- Increased space exploration changed the perception of states & other stakeholders towards it.
- It is replacing a romantic notion with narratives with financial, socio-economic & geopolitical implications.
- Space technologies & space flight are expensive, risky endeavours that only national agencies were suited to engage in for decades.
- The private sector players are increasingly expected to complement, augment, and/or lead the way by identifying market opportunities and innovating rapidly
- India started on this path in 2020 with state-led reforms that opened its space sector to private companies, then releasing the 'Geospatial Guidelines' & later the 'Indian Space Policy', creating the Indian National Space Promotion and Authorisation Centre (IN-SPACe), & passing the Telecommunications Act 2023 that, among other departures from the Indian Telegraph Act, 1885, provided for satellite broadband services.

GEO-SPATIAL GUIDELINES

WHAT IS INDIA'S GEOSPATIAL POLICY ?

- After making waves with liberalisation in the field of geospatial data in 2021, the government notified the 2022 National Geospatial Policy on December 28, 2022, for implementation with immediate effect.
- The new Geospatial Policy will replace the National Map Policy, 2005.
- It aims to strengthen the location-centric industry to support the information economy.
- It uses guidelines for acquiring & producing geospatial data and related services including maps, issued by the Department of Science & Technology (DST) in February 2021, as its foundation.
- The DST guidelines deregulated the geospatial sector & liberalised the acquisition, production, & access of data in the field.
- Building on it, the 2022 policy lays down a framework for the development of a geospatial ecosystem, including goals and strategies to achieve it.

WHAT IS GEOSPATIAL DATA ?

- Geospatial data are descriptions of events or occurrences with a location on or near the surface of the earth.
- This location can be static – relating to earthquakes, vegetation, etc., or dynamic – a person walking on the road, a package being tracked, etc.
- The location data obtained is usually combined with other characteristic attributes or recorded parameters to provide meaningful insights in the form of geospatial data.

ROADMAP

- The National Geospatial Policy lists the following targets to be achieved before 2035.
- Enable policy, legal framework supporting geospatial sector and democratisation of data for enhanced commercialisation
- Redefine National Geodetic Framework using modern positioning technologies & online access
- High accuracy Geoid for the country
- Establish & strengthen an integrative interface for all digital data having location dimension collected or developed utilising public funds, for easy access, sharing, use and reuse
- High resolution topographical survey & mapping (5-10 cm for urban & rural areas and 50 cm-100 cm for forests & wastelands)
- High accuracy Digital Elevation Model (DEM) for entire country (25 cm for plain, 1-3 metre for hilly and mountainous areas)
- A digital elevation model (DEM) is a topographic model of the Earth's bare ground. DEMs are digital cartographic datasets in three (XYZ) coordinates
- Geospatial Knowledge Infrastructure (GKI) underpinned by Integrated Data & Information Framework Enhance capabilities, skills and awareness to meet future needs.
- High resolution geospatial survey of inland waters & sea surface topography of shallow/deep seas to support Blue Economy.
- Survey & mapping of sub-surface infrastructure in major cities and towns.
- National Digital Twin of major cities and towns.
- A digital twin is a digital model of a physical or intangible system, process, or product.
- It's a computer program that uses real-world data to create simulations that can predict how a product or process will perform.

POLICY GOALS

- With the National Geospatial Policy, the objective is to employ geospatial technology & data towards achieving Sustainable Development Goals (SDGs).
- The policy emphasises the importance of locally available and locally relevant maps and geospatial data.
- It also aims to support innovation and creation in the field , "bridging the geospatial data divide".
- It seeks to create long-term, sustainable geospatial information management through capacity development & education programmes.
- The policy may encourage open standards, open data & platforms.

- The policy is structured to contribute towards the democratisation of data — Survey of India (SoI) topographic data & other geospatial data produced using public funds would be treated as common goods and made easily available.
- While the SoI will play the lead role in maintaining high resolution/high spatial accuracy orthoimagery (geometrically corrected image to remove geographical & optical distortion), actual collection & collation of data will be "increasingly done with private sector participation".
- Liberalisation in the field has the potential to support the government's ease of doing business policy.
- The private sector is expected to predominantly cater to geospatial/location data-related needs and requirements of citizens.
- It will also play a key role in the creation and maintenance of geospatial and mapping infrastructures.

