INDIA'S SPACE PROGRAM

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Introduction

India’s Space Program is an infographic collection that presents India’s space effort as a progression from institutional formation and initial launch capability to satellite-enabled development, exploration, commercial activity, human spaceflight, and planned missions extending toward 2040–2047. Its central subject is the development of national space capabilities, the uses and organization of those capabilities, and the technologies and plans associated with India’s next phase in space. The collection opens with “From INCOSPAR to ISRO: The Birth of India’s Space Program,” establishing the institutional beginning of the program. It then follows the path “From Aryabhata to LVM3: How India Achieved Independent Access to Space,” focusing on the development of launch capability. “Space for Development: How Satellites Transformed India” shifts from institutions and launch systems to the role of satellites in national development. Together, these opening infographics frame the program through its origins, access to space, and practical applications. The next stage concerns the expansion of India’s space activities. “From Chandrayaan to Aditya-L1: India Becomes a Space-Exploration Power” addresses lunar and solar exploration, while “India’s Space Capabilities Today: What Can ISRO Actually Do?” provides a present-focused view of the capabilities associated with the Indian Space Research Organisation. “From ISRO to a National Space Industry: India’s Commercial Space Revolution” then broadens the scope beyond the public institutional structure to the development of a national commercial space industry. The final four infographics move from current capability to future-oriented programs and technologies. “Gaganyaan: India’s Road to Human Spaceflight” addresses the human-spaceflight effort. “SpaDeX to Chandrayaan-4: Mastering the Technologies for the

Next Era” presents the technologies and missions associated with the next phase. “Bharatiya Antariksh Station: India’s Plan for Its Own Space Station” focuses on the planned space-station effort. The collection concludes with “India in Space 2040–2047: From Space Station to the Moon,” extending the sequence into a longer-term outlook centered on the space station and lunar objectives. The organization is chronological and thematic at the same time. It begins with the creation of the program, proceeds through independent access to space and satellite applications, examines exploration and present capabilities, and then considers commercialization, human spaceflight, enabling technologies, a space station, and longer-range lunar plans. This sequence links institutions, infrastructure, applications, markets, missions, and future plans without separating them into isolated subjects. For professional readers, the collection provides a concise way to examine how the program’s foundations relate to its current capabilities and stated future direction. It identifies the institutional, technological, developmental, commercial, and exploratory dimensions that shape the subject and provides a visual reference for understanding India’s space program from its origins through its proposed 2040–2047 horizon.

FROM INCOSPAR TO ISRO: THE BIRTH OF INDIA'S SPACE PROGRAM

BUILDING SPACE CAPABILITY FOR NATIONAL DEVELOPMENT

WHY IT BEGAN

- TO HARNESS SPACE TECHNOLOGY FOR NATIONAL DEVELOPMENT.
- TO IMPROVE THE QUALITY OF LIFE FOR PEOPLE ACROSS INDIA.
- TO SUPPORT SELF-RELIANCE THROUGH INDIGENOUS CAPABILITIES.
- TO USE SPACE FOR PRACTICAL NEEDS, NOT PRESTIGE ALONE.

KEY MILESTONES: THE JOURNEY FROM INCOSPAR TO ISRO

1962

INCOSPAR WAS ESTABLISHED.

Indian National Committee for Space Research.

1963

FIRST SOUNDING ROCKET LAUNCHED

from Thumba Equatorial Rocket Launching Station (TERLS) near Thiruvananthapuram.

1969

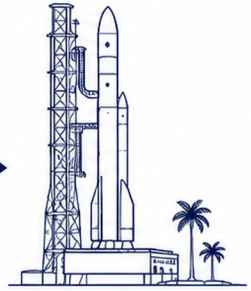
ISRO WAS ESTABLISHED,

replacing INCOSPAR as the country's space agency.

1972

GOVERNMENT OF INDIA CREATED THE SPACE COMMISSION AND THE DEPARTMENT OF SPACE,

bringing ISRO under the Department of Space.



KEY PEOPLE AND INSTITUTIONS

VIKRAM SARABHAI

WIDELY REGARDED AS THE FOUNDING ARCHITECT OF INDIA'S SPACE PROGRAM.

INCOSPAR

ESTABLISHED IN 1962 AS THE INDIAN NATIONAL COMMITTEE FOR SPACE RESEARCH.

ISRO

ESTABLISHED IN 1969, REPLACING INCOSPAR AS THE NATIONAL SPACE AGENCY.

TERLS (THUMBA)

THUMBA EQUATORIAL ROCKET LAUNCHING STATION, SITE OF INDIA'S FIRST ROCKET LAUNCH IN 1963.

DEPARTMENT OF SPACE

CREATED IN 1972 TO OVERSEE AND COORDINATE SPACE ACTIVITIES IN INDIA.

SPACE COMMISSION

CREATED IN 1972 TO PROVIDE POLICY DIRECTION AND STRATEGIC GUIDANCE.

