditya-L1

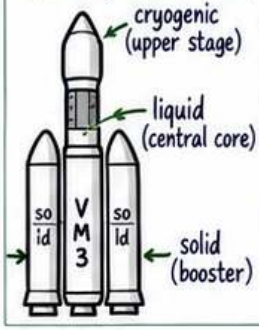
GSLV
Geosynchronous Satellite Launch Vehicle



- communication / weather payload launches
- cryogenic upper stage
- geosynchronous missions

orbit name ≠ launch vehicle

LVM3
Launch Vehicle Mark-3 (formerly GSLV MkIII)



- heavy lift
- ≈ 8 tonnes → LEO
- ≈ 4 tonnes → GTO
- Chandrayaan-2 + Chandrayaan-3
- human-rated version for Gaganyaan

SSLV
Small Satellite Launch Vehicle



- ≈ 500 kg → LEO
- small payloads
- quick dedicated ride rather than wait for rideshare

02 SATELLITES – FOUR JOBS

COMMUNICATION
INSAT / GSAT

- GEO links
- TV • telephone • broadband • emergency broadcasts



tele-education / telemedicine

GSAT-N2: launched late 2024; broadband + in-flight connectivity

NAVIGATION
NavIC: India's regional system

- precise broadcast time → signal travel time → position
- Independent regional capability
- GPS is a separate system



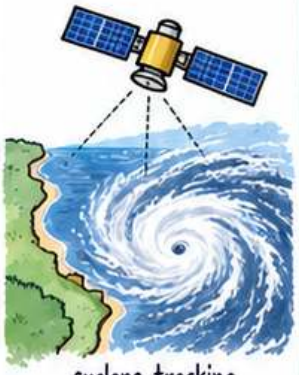
EARTH OBSERVATION

- remote sensing = observing from a distance
- Cartosat → detailed maps
- Resourcesat → natural resources
- RISAT → radar; through cloud + darkness
- Oceansat → seas



WEATHER
INSAT-3D family

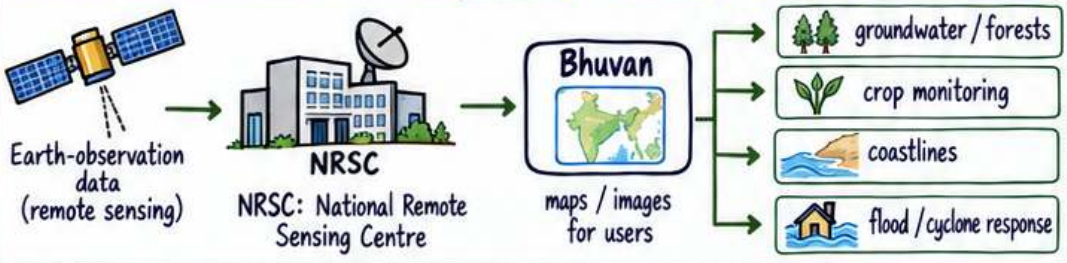
- atmosphere images → forecasts + cyclone tracking



cyclone tracking

03 DATA → USE ON THE GROUND

Earth-observation data → NRSC, Hyderabad → Bhuvan → maps / images for users



INCOIS, Hyderabad
Indian National Centre for Ocean Information Services

- storm-surge • high-wave • potential fishing-zone advisories



Andhra fishing coast

04 ANDHRA LOCATION CHECK

ANDHRA PRADESH
SDSC SHAR – Satish Dhawan Space Centre
Sriharikota, Tirupati district



NARL: National Atmospheric Research Laboratory

- Gadanki
- atmospheric research



TELANGANA
NRSC + INCOIS
Hyderabad



Hyderabad institutions serve AP; location ≠ Andhra Pradesh.