REACTION TO THE POLICY

- Geospatial data enthusiast Devdatta Tengshe says that the policy is a mere wish list of what the government wants to achieve but there are no fixed timelines or responsibilities to achieve those goals.
- The National Geospatial Policy is a good step in the right direction but is very abstract & generic in nature.
- According to Mr. Tengshe, the e-commerce & delivery industry will be one of the main beneficiaries of deregulation in the field of geospatial data in India.
- Currently, Google Maps is among the biggest international companies catering to requirements in the field. "Why should Google Maps be the one providing (geospatial) data to us?
- Using data from Google Maps is expensive, & open data is not always reliable
- Location data is now beyond the maps —Almost all bigger players in the industry use location data in some ways
- According to experts , the applications of and insights you can get from geospatial data are a lot more, which is why it is impossible to control by a single agency
- While the rest of the world has evolved in the field of geospatial data, India has been stuck in the past, with no clear direction on how to proceed

INDIAN SPACE POLICY

- The new Indian Space Policy, announced on , April 20, 2023, has said the Indian Space Research Organisation shall transition out from manufacturing operational space systems & focus its energies on research and development in advanced technologies.
- The Indian Space Policy-2023, which was approved by the Cabinet Committee on Security , also permits non-government entities (NGEs) to offer national & international space-based communication services, through self-owned, procured or leased geostationary orbit (GSO) & non-geostationary satellite orbit (NGSO) satellite systems.
- NGSO is a reference to low earth orbit or medium earth orbits that are home to satellites providing broadband internet services from space.
- The policy also encourages NGEs to establish and operate ground facilities for space objects operations, such as telemetry, tracking and command (TT&C) Earth Stations and Satellite Control Centres (SCCs).
- It also allows NGEs to undertake end-to-end activities in the space sector through the establishment and operation of space objects, ground-based assets & related services such as communication, remote sensing and navigation.
- It encouraged NGEs to use Indian orbital resources and/or non-Indian orbital resources to establish space objects for communication services over India and outside.
- The policy encouraged NGEs to manufacture and operate space transportation systems, including launch vehicles, shuttles, as well as design and develop reusable, recoverable and reconfigurable technologies & systems for space transportation.
- It also encouraged NGEs to engage in the commercial recovery of an asteroid resource or a space resource.
- Any NGE engaged in such a process shall be entitled to possess, own, transport, use, and sell any such asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of India," it said.
- Industry leaders welcomed the policy and described it as a "futuristic" one that will position India and launch the Indian Space Sector in the 21st century.
- Lt Gen A K Bhatt, Director General Indian Space Association, told PTI. "This policy provides the much needed clarity on all space activities especially regarding space communication and other Applications,"
- The policy also states that Indian consumers of space technology or services -- such as communication, remote sensing, data services and launch services -- whether from the public or the private sector, shall be free to directly procure them from any source.
- The govt unveiled space sector reforms in 2020 by opening it up for private participation
- The new space policy , has been formulated as an overarching, composite and dynamic framework to implement the reform vision.
- The policy states that ISRO, will focus primarily on the research and development of new space technologies and applications and on expanding the human understanding of outer space.

- To achieve this goal, ISRO shall carry out applied research and development of newer systems so as to maintain India's edge in the sector in the areas of space infrastructure, space transportation, space applications, capacity building & human spaceflight.
- It said the space agency shall transition out from the existing practice of being present in the manufacturing of operational space systems.
- "Hereafter, mature systems shall be transferred to industries for commercial exploitation.
- The policy stated that the Indian National Space Promotion and Authorisation Centre (IN-SPACe) shall function as an autonomous government organisation, mandated to promote, handhold, guide and authorise space activities in the country.
- The policy made it clear that NewSpace India Limited (NSIL), as the public sector undertaking under the Department of Space, shall be responsible for commercialising space technologies and platforms created through public expenditure.
- It also mandated NSIL to manufacture, lease or procure space components, technologies, platforms & other assets from the private or the public sector on sound commercial principles.
- The policy also tasked NSIL to service the space-based needs of users, whether government entities or non-government entities, on sound commercial principles.
- It said the Department of Space shall oversee the distribution of responsibilities outlined in this policy & ensure that the different stakeholders are suitably empowered to discharge their respective functions without overlapping into the others' domains.
- Under the amended FDI policy, 100% FDI is allowed in space sector. The liberalised entry routes under the amended policy are aimed to attract potential investors to invest in Indian companies in space
- The amended policy extends the facility of up to 74% FDI under the automatic route for satellite manufacturing & operation, satellite data products and ground/user segment. Beyond 74%, these activities are under government route.
- Up to 49% FDI under the automatic route will be allowed for launch vehicles and associated systems or subsystems, & creation of spaceports for launching and receiving spacecraft.
- Beyond 49%, these activities will be under government route.
- Up to 100% FDI under the automatic route would be permitted for manufacturing of components and systems/sub-systems for satellites, ground segment and user segment.
- The decision gives India the ability to take advantage of its less vitiated foreign ties to catch up with China’s more advanced position as a space power.
- While the Chinese programme benefits from not-inconsiderable private sector participation, its ability to attract foreign investments is hamstrung by its belligerent foreign policies and the Xi Jinping administration’s plan to modernise the military by, adapting civilian technologies for military use, though other countries, including the U.S., have similar policies.
- According to IN-SPACe chairman Pawan K. Goenka, the $37.1 billion that the space sector raised worldwide in 2021-23 went to space start-ups.
- New investments can add to India’s space economy by improving start-ups’ access to talent and capital; effecting a better balance between upstream and downstream opportunities, versus the current skew in favour of the former; boosting local manufacturing; and improving investor confidence.
- To date, FDI is permitted to establish and operate satellites only through the government’s approval route.

