

SPACE TECHNOLOGY PARKS

To energize Aatmanirbhar Bharat in Space domain





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ISpA- Indian Space Association

About ISpA

ISpA is an apex, non-profit industry body exclusively working towards the successful exploration, collaboration, and development of the private and public Space Industry in India.

ISpA will undertake Policy Advocacy, Engage and Operate with all Stakeholders and act as a catalyst for accelerating the exchange of knowledge, information and technology of space-related domains amongst all stakeholders of the entire Indian Space ecosystem including the government and its agencies, to make India self-reliant, technologically advanced and a leading player in the Global Space arena.

Vision

Work with all stakeholders, to create an enabling environment for strengthening the private industry in the Indian Space sector. ISpA envisions to propel India to the global forefront in the entire Space ecosystem. ISpA echoes the Hon'ble Prime Minister's vision of 'Atma Nirbhar Bharat'.

Our Focus Areas



UNIFIED VOICE

FOR ENSURING

ENABLING

POLICY

FRAMEWORKS



BUSINESS

GROWTH





WITH DEFENCE AND SECURITY **AGENCIES**



GLOBAL

HUB OF

SPACE



CAPACITY AND **KNOWLEDGE INDUSTRY** BUILDING

INTERNATIONAL **PARTNERSHIPS** AND **COOPERATION**

Space Verticals



Chairman's Message



Shri Jayant Patil, Member of IN-SPACe Board Member of Executive Council of Management & Advisor (Defence & Smart Technologies) to CEO & MD Larsen & Toubro Limited, Former Whole Time Director Larsen & Toubro Limited

India's Space Sector is a great example of being Atmanirbhar. Leveraging on this the current government's focus is to acquire meaningful share of Space Commerce befitting the end to end capabilities and track record India has in this vital sector to serve the people at large. To accomplish this and build our own defence space capabilities, one of many important ways is promote startup ecosystem through establishment of Space Technology Parks. Space technology parks are centres for innovation in space-related sectors that are intended to assist established industries in driving growth in new and emerging fields. This will create an energising environment for the development of space technology by encouraging collaboration between large and small companies for assured access to mentors and incubation support to start-ups and independent innovators. Towards this goal, ISpA is pleased to present the **Concept paper on Space Technology Parks (STPs).** This paper focuses on the reforms and enablers needed to develop a framework for STPs, as well as a comprehensive STP Incentivization policy guidelines. The Concept paper sums up the concerted efforts taken by the Central Government and various States Governments to make India the hub of the Space Industry.

The Kerala government is building a Space Park in Trivandrum with the assistance of ISRO and Kerala IT Parks, while the Gujarat government is aiming to establish a Space Manufacturing Park in partnership with IN-SPACe with commensurate incentive. ISpA, as the apex industry body and having been created as dedicated society towards the space sector, considers this as its mandate to be a policy advocate to facilitate industry across space domain operations including Space Parks incubated firms. As India's position in the global space market grows, our policy advocacy strategies and actions will have to adopt to newer business models and reach while emphasising enterprise and B2B settings. There are underlying challenges to overcome, particularly for start-ups, but the government has resolved to provide support through essential policy innovation and guidance to help them expand and achieve their goals. Large Companies must come forward to act as a handholding accelerator to early-stage entrepreneurs, academics and non-profit organisations through Corporate Social Responsibility (CSR) and other promotional government schemes.

In conclusion, it is crucial to have the support of existing corporations and tech conglomerates in establishing Space Technology Parks in India, thus propelling the Indian Space Industry Ecosystem ahead. Companies should consider to prioritise CSR towards this as it is becoming increasingly important to project a socially conscious image. Consumers, employees, and stakeholders are known to increasingly place a premium on consencious organisations when choosing a service or company, and they hold corporations accountable for using their principles, practises, and profits to effect social change.

Director General's Message



Lt Gen Anil Kumar Bhatt (Retd) PVSM, UYSM, AVSM, SM, VSM

Post the declaration by Hon'ble PM Shri Narendra Modi in 2020 for the privatization of space, the growth of the space industry has been phenomenal. With new innovations and technologies emerging at a rapid pace, the need for a dedicated Space Technology Park is apparent. Space Technology Parks are designed to take advantage of this growth and provide a supportive environment for startups, academia and Space sector companies to work together in this field. By bringing together like-minded organizations and individuals, space technology parks can encourage collaboration and the creation and transfer of knowledge and technologies.

The significance of space technology parks is clear. They have the potential to drive economic growth, create new jobs, and foster innovation in the space industry. Additionally, they can help to establish a strong presence for India and other countries in the global space community and create new opportunities for collaboration and investment.

As the development of Space Technology Parks gains momentum, it is important to reflect on the impact that these facilities will have on the country in the next decade. For example, the creation of IT parks in India has provided valuable lessons on the potential benefits that can be realized through the development of technology hubs. In much the same way, the development of space technology parks has the potential to bring about significant advancements in the country's space industry and to have a transformative effect on the economy as a whole.

Just as IT parks have attracted foreign investment, created jobs, and generated significant revenue, space technology parks have the potential to drive the growth of the space industry and attract investment from leading companies and organizations in the field. By providing state-of-the-art facilities, access to key technologies, and a supportive environment for innovation, space technology parks will play a key role in the advancement of space-related technologies and the development of new applications and services.

In addition, the development of space technology parks will also contribute to the improvement of infrastructure and the quality of life in the surrounding areas, much like the impact of the development of IT parks and Industrial Corridors. This will further enhance the competitiveness of the country and help to attract even more investment and talent in the years to come.

In conclusion, the development of space technology parks is a critical step in the advancement of the country's space industry and will have far-reaching impacts on the economy, infrastructure, and quality of life in the years to come. By drawing parallels from the experiences of IT parks and industrial corridors, we can look forward to a future of continued growth, innovation, and prosperity in the space sector.