EARLY PRIORITIES

COMMUNICATIONS

CONNECTING PEOPLE AND PROMOTING SOCIO-ECONOMIC DEVELOPMENT.

EDUCATION

SUPPORTING EDUCATION AND KNOWLEDGE DISSEMINATION ACROSS THE COUNTRY.

METEOROLOGY

IMPROVING WEATHER FORECASTING AND DISASTER PREPAREDNESS.

RESOURCE MONITORING

ASSESSING NATURAL RESOURCES FOR PLANNING AND MANAGEMENT.

LEGACY OF THE FOUNDING ERA

- BUILT INSTITUTIONS, POLICIES, AND A STRONG FOUNDATION.
- NURTURED TALENT AND PROMOTED INDIGENOUS CAPABILITIES.
- DRIEVED TECHNOLOGY DEVELOPMENT FOR SATELLITES AND LAUNCH VEHICLES.
- BUILT COLLABORATION FOR APPLICATION PROGRAMS AND SERVICES.
- ESTABLISHED A NATIONL &'VISION OF SPACE FOR, SOCIETAL BENEFIT AND. PROGRESS.

AT A GLANCE

YEAR	EVENT	INSTITUTIONAL CHANGE
1962	INCOSPAR ESTABLISHED	INDIAN NATIONAL COMMITTEE FOR SPACE RESEARCH
1963	FIRST ROCKET LAUNCHED	SOUNDING ROCKET FROM TERLS, THUMBA
1969	ISRO ESTABLISHED	ISRO REPLACES INCOSPAR AS THE NATIONAL SPACE AGENCY
1972	SPACE COMMISSION AND DEPARTMENT OF SPACE CREATED	ISRO BROUGHT UNDER THE DEPARTMENT OF SPACE

FROM ARYABHATA TO LVM3: HOW INDIA ACHIEVED INDEPENDENT ACCESS TO SPACE

A JOURNEY OF VISION, INNOVATION AND SELF-RELIANCE

LAUNCH-CAPABILITY TIMELINE

1975 — ARYABHATA
Aryabhata was India's first satellite; it was built in India and launched by the Soviet Union.

1980 — ROHINI & SLV-3
Rohini was placed in orbit by SLV-3, giving India its first successful indigenous satellite launch.

EARLY 1980s — ASLV
ASLV followed as a technology bridge and helped advance launch capability.

1990s–2000s — PSLV
PSLV became India's reliable workhorse launcher and has served Earth-observation, navigation, science, and commercial missions.

2000s — GSLV
GSLV was developed for heavier payloads and geosynchronous missions. Indigenous cryogenic propulsion was an important milestone in GSLV development.

2010s–PRESENT — LVM3 & SSLV
LVM3 (formerly GSLV Mk III) became India's heavy-lift launcher and has supported major missions and commercial launches. SSLV was developed for smaller satellites and more responsive launch services.

INDIAN LAUNCH VEHICLES: COMPARISON AT A GLANCE

LAUNCH VEHICLE	FIRST FLIGHT	PAYLOAD CAPACITY (TO LOW EARTH ORBIT)	TYPICAL PAYLOADS & MISSIONS	KEY ROLE
SLV-3	1980	~40 kg	Small experimental satellites	First indigenous satellite launch vehicle
ASLV	1987	~150 kg	Technology demonstration missions	Technology bridge to advanced launchers
PSLV	1993	~3,800 kg	Earth observation, navigation, science, and commercial satellites	Reliable workhorse launcher with high flight rate
GSLV	2001	~2,250 kg	Geosynchronous satellites and heavier payloads	For heavier payloads and geosynchronous missions; featured indigenous cryogenic propulsion
LVM3 (formerly GSLV Mk III)	2014	~8,000 kg	Heavy communication satellites, deep-space missions, and commercial launches	India's heavy-lift launcher for major missions and commercial launches
SSLV	2022	~500 kg	Small satellites, rapid deployment, and dedicated missions	Designed for smaller satellites and more responsive launch services

WHY LAUNCH INDEPENDENCE MATTERS

STRATEGIC AUTONOMY
Independent access to space reduces reliance on other nations and safeguards national interests.

ECONOMIC GROWTH
Enables cost-effective space missions, supports industries, and creates high-value jobs.

SERVICE FOR SOCIETY
Powers communication, weather forecasting, disaster management, agriculture, navigation, and education.

TECHNOLOGICAL LEADERSHIP
Builds indigenous capabilities in advanced materials, propulsion, robotics, and systems engineering.

GLOBAL CONTRIBUTION
Strengthens India's role as a trusted partner in global space exploration and commercial services.

KEY TAKEAWAYS

- From Aryabhata to today, India's space journey reflects decades of consistent progress and self-reliance.
- ISRO's launch vehicles have evolved step by step, building capability and confidence mission after mission.
- Indigenous innovation, including cryogenic propulsion, has been critical to reaching higher payload classes.
- LVM3 and SSLV expand India's ability to serve diverse missions and meet global market needs.
- India's independent access to space is a foundation for a more secure, prosperous, and developed future.