THE SIZE OF SPACE ECONOMY

- Until the early 1990s, India’s space industry and space economy were defined by ISRO. Private sector involvement was limited to building to ISRO designs and specifications.
- The Second Space Age began with the licensing of private TV channels, the explosive growth of the Internet, mobile telephony, and the emergence of the smartphone.
- Today, while ISRO’s budget is approximately $1.6 billion, India’s space economy is over $9.6 billion. Broadband, OTT and 5G promise a double-digit annual growth in satellite-based services
- It is estimated that with an enabling environment, the Indian space industry could grow to $60 billion by 2030, directly creating more than two lakh jobs.
- In a first-of-its kind attempt at measuring the size of India's space economy, researchers from the Centre for Development Studies (CDS) and the Indian Institute of Space Science and Technology (IIST) arrived at a figure of ₹36,794 crore for the 2020-21 fiscal.
- The estimated size of India's space economy, as a percentage of the GDP, has slipped from 0.26% in 2011-12 to 0.19% in 2020-21, they found.
- By employing internationally-accepted frameworks, the authors have examined the annual budget for the space programme and its constituents; space manufacturing, operations and application.
- According to the paper, space applications accounted for the major chunk of this evolving economy, constituting 73.57% (₹ 27061 crore) of it in 2020-21, followed by space operations (₹ 8218.82 crore or 22.31%) and manufacturing (₹ 1515.59 crore or 4.12%).
- The budget outlay for space has considerable influence on the dynamics of the space economy, according to the study.

- We have also noticed a decline in the budget for space-related activities, leading to a reduction in the size of the economy in the last two years,''
- The budget outlay in 2020-21 was ₹9,500 crore, shrinking from ₹13,033.2 crore in the previous fiscal.
- The study also found that the space budget as a percentage of the GDP slipped from 0.09% in 2000-01 to 0.05% in 2011-12, and has remained more or less at that level since then.
- In relation to GDP, India's spending is more than that of China, Germany, Italy and Japan, but less than the U.S. and Russia.
- The next step for us should be to look at the impact of space economy on the Indian economy itself. The impact is both direct and indirect.
- For the present study, the authors have relied on Indian Space Research Organisation (ISRO) and Parliament documents, the Comptroller and Auditor General's (CAG) reports, data on intellectual property rights and other government data, in addition to Scopus-indexed space publications.