Rationale of the Document

The Hon'ble Prime Minister's game-changing initiative to open up the Space Sector for Commercial activities as well as allowing the Indian Private Industry to work along with ISRO and other government agencies for fulfilling government requirements is historic and would go down in history as one of the most significant enabling decision to catalyse niche technology development in India.

Space Technology capability is often seen as a determinant of the technological prowess of a nation as it brings a convergence of the "best-in-class" multi-sectoral as well as multi-disciplinary technology. To emerge as a credible Global Space Economy, India needs to add more teeth to upgrade its technological capabilities to emerge as a Global Brand as a maker of best-in-class products across all levels. For this, we need to systematically and meticulously build a credible, dependable and resilient Space Ecosystem catering for producing products which cover the entire life-cycle of spacelinked activities, across all verticals in the long run.

While India has made tremendous progress which includes many enviable achievements in Space mainly by ISRO, much more focused efforts are required to propel India to the aspired high seat of the Global Space Ecosystem. This journey is going to be both inspiring and challenging but we have to get there. While we do this, we need to focus on each vertical and simultaneously also look for its lateral integration. Commonality, Interoperability, Quality, Scalability and Sustainability are going to be important aspects which determine the success of this journey.

As unlike other IT-driven sectors, the cost of technical infrastructure needed for design, development and testing is very high. Further, Space Domain by itself is characterized by high investments and long gestation periods for Rol. For the reasons stated above as well as due to the government's control over the Space domain earlier, the bulk of such Technical Infrastructure for Testing, Calibration and Validation is held by the government agencies like ISRO, DRDO and other Government assisted Labs.

While in recent times, the government has shown the inclination to give access to some of its infrastructure to the private industry, there still exist challenges to their access and affordability on various counts which are impacting the pace of progress of our young start-ups, which operate under very thin budgets, the tight investor is driven milestones and very limited Human Resources. At the global level, we are seeing rising competition with new pathbreaking innovations unleashing disruption frequently. Given the above scenario, India must urgently invest in new-gen technical infrastructure as part of the Space Technology Parks (STPs) to provide single-window affordable access to Entrepreneurs for technology/product design, development, testing, validation and simulations. Additionally, the STPs could become breeding grounds for innovation as well as collaborations between Entrepreneurs, Academia, Mentors and Users of the New Space Ecosystem. It is also proposed to equip them with adequate administrative structure and authority to allow them autonomy as well as the teeth to deliver on the aspirations of the industry.

Like the IT Parks, we expect the STPs to energize the next level of technology development in niche areas never attempted before in addition to becoming the bestin-quality test-bed destination for both national and global innovators. The STPs could also provide the ecosystem to facilitate strong international business partnerships and energize space commerce.

We look forward to big financial and business leaders joining hands to support the developing private Space Ecosystem which has tremendous commercial potential, both domestically as well as globally. It is also important to note that India's strength lies in its diversity in terms of, diverse cultures; climate; terrain; socio-economic; and, ethnographic patterns. Hence, technology developed under an Indian ecosystem have a greater potential of universal acceptability, which when supported by our excellent IT power makes India, the best global design and manufacturing destination to deliver to the world in times to come.

Further, India being the largest digitally enabled democracy with a young demography, is potentially the best and the largest market for space-data-enabled services. Solutions leveraging seamless high-speed Space communication to offer GeoSpatial-AI applications (consuming multi-sensor satellite data) and powered by resilient Space-based PNT services offer a fantastic bouquet of opportunities to serve the 1.4 Billion strong Indian Population which has no global parallel. Such solutions can also be made globally scalable and have the potential huge business potential.

The potential of such limitless opportunities must make India think differently. Investing in STPs with cutting-edge infrastructure is a must for India to become the Vishwa-guru in Space in terms of Innovation, Design, Testing, Standards and Applications. The proposed STPs, are therefore an essential building block, in the execution of this vision.



Wing Commander Satyam Kushwaha (Retd) Director, Indian Space Association

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Executive Summary

This document outlines a comprehensive plan for the development of Space Technology Parks (STPs) in India. The aim of this plan is to provide a supportive environment for the development of the space industry and to encourage innovation and entrepreneurship in the sector.

The requirement for the development of STPs is driven by the need to create a supportive environment for the growth of the space industry. The objective of this plan is to create a framework for the establishment and operation of STPs, and to promote a culture of innovation and entrepreneurship in the space sector.

The focus areas of this plan include the reforms and enablers required to create a comprehensive STP incentivization policy, the framework for STPs, and the present status of STPs in India.

The key inputs for creating a comprehensive STP incentivization policy include administrative aspects, a single window mechanism, financial enablement, a legal and policy framework, and skill and capacity development. The government framework required to enable STP development includes the adoption of a national geospatial policy and international cooperation and harmonization.

The framework for STPs includes centres of excellence, ground infrastructure and facilities, testing facilities and services, a regulatory sandbox, and legal/intellectual property rights support. The present status of STPs in India includes the Space Manufacturing Park and the Kerala Space Park, both of which are initiatives of the government and the Indian Space Research Organization.

The development of STPs has the potential to have a significant socio-economic impact by creating job opportunities, promoting innovation and entrepreneurship, and fostering the growth of the space industry in India.

The Space Technology Parks will act as a comprehensive facility & state-of-the-art accelerator that provides support and resources to space-related startups, entrepreneurs, and businesses. It is designed to help advance the development of innovative technologies and ideas in the space industry and to provide a supportive environment that promotes growth and success.

The infrastructure of the park would include state-of-the-art laboratory space, office facilities, and meeting rooms, as well as access to high-speed internet, advanced computing resources, and other essential tools and equipment. These resources are designed to help startups and entrepreneurs get up and running quickly and efficiently and to provide the necessary resources to take their ideas and innovations to the next level.

Visibility and outreach are key components of the STP, and the centre is designed to be highly visible to the wider community. The STP will have an active marketing and outreach program to promote its services and to connect startups and entrepreneurs with key players in the space industry, including investors, suppliers, customers, and others.