SPACE FOR DEVELOPMENT: HOW SATELLITES TRANSFORMED INDIA

SPACE-BASED SOLUTIONS. REAL-WORLD IMPACT.

INDIA'S SPACE PROGRAM LONG EMPHASIZED SOCIETAL APPLICATIONS, NOT ONLY EXPLORATION.

FOUR CORE APPLICATION AREAS

COMMUNICATIONS

- INSAT satellites supported telecommunications, television broadcasting, and meteorology.

EARTH OBSERVATION

- Indian Remote Sensing satellites supported agriculture, water-resource management, forestry, urban planning, and disaster response.
- Cartosat satellites improved high-resolution Earth observation.

WEATHER & DISASTER MANAGEMENT

- Space-based services support cyclone tracking, early warning, and public-service delivery.

NAVIGATION

- NavIC provides regional satellite navigation services.
- Supports positioning, timing, and messaging applications.

KEY SATELLITE SYSTEMS AND THEIR CONTRIBUTIONS

INSAT

Supported telecommunications, television broadcasting, and meteorology for decades.

INDIAN REMOTE SENSING (IRS)

Enabled applications in agriculture, water-resource management, forestry, urban planning, and disaster response.

CARTOSAT

Improved high-resolution Earth observation for detailed mapping and infrastructure planning.

OCEANSAT

Data supported ocean studies and fisheries-related applications.

RISAT

Introduced radar imaging useful in all-weather conditions.

NavIC

Provides regional satellite navigation services for precise positioning and timing.

PRACTICAL BENEFITS FOR INDIA

DOMAIN	HOW SATELLITES HELP	IMPACT
AGRICULTURE	Crop monitoring, acreage estimation, drought assessment	Better planning, improved yields, and food security
WATER RESOURCES	Watershed mapping, reservoir monitoring, groundwater assessment	Sustainable use and efficient management of water
ENVIRONMENT & FORESTRY	Forest cover monitoring, biodiversity assessment, habitat conservation	Conservation support and policy planning
URBAN PLANNING	Land-use mapping, infrastructure planning, smart city support	Better urban growth and resource allocation
DISASTER MANAGEMENT	Cyclone tracking, flood mapping, early warning, damage assessment	Faster response, risk reduction, and saved lives
PUBLIC SERVICES	Tele-education, telemedicine, DTH TV, connectivity in remote areas	Wider access to essential services

KEY TAKEAWAYS

- India's space program was designed around development needs, ensuring technology serves society.
- Satellites provide critical data and services that strengthen sectors and support informed decision-making.
- From daily communications to disaster warnings, satellites enhance resilience and safety.
- Space applications drive economic growth, efficiency, and innovation across the country.
- By focusing on practical solutions, India's space program delivers lasting social and economic value.

FROM CHANDRAYAAN TO ADITYA-L1: INDIA BECOMES A SPACE-EXPLORATION POWER

A JOURNEY OF AMBITION, INNOVATION & ACHIEVEMENT

EXPLORATION TIMELINE

2008 — CHANDRAYAAN-1
Launched. Evidence of water/hydroxyl on the Moon confirmed.

2013 — MARS ORBITER MISSION
Launched.

2014 — MARS ORBITER MISSION
Entered Mars orbit. India became the first nation to reach Mars orbit on its first attempt.

2015 — ASTROSAT
Launched as India's first dedicated multi-wavelength space observatory.

2019 — CHANDRAYAAN-2
Launched. Orbiter remained successful even though the lander was lost.

2023 — CHANDRAYAAN-3
Achieved a successful lunar soft landing near the Moon's south polar region.

2024 — ADITYA-L1
Became India's first dedicated solar mission and reached halo orbit around Sun-Earth L1.

2024 — XPOSAT
Launched as India's first dedicated X-ray polarimetry mission.

CHANDRAYAAN-1

India's first lunar mission.

Confirmed the presence of water/hydroxyl on the Moon using data from the Moon Mineralogy Mapper.

LAUNCHED: 2008

MARS ORBITER MISSION (MOM)

Launched in 2013 and entered Mars orbit in 2014.

India became the first nation to reach Mars orbit on its first attempt.

LAUNCHED: 2013
MARS ORBIT: 2014

ASTROSAT

India's first dedicated multi-wavelength space observatory.

Studies objects across the electromagnetic spectrum.

LAUNCHED: 2015

CHANDRAYAAN-2

Launched in 2019.

Orbiter continues to study the Moon successfully even though the lander was lost.

LAUNCHED: 2019

CHANDRAYAAN-3

Achieved a successful lunar soft landing near the Moon's south polar region in 2023.

Demonstrated safe landing and rover operations.

LAUNCHED: 2023

ADITYA-L1

India's first dedicated solar mission.

Reached halo orbit around Sun-Earth L1 in 2024.