GROUND VIEW OF SPACE POLICY

- Yet, it is the enabling policy environment that has proved elusive. The first satellite communication policy was introduced in 1997, with guidelines for foreign direct investment (FDI) in the satellite industry that were further liberalised but never generated much enthusiasm.
- Today, more than half the transponders beaming TV signals into Indian homes are hosted on foreign satellites, resulting in an annual outflow of over half a billion dollars.
- A remote sensing data policy was introduced in 2001, which was amended in 2011; in 2016, it was replaced by a National Geospatial Policy that has been further liberalised in 2022.
- Yet, Indian users including the security and defence agencies spend nearly a billion dollars annually to procure earth observation data and imagery from foreign sources.
- To streamline matters, a draft Space Activities Bill was brought out in 2017, which went through a long consultative process. It lapsed in 2019 with the outgoing Lok Sabha.
- The government was expected to introduce a new Bill by 2021, but it appears to have contented itself with the new policy statement.
- To be fair, the Indian Space Policy 2023 is qualitatively different from previous efforts.
- It is a short 11-page document, which includes three pages devoted to definitions and abbreviations.
- The 'Vision' is to "enable, encourage and develop a flourishing commercial presence in space" that suggests an acceptance that the private sector is a critical stakeholder in the entire value chain of the space economy.
- It makes five key points. It defines its role in India's "socio-economic development and security, protection of environment and lives, pursuing peaceful exploration of outer space, stimulation of public awareness and scientific quest.
- First, this is the only reference to 'security' in the document, making it clear that the focus is on civilian and peaceful applications.
- Considering that space-based intelligence, reconnaissance, surveillance, communication, positioning & navigation capabilities are increasingly seen as mission critical by the defence services, that India conducted a successful A-SAT (anti-satellite) direct ascent test in March 2019, &, in the same year, set up the Defence Space Agency & the Defence Space Research Organisation, it is reasonable to infer that a defence-oriented space security policy document will be a separate document.
- The United States puts out a space policy under the aegis of the White House Office of Science and Technology Policy, National Aeronautics and Space Administration (NASA) & the Departments of Commerce & Transportation, while the Department of Defence & the Director of National Intelligence are responsible for the space security strategy.
- The policy lays out a strategy & then spells out the roles of the Department of Space, ISRO, the Indian National Space Promotion & Authorisation Centre (IN-SPACe) set up in 2020, & the NewSpace India Limited (NSIL), a public sector unit set up in 2019 under the Department of Space as the commercial arm of ISRO to replace the now defunct Antrix.
- Another of ISRO's tasks in the new policy is to "share technologies, products, processes and best practices with NGEs (non-government entities) and/or Government companies
- This implies that ISRO will now use its biggest asset, its qualified & talented manpower, to concentrate on cutting edge research & development and long-term projects such as Chandrayaan & Gaganyaan.
- As ISRO's commercial arm, NSIL will become the interface for interacting with the industry, undertake commercial negotiations & provide hand-holding support to ensure smooth and efficient transfer of technologies.
- NGEs can design & operate launch vehicles for space transportation & establish their own infrastructure.
- NGEs can now make filings with the International Telecommunication Union (ITU) & engage in commercial recovery of asteroid resources.
- In short, the entire gamut of space activities is now open to the private sector.
- Security agencies can task NGEs for procuring tailor-made solutions to address specific requirements.

- The activities of the NGEs will be in keeping with guidelines and regulation to be issued by IN-SPACe.
- It is expected to act as the single window agency for authorising space activities "by government entities and NGEs", in keeping with safety, security, international obligations and overall national interests
- IN-SPACe is expected to create a "stable & predictable regulatory framework" that will ensure a level playing field for the NGEs.
- It will act as a promoter by setting up industry clusters & as the regulator, issue guidelines on liability issues.