Mentoring is a critical component, and the centre will provide startups and entrepreneurs with access to experienced advisors and experts who can help guide them through the complex and challenging process of building a successful space-related business. These mentors will provide support, advice, and guidance to help startups and entrepreneurs navigate the often-difficult journey from idea to launch.

Funding is another important aspect of the STP, and the centre will work closely with investors and funding organizations to provide startups and entrepreneurs with the resources they need to grow and succeed. This includes access to seed funding, venture capital, and other types of financial support.

Skill development is also a key component of the STP, and the centre will offer a range of training and development opportunities to help startups and entrepreneurs build the skills they need to succeed. This may include workshops, training sessions, and other programs designed to help startups and entrepreneurs build the skills they need to succeed in the space industry.

The legal and intellectual property aspects of the STP will provide startups and entrepreneurs with the support they need to protect their ideas and innovations. This includes access to legal advice and support, and the necessary resources to secure patents, trademarks, and other types of intellectual property protection.

Finally, the STP will focus on supporting startups and entrepreneurs in the space industry and will provide them with the resources they need to build and grow successful businesses. This may include access to office and laboratory space, access to key technologies, and support from experienced mentors and advisors.

In addition to the above components, the Earth Observation Resource at the STP will provide support for businesses focused on earth observation technologies, such as avionics, optics, detectors, electronics, ground equipment, and space applications. The STP will also provide access to frequently used test facilities, such as advanced machining and structure fabrication and assembly, integration, and testing (AIT), environmental testing, and critical technology manufacturing. These resources are designed to help startups and entrepreneurs validate their technologies and move them towards commercialization.

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Aim

To incentivize industry in India, it is proposed to set-up "Space Technology Parks (STPs)" as "Centres of Excellence in Space Technology Products, Applications and Systems". The Aim is to further strengthen Government of India initiatives to make India "self-reliant" and "technologically advanced".

Requirement

Space is a Dual-Use Domain. Niche industry capabilities (including 4th Industrial Revolution Technology) need to be best in-class to serve Space Sector. Some segments of space technology have long gestation periods, need high-value of investments, and give low yields while carrying high-risk factors. Significant global focus on the development of cutting-edge Space Technologies and Applications for both securing as well as interdicting Space Assets is being seen. Further, the increasing complexity of missions in Space is being planned to "Explore and Understand" the Earth, our Solar system, and the Universe within the arena of Civilian Applications. While many requirements are overlapping in terms of Civil and Strategic Requirements, there are exceptions which need to be handled separately, as follows:-

Common Requirements

- Reliable space communications
- Secure space-based broadband
- Meteorological observations
- Near-Realtime Earth Observation
- Tele-medicine
- Tele-education
- Disaster warning rescue & management
- Scientific and Space Exploration.

Strategic Requirements

Space domain and considered the Fourth Dimension of Warfare. The rising buildup of Space Capabilities in neighbourhoods is worrisome and needs urgent efforts to arrest the same. For this, there is an urgent requirement to strengthen our National Space Capabilities, with the need to leapfrog in some cases with external support, to address rising asymmetry. Some key areas, where we need to build strategic self-reliance would include,

- Protection and Security of Space Infrastructure
- Earth Observation Sensors
- Space Surveillance & Situational Awareness
- Space Defence
- Space Interdiction
- Secure Communications
- Indigenous Global Navigation Satellite System to support PNT requirements
- Space Infrastructure Protection & Security in both Space and Ground
- Launch on Demand to support Disaster Management.

Objectives & Outcomes

STPs would incentivize all stakeholders which include, Private Companies, Startups, Academia, and Investors to join hands to collaboratively and synergistically design, develop, productionize, market as well as export Space technologies from "**Lab to Space**". The wide spectrum of outcomes would include,

- Improving our leadership in key research areas
- Enabling the development of niche capabilities in the long term
- Spawning game-changing innovations to strengthen self-reliance
- Establishing a Space Knowledge Hub
- Promoting innovative products and services
- Aiding in talent pool creation and job generation
- Facilitating and Generating entrepreneurship opportunities
- Spur exports and economic growth.

Creation and Development of STPs can have multiple positive outcomes in the short, medium, and long term. These could be as follows:-

- A robust national capability for space technologies will improve our competitive capabilities in the international marketplace.
- Enable new industries and contribute to economic growth.
- Serve as a spark to innovation that can be applied broadly to a more robust technology-based economy.
- Become an international symbol of the nation's scientific innovation, engineering creativity and technological skill.
- Give an opportunity to motivate young students of science, mathematics and engineering to showcase their capabilities.
- Generate employment and boost the GDP and development indices of the nation
- Encourage investments from national and international entities.
- Create a leadership position in Space IPs.

STPs aim to be the premier technology and innovation hub with focus on niche technologies areas, with the intent of:-

- Building synergies between academic and research institutions and industries.
- Encouraging Startups and SMEs and MSMS in establishing Space qualified products, technologies and services.
- Creating an environment for Innovation by encouraging the development of IPs, Patents and Indigenization of critical imported components vital for use in Space.
- Giving an impetus to the "Make in India" program in the vital area of Space Technologies

Focus Areas

India is poised to be a globally relevant consumer and supplier of space technology, production and services. India's talent pool, proven track record in Space exploration and innovation, ancillary support, and a vibrant private and public sector coupled with academic institutions presents an attractive outsourcing option in the global space technology market. The STPs will aim to attract global players looking for innovative investment opportunities. These STPs need to be strategically positioned in the following domains of Components, Products, Software, Technologies and Services for Civilian and Defence needs. Some of these have been mentioned in succeeding paragraphs.