LAUNCHED: 2024

XPOSAT

India's first dedicated X-ray polarimetry mission.

Designed to study X-ray sources in detail.

LAUNCHED: 2024

KEY ACHIEVEMENTS

- REVEALED NEW SCIENCE: WATER ON THE MOON, MARS ORBIT, SOLAR OBSERVATIONS, X-RAY POLARIMETRY.
- DEMONSTRATED END-TO-END CAPABILITIES FROM DEEP SPACE NAVIGATION TO PRECISION LANDING.
- BUILT INDIGENOUS TECHNOLOGIES AND INSTRUMENTS ACROSS MULTIPLE MISSIONS.
- INSPIRED A NEW GENERATION AND STRENGTHENED INDIA'S GLOBAL SPACE STANDING.

MISSION SUMMARY

MISSION	LAUNCH YEAR	KEY HIGHLIGHT	PRIMARY FOCUS
CHANDRAYAAN-1	2008	Evidence of water/hydroxyl on the Moon confirmed.	Lunar exploration
MARS ORBITER MISSION (MOM)	2013	Entered Mars orbit in 2014; first nation to reach Mars orbit on first attempt.	Mars exploration
ASTROSAT	2015	India's first dedicated multi-wavelength space observatory.	Astronomy
CHANDRAYAAN-2	2019	Orbiter remains successful despite loss of lander.	Lunar exploration
CHANDRAYAAN-3	2023	Successful lunar soft landing near Moon's south polar region.	Lunar exploration
ADITYA-L1	2024	Reached halo orbit around Sun-Earth L1.	Solar observation
XPOSAT	2024	India's first dedicated X-ray polarimetry mission.	X-ray astronomy

WHAT CHANGED

SCIENTIFIC IMPACT
Expanded knowledge of the Moon, Mars, the Sun, and high-energy universe.

STRATEGIC SIGNIFICANCE
Proved India's ability to take on complex, high-risk deep-space missions successfully.

TECHNOLOGICAL CONFIDENCE
Strengthened autonomy in mission design, navigation, instrumentation, and data analysis.

GLOBAL RECOGNITION
Established India as a reliable and innovative space-exploration power.

INDIA'S SPACE CAPABILITIES TODAY: WHAT CAN ISRO ACTUALLY DO?

A COMPREHENSIVE SNAPSHOT OF INDIA'S SPACE STRENGTH IN 2026

CAPABILITY STACK

LAUNCH CAPABILITIES	By 2026 India operates multiple launch vehicles including PSLV, GSLV, LVM3, and SSLV.
SATELLITE CAPABILITIES	Strong capabilities in communications satellites, Earth observation, weather support, and disaster management.
NAVIGATION CAPABILITIES	Regional navigation system NavIC provides positioning, navigation, and timing services over India and surrounding region.
SPACE SCIENCE CAPABILITIES	Operates space-science missions such as AstroSat, Aditya-L1, and XPoSat advancing astrophysics and solar studies.
PLANETARY EXPLORATION	Completed lunar mission Chandrayaan-3 (2023) and Mars mission Mangalyaan (2013).
HUMAN SPACEFLIGHT PREPARATION	Gaganyaan program is advancing crew flight, life support, training, and recovery systems.
IN-SPACE TECHNOLOGIES & RENDEZVOUS	Orbital rendezvous and docking technologies are becoming more important for future missions and space station goals.
COMMERCIAL LAUNCHES & PARTNERSHIPS	Commercial launches and international partnerships now form a visible part of India's space activity.
DEEP-SPACE COMMUNICATIONS & INFRASTRUCTURE	Deep-space communications and mission-support infrastructure, including launch operations at Sriharikota.
INTERNATIONAL COLLABORATION	NISAR, a joint NASA–ISRO mission launched in 2025, reflects India's major international collaboration role.