KERALA
IIST
Indian Institute of Space Science and Technology



TAMIL NADU
Kulasekarapattinam

- second spaceport project



Space capability → services on the ground

bloom. APPSC GROUP 2 | SPACE • 03

Milestones • missions • institutions

01 ROOTS OF THE PROGRAMME

Vikram Sarabhai: father of Indian space programme
communication • weather • resource mapping

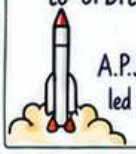


→ **1969:** **ISRO** established
Indian Space Research Organisation
इसरो ISRO

→ **1975:** **Aryabhata,** first Indian satellite
Soviet launch vehicle



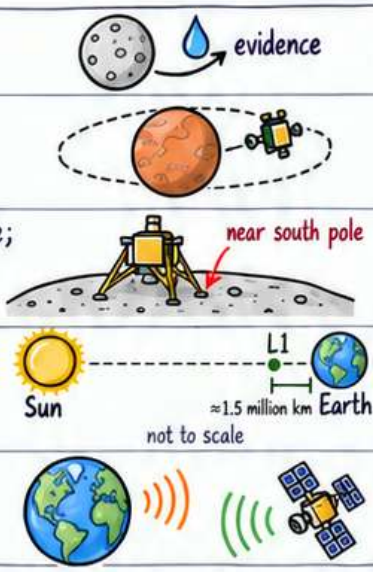
→ **1980:** indigenous launch-to-orbit milestone
A.P.J. Abdul Kalam led launch-vehicle effort



Indian satellite ≠ necessarily Indian launch vehicle

02 EXPLORATION MISSIONS

Mission	purpose / milestone	recall distinction
CHANDRAYAAN-1	2008; first Indian Moon mission; instruments found evidence of lunar water	lunar exploration
MOM / MANGALYAAN	2013 launch → 2014 Mars orbit; first-attempt Mars orbital success; cost ≈ ₹ 450 crore	Mars ORBITER
CHANDRAYAAN-3	23 Aug 2023: soft landing near lunar south pole; India 4th soft-landing country; first landing in south-polar region	23 Aug: National Space Day; near south pole ≠ exact pole
ADITYA-L1	launched 2023; India's first solar mission; observes Sun from near Sun–Earth L1 ≈ 1.5 million km from Earth	watches Sun, does not land on it
NISAR	NASA + ISRO; launched 30 July 2025; Earth-observation radar using two bands	earthquakes/landslides; glaciers; forests/crops



03 HUMAN SPACEFLIGHT + DOCKING

GAGANYAAN = sky craft
- planned crew of 3
- human-rated LVM3



Vyommitra: humanoid robot for uncrewed test mission



SpaDeX — Space Docking Experiment
Jan 2025: two Indian satellites docked in orbit
India 4th country with independent docking capability



rendezvous → docking (join in orbit)

Applications:
- space-station assembly
- sample-return architecture

RAKESH SHARMA
1984, first Indian in space



SHUBHANSHU SHUKLA
ISS visit June–July 2025; first Indian on ISS; second Indian in space



Indian aboard ISS ≠ crewed Gaganyaan flight

04 RESEARCH / AUTHORISATION / BUSINESS

ISRO
इसरो ISRO research + technology development

IN-SPACe
IN-SPACe Indian National Space Promotion and Authorisation Centre
- single-window promotion/authorisation of private activity
- established 2020

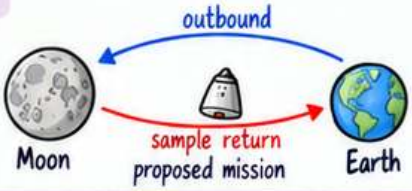
NSIL
NSIL NewSpace India Limited
commercialisation of launches/satellites

Examples (private firms)
- **Skyroot:** Vikram-S, 2022 — first privately built Indian rocket
- **Agnikul:** rocket engine built as one 3D-printed piece

Indian Space Policy 2023: clearer division of roles; private firms can undertake end-to-end missions

05 PLANS ≠ COMPLETED MISSIONS

Chandrayaan-4: lunar sample-return mission;
- approved 2024
- two heavy launches + orbital docking planned



Indian space station:
- planned



Source projections are not completed milestones; dates can change.