Components

At the component level, the following areas would be relevant: -

- Military and Space grade composites components include Carbon and Carbon composites (CCC), Ceramic Matric composites (CMC), and Polymer Matrix composites (PMC).
- Military and Space grade Metallurgical Components.
- Military and Space grade Electronic components and assembly.
- Military and Space grade enclosures, connectors and cables.
- Advanced Inertial Sensors (Fiber Optic, Ring Laser, DTG, MEMS-based) and high-precision mechanical and solid-state MEMS accelerometers.
- Space-grade high-reliability Electro-Mechanical actuator components and control surfaces.
- Thrush Vector control system components.
- Extreme temperature and extreme pressure components.
- Microwave Travelling wave tubes.
- Optical and IR sensors and components.
- Low noise and RF components, and transducers.
- 3D printed high-precision components.
- Smart Materials

Following technology eco-systems would need to be developed:-

- Hypersonic Systems.
- Innovative Space Propulsion.
- Space Quantum Communication.
- Directed Energy Weapon Systems.

Products

At the product level, the following would be relevant

- Rocket Assembles.
- Electronic Subsystems.
- Space Communication Equipment.
- DSP and On-Board Computer Systems.
- Indigenous Global Positioning Systems.
- Sensors Systems and sub-systems.
- Satellites and their sub-systems.

Services

From the Services perspective, the following aspects would merit attention:-

- Image Analytics.
- GIS and Geo Spatial Services.
- CFD and Thermal Analysis.
- Think Tanks and Strategic Analysis.
- Cloud Computing and Big Data Analytics.
- Embedded and Real-Time Software Development.
- Radiation Testing for space systems.
- Simulation and Non-Destructive Testing.
- Environmental, EMI/EMC, NHV testing for Space and Military standards.

Software

From software perspective following would the broad heads which merit attention:-

- Autonomous Systems.
- Big Data Analytics Products.
- Quantum Computers and Software.
- Geo-Spatial Analyses Systems.
- AI and ML-based Classification and Learning Systems.
- Embedded and Ground Systems Software.
- Automated Surveillance and Intelligence Systems.

Present Status

Space Manufacturing Park: IN-SPACe and Gujarat Government Initiatives

Gujarat Government and IN-SPACe are collaborating to construct a space manufacturing park. For satellite manufacturing and an applications hub, the park will include Plug-n-Play infrastructure. The park will promote Gujarat's space economy, allow for private sector participation in space operations, and provide new space force frontiers.

A Space Accelerator Centre will also be setup as an integral part of the Space Manufacturing Park to provide -

 Space Accelerator Centre Infrastructure Visibility/Outreach Mentoring Funding Skill Development Legal & Intellectual Property Start-Ups/Entrepreneurs 	 Frequently used Test Facilities Adv. Machining & Structure Fab/Assembly Assembly, Integration & Testing (AIT) Environmental Testing Critical Technology Manufacturing 	 Earth Observation Resource Avionics Optics/Detectors/Electronics Ground Equipment/Systems Space Applications
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Under the same, a Space Science Popularization - Science City containing Astronomy Gallery is being constructed over an 8500 Sqm area to popularize with the project cost of Rs 150 cr. This Gallery entails several attractions like (a) 172 seater hybrid 3D planetarium with 10 degrees tilted diameter dome, (b) Observatory with 6.2 meter retractable dome and 24-inch reflective telescope, (c) Simulators providing the 4D experience of space & (d) 150+ Exhibits covering different aspects of Astronomy & Space Science.

Furthermore, the Gujarat government along with Gujarat DST has come up with several initiatives for the Space Sector-

- **Gujarat Electronics Policy (2022-28)** where to develop space ecosystem products like Telecom, RF & Optical systems, VSAT-based systems, Strategics electronics, Avionics, Opto-electronics aka any Electrical, Electronic and Electromechanical (EEE) required for the space equipment.
- **IT/ITeS Policy** with CAPEX at 25% upto INR 50 Cr. and OPEX support at 15% up to INR 20 Cr. Per year for 5 years including Cloud Rental, Patent Support, Lease Rental, Bandwidth and Power Tariff,
- Startup Policy- Electronics & IT/ITeS- to create a vibrant start-up culture &
- **GUJCOST** as a nodal agency for science popularization.

Kerala Space Park (K-Space): ISRO-VSSC and Kerala Government Initiatives

Vikram Sarabhai Space Centre (VSSC) has inked an MoU with the State Government to support its initiatives in developing Space Technology sector in the State, providing a significant boost to the **Kerala Space Park project**.



Space Park will be built at the Knowledge City within the Technocity by Kerala State Information Technology Infrastructure Ltd. (KSITIL). The overall infrastructure of the Space Park will include the Dr. A P J Abdul Kalam Knowledge Centre and Space Museum, which will be built by VSSC as an amenable memorial to the former president and leading space scientist.

Some of the major ISRO facilities, including the Vikram Sarabhai Space Centre (VSSC), the Thumba Equatorial Rocket Launching Station (**TERLS**), the Liquid Propulsion Systems Center (**LPSC**), the ISRO Inertial Systems Unit (**IISU**), BrahMos Aerospace, and the Indian Institute of Space Science & Technology, are located in Thiruvananthapuram (**IIST**).

In order to utilise both the upstream and downstream capabilities of the space technology domain, Kerala Space Park comprises two sub-verticals: **Nano Space Park** and the **Space Technology Application Development Ecosystem (STADE)**.

The Nano Space Park will be primarily focused on hardware assembly. Building an ecosystem for SMBs and startups engaged in the development and manufacture of components and subcomponents will be its main objective.

Application development is a focus area for STADE. The key goal, in this case, is to comprehend how to develop business in areas like the downstream market. For the promotion of space and aerospace startups, STADE has already secured agreements with the French space agency CNES and Airbus.

Framework for Space Technology Park (STP)

It is proposed to set-up a Special Purpose infrastructure called "**Space Technology Parks (STPs)**" at various locations to further strengthened the Government of India's initiatives in Space. The "Prime Aim" is to use a network of STPs to make India "**self-reliant**" and "**technologically advanced**".