WHAT EACH CAPABILITY ENABLES

CAPABILITY	KEY CAPABILITIES	EXAMPLES & STATUS (2026)
LAUNCH CAPABILITIES	Place satellites into orbit for India and international clients across LEO, SSO, GTO, and beyond.	• PSLV (workhorse for LEO/SSO payloads) • GSLV Mk II (GTO missions) • LVM3 (heavy-lift for large payloads and deep-space missions) • SSLV (small satellite launcher)
SATELLITE CAPABILITIES	Provide communications, Earth observation, meteorological data, and disaster support for national development.	• Communications satellites for telecom, broadcasting, and connectivity • Earth observation for agriculture, resources, environment, security • Weather satellites for forecasting and cyclone alerts
NAVIGATION CAPABILITIES	Deliver accurate positioning, navigation, and timing services for strategic and civilian users.	• NavIC (IRNSS) operational with regional coverage • Supports navigation for transport, maritime, and disaster management
SPACE SCIENCE CAPABILITIES	Advance understanding of the universe, Sun, and high-energy phenomena through dedicated observatories.	• AstroSat – multi-wavelength space observatory • Aditya-L1 – solar observation mission at L1 point • XPoSat – X-ray polarimetry mission
PLANETARY EXPLORATION	Explore the Moon and Mars and build expertise for future planetary missions.	• Mangalyaan (2013) – Mars Orbiter Mission • Chandrayaan-3 (2023) – soft landing near lunar south pole
HUMAN SPACEFLIGHT PREPARATION	Build the systems needed for safe human missions in low Earth orbit.	• Gaganyaan program – crew module, service module, launch escape system, life support, training, recovery
IN-SPACE TECHNOLOGIES & RENDEZVOUS	Enable docking, undocking, and in-space operations critical for future space station and deep-space missions.	• Orbital rendezvous and docking technologies • Foundation for Bharatiya Antariksh Station and advanced missions
COMMERCIAL LAUNCHES & PARTNERSHIPS	Offer reliable, cost-effective launch services and collaborate on global missions.	• Launches for international customers • Partnerships with space agencies and industry worldwide
DEEP-SPACE COMMUNICATIONS & INFRASTRUCTURE	Support missions beyond Earth orbit and ensure reliable operations from the ground.	• Deep-space network for lunar, planetary, and solar missions • Launch operations and mission control at Sriharikota
INTERNATIONAL COLLABORATION	Contribute to and lead international science and Earth observation missions.	• NISAR (NASA–ISRO) launched in 2025 – global Earth observation using L-band and S-band SAR

KEY TAKEAWAYS

- ISRO DELIVERS END-TO-END SPACE CAPABILITIES FROM LAUNCH TO OPERATIONS.
- STRONG TRACK RECORD IN RELIABLE, COST-EFFECTIVE MISSIONS AND SERVICES.
- SUPPORTS NATIONAL DEVELOPMENT, SECURITY, AND DISASTER RESPONSE.
- GROWING GLOBAL ROLE THROUGH PARTNERSHIPS AND COMMERCIAL SERVICES.

CURRENT LIMITATIONS

- PAYLOAD CAPACITY TO GEO STILL LIMITED COMPARED TO GLOBAL LEADERS.
- DEPENDENCE ON SELECT CRITICAL TECHNOLOGIES REMAINS.
- HUMAN SPACEFLIGHT AND SPACE STATION CAPABILITIES ARE STILL IN DEVELOPMENT.

FROM ISRO TO A NATIONAL SPACE INDUSTRY: INDIA'S COMMERCIAL SPACE REVOLUTION

POLICY REFORMS. INSTITUTIONAL ROLES. PRIVATE INNOVATION. NATIONAL GROWTH.

REFORMS TIMELINE: BUILDING THE FOUNDATION FOR A COMMERCIAL SPACE ECOSYSTEM

2020 — SPACE SECTOR REFORMS ANNOUNCED
India's space sector reforms announced in 2020 opened greater participation for private non-government entities.

2021 — IN-SPACe CREATED
IN-SPACe was created to promote, authorize, and facilitate private-sector participation.

2022 — NSIL ESTABLISHED AS COMMERCIAL ARM
NSIL is the public-sector commercial arm responsible for commercializing space products and services.

2023 — INDIAN SPACE POLICY 2023
The Indian Space Policy 2023 opened the full space value chain to wider participation and clarified institutional roles.

2024 — FDI RULES LIBERALIZED
FDI rules were liberalized in 2024 to encourage more investment in space.

2026 — ECOSYSTEM MATURING
By 2026 India had roughly 440 registered space startups, reflecting strong ecosystem growth.

WHO DOES WHAT: INSTITUTIONS AND THEIR ROLES

INSTITUTION	PRIMARY ROLE	FOCUS AREAS	HOW IT ADDS VALUE
ISRO	National space agency and program implementation	Research, mission design, development, launch, national missions	Leads strategic missions and builds critical space capabilities
IN-SPACe	Regulator and facilitator for private participation	Authorization, handholding, promoting industry, policy facilitation	Enables, de-risks and accelerates private sector participation
NSIL	Public-sector commercial arm of the Government	Commercializing space products and services, global marketing	Bridges ISRO capabilities with global markets, drives revenue
PRIVATE FIRMS & STARTUPS	Industry, innovation and service delivery	Manufacturing, launches, data services, applications, solutions	Drive innovation, efficiency and customer-centric solutions

THE COMMERCIAL SPACE VALUE CHAIN: OPEN TO WIDER PARTICIPATION

LAUNCH SERVICES
Small, medium and heavy launch services for global and domestic customers.

SATELLITE MANUFACTURING
Design, build and integration of satellites for diverse missions.

COMPONENTS
Electronics, propulsion, structures and other critical components and subsystems.

GEOSPATIAL DATA
High-resolution imagery and earth observation data.

ANALYTICS
Data processing, insights and AI/ML driven analytics.

DOWNSTREAM APPLICATIONS
Solutions for agriculture, climate, infrastructure, mobility, defence and more.