SCOPE OF GROWTH

- What is urgently needed is a time frame to provide the necessary legal framework to translate this vision into reality, to successfully launch India into the Second Space Age.
- In 2020, the global space economy was estimated at $450 billion, growing to $600 billion by 2025.
- The Indian space economy, estimated at $9.6 billion in 2020, is expected to be $13 billion by 2025.
- However, the potential is much greater with an enabling policy and regulatory environment.
- The Indian space industry could easily exceed $60 billion by 2030, directly creating more than two lakh jobs.
- The reason is that in terms of the end-user revenue, only a fifth is generated by the government.
- Media and entertainment account for 26% of India's space economy, with consumer and retail services accounting for another 21%.
- In terms of , downstream activities such as satellite services and associated ground segment are dominant, accounting for over 70% of India's space economy
- Upstream activities of satellite manufacturing and launch services contribute the smaller share.
- A similar trend can be seen in developed countries. The reason is that India has been an early adopter of digital app-based services.
- The growing role of the private sector is also evident in the numbers and ownership of satellites.
- According to the United Nations Office for Outer Space Affairs (UNOOSA), there are 8,261 satellites in orbit, of which nearly 5,000 are active.
- Till 2010, about 60 to 100 satellites were launched annually. The pace has picked up in recent years.
- In 2020, 1,283 satellites were launched.
- Today, Starlink operates a constellation of over 3,500 satellites and has a million paying customers.
- Both Starlink & OneWeb (in which Airtel has a stake) project constellations of 40,000 satellites each. And Jeff Bezos of Amazon has launched Project Kuiper to bring low-latency broadband connectivity around the globe.
- How this domain will be regulated is a separate challenge, but this provides a glimpse of the scope of expansion.
- The Indian private sector is responding to the demands of the Second Space Age.
- From less than a dozen space startups five years ago, there are over 100 today.
- The pace of investment is growing. From $3 million in 2018, it doubled in 2019 and crossed $65 million in 2021.
- The sector is poised for take-off — as a transformative growth multiplier like the IT industry did for the national economy in the 1990s.
- Today, ISRO manages four to five launches annually. It manages 53 operational satellites – 21 for communication, 21 for earth observation, eight for navigation and the remaining as scientific experimental satellites (China operates 541).
- In addition, ISRO has missions such as Chandrayaan, Mangalyaan and Gaganyaan (manned space mission).
- ISRO has always been an open organisation that has worked closely with the Indian private sector.
- However, for some private sector companies, space technology-related work is a small part of their revenue stream.
- They were content as vendors, producing to defined specs and designs.
- The start-ups are different. Their revenue stream depends on space-related activities and they need a different relationship with ISRO and government.
- ISRO today is the operator, user, service provider, licensor, rule maker and also an incubator.
- There has been talk of commercialising the PSLV and SSLV launch services and NewSpace India Limited (NSIL) was set up to replace Antrix.
- The Indian National Space Promotion and Authorization Centre (IN-SPACe) was set up in 2020 as a single-window-clearance for the private sector.
- However, it is unclear whether it will emerge as the licensing authority or a regulator.
- An Indian Space Association (ISpA) was created as an industry association.
- As per SpaceTech Analytics, India is the sixth-largest player in the industry internationally having 3.6% of the world's space-tech companies (as of 2021).
- U.S. holds the leader's spot housing 56.4% of all companies in the space-tech ecosystem.
- Other major players include U.K. (6.5%), Canada (5.3%), China (4.7%) and Germany (4.1%).
- The country's standout feature is its cost-effectiveness. India holds the distinction of being the first country to have reached the Mars' orbit in its first attempt and at $75 million — way cheaper than Western standards.
- Most of the start ups in this sector in India —a majority of them were dealing in projects related to space debris management.

- U.S. and Canada were the highest receivers of space-related investment in 2021.
- A scrutiny of SpaceTech data puts forth that U.S. alone has more companies in the sector than the next 15 countries combined.
- Forbes pointed out in May 2021 that, "…it helps when your country's government budget in the realm is six times larger than its nearest competitor."
- Its space budget was $41 billion in 2021, $23.3 billion of which was focused on NASA.
- India's total budgetary allocation for FY 2022-23 towards the Department of Space was ₹13,700 crore.
- Currently, a report on a leading news portal says: the reason for the lack of independent private participation in space includes the absence of a framework to provide transparency and clarity in laws.
- The laws need to be broken down into multiple sections, each to address specific parts of the value chain and in accordance with the Outer Space Treaty.
- Another crucial aspect of space law is insurance and indemnification clarity, particularly about who or which entity undertakes the liability in case of a mishap.
- Mature space agencies such as the National Aeronautics and Space Administration (NASA) of the United States, China's China National Space Administration (CNSA), and Russia's Roscosmos (Roscosmos State Corporation for Space Activities) seek support from private players such as Boeing, SpaceX and Blue Origin for complex operations beyond manufacturing support, such as sending crew and supplies to the International Space Station.
- For such purposes, NASA and the CNSA award a part of their annual budget to private players.
- Until 2018, SpaceX was a part of 30 missions of NASA, getting over $12 billion under contract.

GAPS IN THE POLICY

- The policy sets out an ambitious role for IN-SPACe but provides no time frame for the necessary steps ahead.
- Neither is there an indicative timeline for ISRO's transitioning out of its current practices nor is there a schedule for IN-SPACe to create the regulatory framework.
- The policy framework envisaged will need clear rules & regulations pertaining to FDI & licensing, government procurement to sustain the new space start-ups, liability in case of violations & an appellate framework for dispute settlement.
- A regulatory body needs legislative authority. The Reserve Bank of India was set up by the 1934 RBI Act, the Securities and Exchange Board of India (SEBI) by the 1992 SEBI Act, and the Telecom Regulatory Authority of India (TRAI) by the 1997 TRAI Act.
- IN-SPACe is expected to authorise space activities for all, both government and non-government entities.
- Currently, its position is ambiguous as it functions under the purview of the Department of Space.
- The Secretary (Space) is also Chairman of ISRO, the government entity to be regulated by IN-SPACe.
- The Space Policy 2023 is a forward-looking document reflecting good intentions and a vision. But it is not enough.