Approach for STP creation would need to include, (1) **whole-of-nation**; (2) **whole-of-ecosystem**; and, (3) **whole-of-lifecycle** approach to include every segment within the Space Domain, including upstream, midstream or downstream sectors.

At the core, the Space Technology Park will establish a framework for:

- Collaboration with academic institutions, research institutions, innovators, startups and large commercial organizations.
- Policies for building human capital, IP, products and services and for commercial operations.
- Ease of doing business support infrastructure to aid the core activities with support for Offices, Infrastructure, Communication, Security, Transport, Power, Cleanliness, Collaboration and Networking support.
- The Government of India will provide the required policy framework for the governance and efficient operation of the Park by having a dedicated focus on the implementation, design, review and operationalization of the Space Technology Park.



Incubation Centre(s)

Wisdom Incubation Center (WIC). This will aim to create an environment and tools for improving the pedagogy of the technical subjects aforementioned in the focus areas and objectives aligned with the technological and strategic needs of India. Innovative and proper teaching tools aid effective teaching and learning. Universities will provide a window for interaction among the best brains in the country and outside. Forums for dialogue on content, new developments, new teaching paradigms, new thought processes, idea incubation and academic review act as the catalyst for overall improvement of the quality of technical education as well as innovation ideation.

Design Innovation Centre will encourage and support innovations. These centres will receive and select ideas for conversion to IPR, Prototypes and Projects. **Central Instrumentation Facility (CIF)** will be a specialized core testing and instrumentation laboratory. CIF will offer sophisticated instruments and technical expertise for research and industrial R&D. Its mission is to provide futuristic research infrastructure and advanced instrumentation. The proposed facility could have specialized equipment as follows: -

- High-Resolution Transmission Electron Microscope.
- High Resolution Scanning Electron Microscope.
- Scanning Electron Microscope.
- Scanning Probe Microscope.
- Nuclear Magnetic Resonance Spectroscopy 500MHz.
- Magnetic Property Measurement System.
- High-Resolution X-Ray Diffraction.
- Bench Top X-Ray Diffraction.
- Particle Image Velocimetry.
- PCB Prototyping Machine.
- Ion Chromatography.
- Multi-Function Tribometer.
- Fourier Transform Infrared Spectroscopy.
- Thermogravimetric Analysis.
- Differential Scanning Calorimetry.
- Surface Area Measurement Facility.
- Inductively Coupled Plasma Mass Spectrometry.
- X-ray photoelectron spectroscopy.

Ground Infrastructure & Facilities

Brown Field Approach

The STPs would be ground infrastructure-heavy and would need major investments. The Hub-n-Spoke model would focus on leveraging existing facilities available within the government system where possible. The government could come out with an online portal to facilitate awareness of availability, pricing, policies and booking of these facilities.

Greenfield Approach

This would require the creation of building capabilities from the scratch. Due diligence would be required to ensure that no duplication is undertaken unless driven by over-congestion and high demand.

Some of the common infrastructure requirements would include the following:-

- Transportation. Availability of international airports, high-speed expressways as well as multi-modal transportation hubs as well as sea-port in case of development of sea-launch capability is recommended.
- Logistics Hub. The establishment of a Logistical Hub will be beneficial for the storage, warehousing and supply chain of critical parts, equipment, raw materials and finished goods. With most of the input materials and finished materials being of high value and critical for space infrastructure, the development of a secure and protected warehousing infrastructure will be a significant advantage.
- Facilitation of Space Park. Keeping human aspirations in mind, such STPs would need to cater to civil infrastructure which is today considered essential for our existence. Some of the important aspects in this regard would include the following:-
 - Establishment of Hotels and Convention Centres for holding Industry meets, symposia and business conferences.
 - Support the development of an eco-system that develops not just industries but also startups with the allocation of funds for incubation.
 - Incubation centres with offices and communication facilities for Startups.
 - Integrated Web-based services portal for single-window clearances.
 - Incubation centres for Robotics, AI and Deep Learning with Cloud Computation Data Centers.
 - Annual Expos on Defence, Space and Cyber Technologies.
 - Ample space for safe and systematic parking near offices and industries.
 - Banking and Financial Institutions for supporting businesses (provided by commercial banks located on-site or in separate premises).
 - Good residential complexes with adequate entertainment facilities as well as good schooling and a college ecosystem to ensure that professionals do not shy away from settling in such places.

- Business registration and licensing
- Investment incentives information
- Employment permits
- Planning and construction
- Social security registration and account management
- Tax and custom services
- Port or airport cargo clearances
- Access to publicly-funded innovation and start-up promotion services
- Quality control services (e.g. lab testing)
- Utilities (electricity, telecom, water and gas) account management
- Environmental approvals
- Legalisation and notarization
- Tourism information services
- Land administration
- Safety from natural disasters, seismic considerations.
- Space system design for operations.
- Supply-chain network on ground and space.
- Managing material flow, services, and information for the "space system lifecycle".
- Launchpad/ Ground station safety including from acts of nature and humans (sabotage/attack).
- Security and privacy of communication services.
- Infrastructure servicing both on ground and space.
- Provisioning of propellants, cryogenic fluids, electrical power, communications, telemetry, rocket, satellites, onboard computing, satellite in-situ processing, communication etc.



ISITE, ISRO HQ. Source: Bloomberg

Testing Facilities & Services

Some of the specialist requirements which need to be considered for STPs would be as under (some of these would supplement the existing key facilities of ISRO/HAL/DRDO).

- **Test Services**. The proposed Space Park will benefit from the establishment of mature and necessary test facilities within the confines of the proposed Space Park. These will supplement the existing key facilities of ISRO/HAL/DRDO.
 - **Wind Tunnel Facility** which is a critical facility that can be leveraged for understanding and testing Aerospace aerodynamics.
 - **Central Instrument Facility (CIF)** to host specialized testing and instrumentation equipment for use by academicians, researchers and industry.
 - **Computation Cluster and Data Center** for advanced aerodynamic simulations and astrodynamics computations.
- Advanced Facilities. The proposed Space Park will benefit significantly from the development and establishment of advanced facilities for testing Environmental conditions, Propulsion performance, Vibration and Shock sustenance, EMI/EMC and Radiation hardening, Hypersonic Wind Tunnel and Hi-Performance computational. The Space Park will facilitate the setting up of Test Facilities by private, or private-public entities with services for hire.