STARTUP GROWTH: A VIBRANT NEW ECOSYSTEM

~440 REGISTERED SPACE STARTUPS BY 2026

India's startup ecosystem is innovating across the value chain and building globally competitive solutions.

KEY TAKEAWAYS

- Policy reforms from 2020 onwards enabled greater private participation across the space sector.
- Clear institutional roles ensure collaboration, not duplication, across the ecosystem.
- The full space value chain is open, unlocking innovation, investment and jobs.
- Liberalized FDI and a growing industry will attract more capital and global partnerships.
- The commercial shift does not replace ISRO; it broadens the national ecosystem.

GAGANYAAN: INDIA'S ROAD TO HUMAN SPACEFLIGHT

AN INDEPENDENT SHORT-DURATION LOW EARTH ORBIT HUMAN MISSION

WHAT GAGANYAAN INCLUDES

HUMAN-RATED LAUNCH VEHICLE

LVM3 configured and qualified to safely launch humans to Low Earth Orbit.

CREW MODULE

Pressurized module to carry astronauts, with systems for a safe mission and re-entry.

SERVICE MODULE

Provides propulsion, power, thermal control and other functions to support the crew module in orbit.

CREW ESCAPE SYSTEM

Designed to quickly and safely take the crew away from the launch vehicle in an emergency.

LIFE-SUPPORT & SAFETY SYSTEMS

Environmental control, life support, health monitoring and safety systems to protect the crew.

TRAINING

Astronaut-designates undergoing rigorous training for mission readiness.

MISSION CONTROL & OPERATIONS

Ground systems and mission operations to plan, monitor and control the mission through all phases.

RECOVERY OPERATIONS

Safe recovery of the crew module from the sea with support from the Indian Navy.

DEVELOPMENT AND TEST MILESTONES

2018

PROGRAM APPROVAL

Gaganyaan approved by the Government of India.

2019–2021

SYSTEM DESIGN & DEVELOPMENT

Design of crew module, service module, escape system and supporting systems underway.

2021–2023

SUBSYSTEM & COMPONENT TESTING

Extensive ground testing of structures, propulsion, avionics, life-support and safety systems.

2023–2025

INTEGRATED TESTS

Integrated vehicle tests including atmospheric re-entry trials and abort tests.

LATE 2026

FIRST UNCREWED ORBITAL MISSION

First uncrewed Gaganyaan mission to Low Earth Orbit is targeted for late 2026.

2027

FIRST CREWED MISSION

First crewed Gaganyaan mission to Low Earth Orbit is targeted for 2027.

BEYOND 2027

CONTINUOUS EVOLUTION

Further missions, capability upgrades and expanded human spaceflight experience.

WHY IT MATTERS

NATIONAL PRIDE

A defining milestone in India's journey as a spacefaring nation.

TECHNOLOGICAL LEAP

Drives advanced capabilities in materials, avionics, life support, and safety critical systems.

ECONOMIC IMPACT

Creates high-value industries, skilled jobs and innovation across sectors.

GLOBAL CONTRIBUTION

Positions India as a responsible contributor to global human space exploration.

KEY TAKEAWAYS

- Gaganyaan is India's human-spaceflight program.
- Mission architecture includes a human-rated LVM3, crew module and service module.
- Program also includes crew escape system, life-support and safety systems, training, mission control and recovery.
- Indian Air Force pilots selected as astronaut-designates; training has been underway.
- Sea-recovery preparations involve the Indian Navy.
- First uncrewed mission targeted for late 2026; first crewed mission targeted for 2027.

SPADEX TO CHANDRAYAAN-4: MASTERING THE TECHNOLOGIES FOR THE NEXT ERA

BUILDING THE CAPABILITIES FOR INDIA'S FUTURE IN SPACE EXPLORATION

TECHNOLOGY LADDER: BUILDING BLOCKS TO LUNAR SAMPLE RETURN

1. RENDEZVOUS
Precise navigation and relative positioning to approach a target object in orbit.

2. PROXIMITY OPERATIONS
Close-range operations and station-keeping to safely align with the target.

3. DOCKING
Secure connection of spacecraft in orbit to transfer crew, cargo or resources.

4. IN-ORBIT OPERATIONS
Integrated operations, experiments, refuelling and module assembly in space.

5. LUNAR SAMPLE RETURN
Collect samples on the Moon, return to Earth with the samples safely delivered.

THESE TECHNOLOGIES BRIDGE CURRENT EXPLORATION CAPABILITY TO MORE ADVANCED FUTURE MISSIONS.

WHY THESE CAPABILITIES MATTER

ENABLING HUMAN SPACEFLIGHT
Orbital docking is essential for crew transportation, life support integration and safe return.

SUPPORTING LUNAR EXPLORATION
Complex lunar missions require rendezvous, docking, refuelling and ascent for sample return.

BUILDING AND SERVICING SPACE STATIONS
Docking and in-orbit operations are critical for assembling and maintaining large space stations.