Skyroot Engine test, source:currentaffairs.adda2 47.com



ISRO CartoSat 2 Vibration Testing. Image Source: ET

Single Window Mechanism

IN-SPACe Digital Platform (IDP) may be designated as the Single-Window for all Government of India approvals for subjects mentioned in the Draft Policy. IN-SPACe could interface with other Government Departments, where considered necessary, by IN-SPACe. It is recommended to include a mechanism for monthly inter-departmental meetings of all stakeholders to **facilitate fast-track review and approval of proposals**. This could be supported by an **integrated online web portal with modules that are integrated with the websites of other government stakeholders like customs, GST, and income tax** which eliminates the need for coordinating between multiple government offices. This web-portal can be facilitated by the **Unified Filing System proposed in Union Budget 2023-24** to reduce redundancy between departments. The process and information could be in terms of simplified templates which could cover, (1) contact details of the nodal agency under each category; (2) guidelines for applicants, criteria for approval, and steps for processing application; and, (3) pricing, service support etc.

Transparent Process Tracking Mechanism

As proposed by IN-SPACe a web-based Portal for the submission of applications and monitoring of the progress of approval would go a long way in bringing transparency. Challenges to clearance need to be reflected with time sensitivity to facilitate an early response from applicants and completion of the approval process within four weeks. Delays beyond four weeks should be deemed approved and such delays to be tracked on the jurisdiction level. Entry and exit should be streamlined and brought under a single integrated authority.

Access to Government facilities & Resources for supporting and handholding Indian Space Industry.

IN-SPACe's transparent mechanism to facilitate Awareness and Actionable Information on various aspects relating to ISRO should also extend to DRDO/Research Institutes/Universities/Government lab facilities available for Indian Industry would be of immense help. Facilities which enable testing, calibration and validation of parts & components; systems & sub-systems covering the entire life-cycle of activities relating to R&D, Design, Manufacturing, Operations and Management would be a great enabler for the Industry. This would also need to cover the entire life-cycle of activities relating to Launch Vehicles & Related Infrastructure; Satellites; Payloads; Cround Segment including TTC & Satellite Reception Stations. This would include hardware, software and services. Information regarding the above aspects could be covered by keeping the following aspects in mind:-

- Policies, Funding and Support Resources of Gol.
- Information on ISRO facilities in terms of simplified templates which could cover,
 - Contact details of the nodal agency under each category
 - Guidelines for applicants, criteria for approval, steps for processing application
 - Availability, booking status & costing (for those facilities which are not free) to facilitate better resource utilization;
- Technologies available for ToT.
- Development of linked infrastructure to boost economic activity in designated areas. This would include high-speed connectivity, business services, utility infrastructure, warehouses, transport facilities etc.
- Given the long gestation period, the flexibility of long-term leases for developers and businesses.
- Dispute resolution mechanism through arbitration or commercial courts to provide swift resolutions.
- Providing utilities like electricity, water etc. at subsidized prices.

STP Authority

A Space Technology Park that facilitates one-stop services and has the necessary decision-making authority is a good solution for offering a single point of contact to facilitate the requirements of numerous stakeholders, especially for regulatory compliance. It increases administrative effectiveness in securing required services and government clearances and streamlines related processes.

On such note, in today's rapidly evolving space landscape, it is essential to have a centralized authority to manage the various aspects of STP, including land, power, water, digital connectivity, and other common facilities/utilities.

The creation of an STP Authority is a step towards achieving this goal. This authority will serve as a single window to Space Technology Park for all the stakeholders involved in the space industry, providing a streamlined and efficient approach to handling the various needs and requirements of the industry.

One of the key responsibilities of the STP Authority will be to provide the necessary ground infrastructure and key facilities needed for the entire life-cycle of space-related activities. This will cover various verticals, including design, development, manufacturing, operations, integration, testing, calibration, skilling, and capacity building. The Authority will also play a critical role in ensuring that the infrastructure and facilities are kept up-to-date and meet the evolving needs of the industry.

Some expected Functions of the STP Authority

- Gives advice and feedback on the subjects, problems, relevance, and impact of current CoE research.
- Investigates and make suggestions regarding the goals, justification, and details of future CoE research programmes.
- Evaluates and offer commentary on the perspectives of the investment portfolio and the research directions
- The Authority will also be responsible for ensuring that all the necessary utilities, including power, water, and digital connectivity, are readily available and accessible to the companies operating in the STP. This will help companies to focus on their core competencies and not be distracted by the hassles of setting up and maintaining basic utilities.
- Startup promotions. This could include the following aspects:-
 - Deep tech space startup centres across the country.
 - End-to-end eco-system consortiums to avail talents/design and manufacturing/services/products etc. in the space domain.
 - Promote and Support Indian-backed companies for all aspects of the Space Domain over foreign competition.
 - Coming up with a policy document on the promotion of Indian-backed start-ups by providing various financial and tax benefits as a growth enabler.
 - **Easy financing options** for the MSMEs considering the long gestation period.

- Marketing and Government Connects. This could include the following aspects:
 - Pre-sales/Post sales/Customer Interfacing with private/strategic clients for custom-made space programs.
 - Generic Satellite Commercial services sales/marketing International.
 - Educational/training/skill augmentation program promotion and marketing.

Below are some guidelines on STP Authority Management Functions

In order to provide appropriately coordinated, clean, and green services at the parkwide level, modern operators' delivery of utilities and waste management services should be based on an understanding of eco-efficiency, by-product synergies, and integrated waste management. Therefore, both administration and public relations are necessary for the efficient operation of industrial parks. On the basis of the park operations framework handbook, the industrial park operator oversees and maintains day-to-day activities. To oversee operations in the industrial park and guarantee ongoing investment, park operators should have the necessary technical skills (such as energy management, waste utilisation, investment, and marketing, etc.).

Plot and shell facilities allocation

- Real estate management
- Plot and facilities leasing or sales

Infrastructure, superstructure and facilities management

• Landscaping, infrastructure and utility provision, operation and maintenance, along with a collection of utility usage fees, including for telecommunication landlines, internal transport networks, drainage, waste management and water distribution

Administrative services

• Registration and licensing, if these functions are delegated to it by the respective government agencies, overseeing regulatory compliance, ensuring park safety and security, and providing overall park financial management

Business development and innovation management

• Providing information on park services

Social service management

• Directly or indirectly ensuring the provision of healthcare, training, retail, community and civil society relations, recreational accommodation for workers and firefighting services within the park

Performance management and monitoring

- Compiling reports, surveying residents, performance assessment
- Economic, social and environmental performance monitoring

Regulatory Sandbox



Policy sandboxes and controlled deployments, where market responses and impacts could be carefully watched, may be used to establish regulatory procedures.

The challenges and risks related to the deployment of solutions may be addressed through the regulatory sandbox. Additionally, it can offer the environment that is required for testing and showcasing industry-specific solutions. Additionally, it is necessary to safeguard developers from any regulatory violations when thev are conducting experiments. It would also be beneficial for policymakers to analyse current regulations and find alternate solutions to these issues.

For a brief period prior to their live deployment, regulatory sandboxes offer a controlled environment that makes it easier to create, test, and validate novel solutions. Additionally, it lessens the burden of regulations, encourages experimentation to improvise, and increases operator trust in space tech solutions when used in a real-world setting.

The following may be the possible objectives for the adoption of regulatory sandboxes:

- To foster Space Tech innovation by establishing a controlled, safe and testing environment during the development and pre-marketing phase.
- To enhance legal certainty for innovators and the competent authorities' oversight, and understanding of the opportunities, emerging risks and the impact of Space Technology use.
- To accelerate access to markets which includes the removal of barriers for small and medium enterprises (SMEs) and start-ups.

Technology Standards

Standardization is a key component of the space industry, as it helps to ensure the safe and efficient operation of space systems, equipment, and processes. Standards provide a common framework for the development, manufacture, and deployment of space systems, which helps to **facilitate interoperability, reduce complexity, and promote the growth of the global supply chain**.

The technology developed by STPs' Incubation Centres needs to adhere to a common benchmark & standardization process to address the specific needs of the space industry (1) **Quality Assessment Plan** (2) **Material Acceptance Procedures/Support** (3) **Inspection support** at supply chain location (4) **Access for Quality Control Portal** as maintained by ISRO/HAL/DRDO.

For example, the **BIS (Bureau of Indian Standards)** is a national standards organization that sets standards for a range of products, services, and processes, including those related to the space industry. **NASA Technical Standards** and the **ESA Standardization Steering Board (ESSB)** and the various specialized **ESA Subboards (ESB, MSB and QSB)** and maintains the **List of ESA Approved Standards** (**LEAS**) applicable to ESA space projects. These two organizations develop and manage standards for various aspects of the space industry, including design, manufacturing, launch safety, and more.

In the context of India, it could be valuable to consider the creation of Indiaspecific standards guidelines from ISRO and BIS. These guidelines could help to address the unique needs and challenges of the Indian space industry and promote its development by **setting standards for areas such as design**, **manufacturing**, **and launch safety**, **as well as for computing**, **data and communication standards**, **safety**, **quality metrics**, **and more**.

The private sector has an important role to play in this effort, as companies can bring their expertise and resources to support the development and adoption of standards. This can help to drive innovation, increase efficiency, and ensure that the global space industry continues to grow and thrive.

Overall, the importance of standards in the space industry cannot be overstated. By working together, industry and government organizations can help to further advance the field of space and ensure that it remains a key driver of innovation and economic growth.



Geographic - Site Planning

The preparation of industrial park zoning maps takes into account a number of important site factors, including the physical characteristics of the site, the shape of the boundary (perimeter), environmental factors, microclimate conditions, compatibility issues, the surrounding areas, the availability of the area, accessibility, transportation issues, and visibility. Making decisions about neighbouring and future onsite land uses and zoning must take into account both current and adjacent land use.

- Examining potential future growth in terms of site size and zoning
- Environmental and social impact considerations
- Integration with local and regional planning
- Consideration of ancillary industries.
- Special infrastructure zones these cover certification laboratories, quarantine services, market intelligence units, etc.
- Logistics zones these cover loading and unloading yards, parking lots, packaging facilities, and transportation hubs.
- Cargo-handling centres, raw material collection and storage depots, goods storage warehouses, etc.
- Utilities zones these cover solid waste collection centres, electrical substations, CETPs, etc.
- Residential zones these cover multi-format worker housing, guesthouses and hotels, etc.
- Green zones these cover green belts and buffer zones along the park's boundaries, lawns, parks and water features, internal walkways between zones, etc.

Outreach and Tourism

Space Parks, comprising **Space Museums**, could be an effort to share Indian Space Program accomplishments, hopes, and concerns with the general public by utilising interactive multimedia presentations, **Augmented & Mixed Reality**, **Interactive BHUVAN**, live panels, static displays of CSLV/PSLV Models, flight suit display, the 3D theatre, and these other technologies.

This could also serve as an opportunity to foster **Space Science Communication** in India through Public Lectures, Visitor tours, outreach and education activities for local schools and colleges, Seminars, Planetarium and Night Sky Observation & **Ham Radio Station to demonstrate space communication** etc.



Legal & Intellectual Property Rights Support

It is crucial to build a legal framework that properly safeguards intellectual property in space. International cooperation and the growth of space science will be hampered by a lack of legal certainty. To encourage the private sector's involvement in space operations given the significant investments involved, a legal framework that ensures a fair and competitive environment is required.