STRENGTHENING INDIA'S SPACE CAPABILITIES
Mastering these technologies advances self-reliance and prepares for deeper space missions.

CHANDRAYAAN-4: LUNAR SAMPLE-RETURN MISSION ARCHITECTURE

1. **LAUNCH**
Launch of the mission to trans-lunar trajectory.

2. **LUNAR ORBIT INSERTION**
Spacecraft enters lunar orbit and performs orbit operations.

3. **LANDING**
Lander safely lands on the lunar surface at a target site.

4. **SAMPLE COLLECTION**
Collects and seals lunar samples using precision handling mechanisms.

5. **ASCENT FROM LUNAR SURFACE**
Ascent vehicle lifts off from the Moon and docks with the orbital module.

6. **ORBITAL DOCKING AND TRANSFER**
Docking in lunar orbit and transfer of the sample to the return module.

7. **EARTH RETURN AND RECOVERY**
Return to Earth, re-entry and safe recovery of the sample capsule.

THE MISSION CONCEPT REQUIRES MULTIPLE COMPLEX CAPABILITIES: PRECISE NAVIGATION, DOCKING, SAMPLE HANDLING, ASCENT FROM THE LUNAR SURFACE, AND EARTH RETURN.

KEY FACTS AT A GLANCE

SPADEX FOCUS	The SpaDeX program is focused on orbital rendezvous and docking technologies.
IMPORTANCE OF ORBITAL DOCKING	Orbital docking is important for future human spaceflight, lunar missions, and station assembly.
FOLLOW-ON EXPERIMENTS	ISRO is studying follow-on docking experiments as precursors for Chandrayaan-4 and the Bharatiya Antariksh Station.
CHANDRAYAAN-4	Chandrayaan-4 is planned as a lunar sample-return mission.
TIMELINE	Government statements have placed Chandrayaan-4 on a 2027 target timeline.

BHARATIYA ANTARIKSH STATION: INDIA'S PLAN FOR ITS OWN SPACE STATION

A ROADMAP TO SUSTAINED HUMAN PRESENCE AND RESEARCH IN SPACE

ROADMAP: FROM CAPABILITY BUILDING TO A FULLY OPERATIONAL SPACE STATION

2022–2027

BUILDING THE FOUNDATION

- GAGANYAAN MISSION: DEMONSTRATING HUMAN SPACEFLIGHT CAPABILITY.
- DEVELOPMENT OF DOCKING, RENDEZVOUS, ROBOTICS AND LIFE-SUPPORT TECHNOLOGIES.

DEVELOP, DEMONSTRATE, AND VALIDATE KEY TECHNOLOGIES

2028

FIRST MODULE: BAS-01

- GOVERNMENT PLANS TARGET THE FIRST MODULE (BAS-01) FOR 2028.
- INITIAL CAPABILITIES FOR CREW STAY, SYSTEM CHECKOUT AND EXPERIMENTS.

LAUNCH AND COMMISSION BAS-01

BY 2035

FULL STATION: FIVE-MODULE SYSTEM

- THE FULL STATION IS PLANNED AS A FIVE-MODULE SYSTEM BY 2035.
- EXPANDED RESEARCH, CREW CAPACITY AND OPERATIONAL MATURITY.

COMPLETE AND OPERATE THE BHARATIYA ANTARIKSH STATION

PLANNED FEATURES AND KEY TECHNOLOGIES

AREA	DETAILS
RENDEZVOUS AND DOCKING	ABILITY TO BRING MODULES TOGETHER AND DOCK SAFELY; SUPPORTS ASSEMBLY AND VISITING VEHICLES.
ROBOTICS	ROBOTIC MANIPULATORS AND AUTOMATION FOR ASSEMBLY, OPERATIONS AND MAINTENANCE.
CREW QUARTERS AND LIFE SUPPORT	HABITABLE VOLUME, ENVIRONMENT CONTROL, LIFE SUPPORT AND CREW COMFORT SYSTEMS.
EXPERIMENT RACKS	INTERNAL AND EXTERNAL PAYLOAD PLATFORMS FOR MICROGRAVITY RESEARCH ACROSS DISCIPLINES.
LOGISTICS AND RESUPPLY	CARGO HANDLING, STORAGE AND RESUPPLY OPERATIONS TO SUSTAIN CREW AND EXPERIMENTS.
CREW-SUPPORT SYSTEMS	POWER, THERMAL CONTROL, COMMUNICATIONS, DATA HANDLING AND SAFETY SYSTEMS.

WHY A SPACE STATION

MICROGRAVITY RESEARCH
ENABLES LONG-DURATION EXPERIMENTS IN BIOLOGY, MATERIALS SCIENCE, PHYSICS AND EARTH SCIENCES.

SUSTAINED HUMAN SPACEFLIGHT
BUILDS EXPERIENCE IN LONG-DURATION MISSIONS, CREW OPERATIONS AND SPACE MEDICINE.

TECHNOLOGY MATURATION
ADVANCES CRITICAL TECHNOLOGIES FOR DEEP-SPACE MISSIONS AND FUTURE EXPLORATION.

NATIONAL CAPABILITY AND SELF-RELIANCE
STRENGTHENS INDIA'S END-TO-END CAPABILITIES IN DESIGN, BUILD, OPERATE AND INNOVATE.

INSPIRATION AND OUTREACH
ENGAGES YOUNG MINDS AND DRIVES STEM EDUCATION AND PUBLIC INTEREST IN SPACE.

KEY TAKEAWAYS

- BHARATIYA ANTARIKSH STATION IS INDIA'S PLANNED SPACE-STATION PROGRAM.
- GOVERNMENT PLANS TARGET THE FIRST MODULE, BAS-01, FOR 2028.
- THE FULL STATION IS PLANNED AS A FIVE-MODULE SYSTEM BY 2035.
- THE STATION IS INTENDED TO SUPPORT MICROGRAVITY RESEARCH AND SUSTAINED HUMAN-SPACEFLIGHT CAPABILITY.
- THE PROGRAM BUILDS ON GAGANYAAN AND DOCKING-RELATED TECHNOLOGY DEVELOPMENT AND IS PART OF INDIA'S LONGER-TERM HUMAN-SPACEFLIGHT STRATEGY.

INDIA IN SPACE 2040–2047: FROM SPACE STATION TO THE MOON

A ROADMAP FOR EXPLORATION, INNOVATION AND NATIONAL PROSPERITY

INDIA'S OFFICIAL LONG-TERM VISION INCLUDES A MAJOR EXPANSION OF HUMAN SPACEFLIGHT AND EXPLORATION CAPABILITY.

1) ROADMAP TIMELINE (2026–2047)

2026 — STRENGTHEN & BUILD

Expand launch cadence, infrastructure and human spaceflight preparations.

2028 — KEY MILESTONES

First Bharatiya Antariksh Station module launch.

Venus Orbiter Mission planned for 2028.

2030 — EXPAND CAPABILITIES

Scale human spaceflight systems, industry participation and space science missions.

2032 — BUILD & INTEGRATE

Add more station modules, advance life support, docking and crew operations.

2035 — FULL STATION GOAL

Complete and commission the full Bharatiya Antariksh Station by 2035.

2040 — MOON LANDING GOAL

Land an Indian astronaut on the Moon by 2040.

2047 — VIKSIT BHARAT 2047

Global leadership in space exploration, innovation and space-driven development.

2) STRATEGIC PILLARS

EXPLORATION

- Deep-space missions including Moon, Venus and beyond.
- Expand planetary science and astrophysics.
- Strengthen international collaborations.

HUMAN SPACEFLIGHT

- Develop end-to-end human spaceflight capability.
- Build, operate and expand the Bharatiya Antariksh Station.
- Prepare for lunar exploration and long-duration missions.

SPACE INDUSTRY & ECONOMY

- Scale commercial launches, satellites and services.
- Attract investment and strengthen private-sector participation.
- Create high-value jobs and global market leadership.

TECHNOLOGY & INNOVATION

- Next-generation launch vehicles and reusable technologies.
- Advanced avionics, robotics, life support and materials.
- AI/ML, data systems and secure communication technologies.

PEOPLE & ECOSYSTEM

- Build a skilled space workforce.
- Strengthen academia, startups and research.
- Promote inclusivity and regional development.

3) PROJECTIONS & GOALS (POLICY-BASED)

SPACE ECONOMY PROJECTIONS

≈ $44 BILLION BY 2033

≈ $100 BILLION BY 2040

HUMAN SPACEFLIGHT GOALS

- 2028: First Bharatiya Antariksh Station module.
- 2035: Full station operational.
- 2040: Indian astronaut on the Moon.

MISSION GOALS

- 2028: Venus Orbiter Mission.
- Expand lunar exploration and deep-space missions.
- Strengthen Earth observation for national development.

INDUSTRY & INNOVATION GOALS

- Next-generation launch vehicles.
- Reusable technologies at scale.
- Commercial expansion and stronger private-sector participation.

4) CURRENT ACHIEVEMENTS (FOUNDATION FOR FUTURE)

- Reliable access to space with proven launch capability.
- World-class satellite missions in communication, navigation and Earth observation.
- Successful lunar missions with cost-effective innovation.
- Strong public institutions and growing private-sector ecosystem.
- Skilled talent pool and expanding space startup community.

5) KEY TAKEAWAYS

- India is expanding human spaceflight and exploration capability at scale.
- Key milestones: 2028 (first station module & Venus mission), 2035 (full station), 2040 (Moon landing).
- Policy projections: ≈ $44B space economy by 2033 and ≈ $100B by 2040.
- Focus areas: next-gen launch, reuse, deep-space, commercial growth, and private participation.
- 2047 vision: Global leadership in space for a Viksit Bharat and inclusive development.

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