The Indian Space Research Organization (ISRO) released the Draft Space Activities Bill for public discussion in 2017. One clause in the **Bill–clause 25–covers IP rights in a way that allows a lot of room for interpretation**. The clause stats:

- Any invention or other form of intellectual property rights such as patents, copyrights, trademarks or such other rights, developed, generated or created during the course of any space activity shall be protected under any law for the time being in force, with the primary objective of safeguarding the national interest.
- Any form of intellectual property right developed, generated or created onboard a space object in outer space, shall be deemed to be the property of the Central Government.

Clause 25(2) is particularly intriguing since it implies that, even if a private/commercial business is the owner of IP on the ground or territorially, the Central Government will hold the IP rights to any object developed in space. Private parties, including space startups, have been quite dissatisfied with this because it forbids them from commercialising any current space-related intellectual property rights or any research they might conduct while engaging in space operations. Although, it is expected that the upcoming space policy will resolve all such issues.

International Laws/Conventions position relating to IPR protection

International conventions relating to intellectual property and outer space:

- Paris Convention for the Protection of Industrial Property, 1883
- The Paris Convention for the Protection of Industrial Property, which is the fundamental international agreement governing industrial property, does not specifically address the issue of inventions made in space. However, it has provisions establishing the common rules, the right of priority (Article 4), and the national treatment principle (Article 2).
- Berne Convention for the Protection of Literary and Artistic Works 1886
- The fundamental agreement in the area of copyright and related rights is the Berne Convention for the Protection of Literary and Artistic Works (hereinafter referred to as the "Berne Convention"). The issue of intellectual property rights in space is not specifically addressed by the Berne Convention. However, it includes clauses that establish fundamental tenets like national treatment, the "independence" of protection, and the principle of automatic protection.

• WIPO Copyright Treaty (WCT)

- The WCT, among other things, protects (i) computer programmes, regardless of the mode or form of their expression, and (ii) collections of data or other materials (collections, or "databases") that, due to the choice or arrangement of their contents, are intellectual works. This holds true for communications from and to spacecrafts as well.
- The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement)
- According to Article 27.1, there cannot be any geographical discrimination in the accessibility of patents or the enjoyment of patent rights. Therefore, national law must ensure that patents are granted and enforced in the region in which it applies for inventions created in space under the same criteria as those for inventions created elsewhere.

Centre(s) of Excellence (Central Knowledge Hub)

This "**Region of Excellence**" will help in promoting the region as a knowledge hub in the Space domain, promote innovative products and services, aid talent pool creation, generate more jobs and entrepreneurship opportunities and yield export revenues.

With the **Nodal Cities supporting the Educational, Medical, Housing, Entertainment and Shopping needs** of the workforce supported by the Nodal Academic Institutions and the proposed Space park, the surrounding area will be well suited to the development of clusters of technical and industrial excellence.

The nodal universities generate graduate, postgraduate and doctors engineers and scientists who are currently **migrating to either Delhi, Bangalore, Hyderabad, or Pune in search of employment in Hi-tech industries**. Many talented youngsters are opting to migrate abroad due to a lack of employment opportunities commensurate with their education, skills and aspirations.

Resources required include (R&D and Education Ecosystem as well as Support Infrastructure (including Academic Support & Knowledge Infrastructure).

- Remote educational Program launch studios, and remote classroom infrastructure.
- Course material (soft material) preparation.
- Simulation software, multi-media educational materials.
- Astronomy hobbyists.
- Programs covering (not limited)
 - Space Tech and Science
 - Astronomy
 - Satellite-based navigation/Positioning
 - Modelling
 - Radio
 - Rocketry
 - Satellite Building
 - Space Situational Awareness
 - Space Simulators
 - On-way Media communication (multi-media service delivery)
 - Emergency communications (remote areas/places, forests/mountains sea/ocean etc.)
 - Tele-communication.

Inputs for making a Comprehensive STP Incentivization Policy

A Comprehensive STP Incentivization Policy. It includes aspects of Land Lease Subsidy & allocation; Human Resources & Labour; and, Financial Incentives (would include minimum GST & Tax Holidays; PLI; FDI, Investments and Soft Loans, as well as various Export incentives and Import Exemptions on Specific Materials and Equipment used by Space Industry, Electricity Subsidy, Master Plans for Zoning, Sustainable Development, Environment Clearances, Digital-Connectivity, Communication Linkage, Cable Landing, Self-Certifications to some extent, Public Utility, Role of Industry Associations etc.



Space Reforms & Enablers

Enabling Government Framework

To energize the development and growth of the Space Industry to its full potential, the Hon'ble Prime Minister has initiated wide-ranging reforms. The approach to this reform is based on four pillars which include the,

- Freedom to Innovate in the Private Sector
- Government as Enabler
- Preparing youth for future
- Space Sector as Resource for Progress

In this regard, the bird's eye view of the emerging Space Landscape includes, (1) the **Creation of enabling Legal and Policy Frameworks** such as the National Geospatial Policy 2022, the upcoming FDI Policy & New Space policy, Satellite Communication Reforms 2022; (2) **Creation of IN-SPACe** as part of DoS to deal with allocation, monitoring, management and regulatory functions; (3) **Creation of NSIL**, a government-owned PSU for Space related work, to handle commercial activities; (4) **Creation of ISpA** to act as the unified voice of the industry for policy advocacy as well as act as an enabling bridge to coordinate on various space-related activities within the country; and, (5) **Acceptance of Indian Private Space Industry** as a co-traveller in all dimensions of Space Activities, include the strategic domain.

In the past few years, Government has been actively participating with the industry in **policy consultations such as Remote Sensing Data Policy, SpaceCom Policy, Technology Transfer, and FDI Policy**. The Space Commission has examined the proposed space policy, and consultation with businesses and other ministries is now complete. The revised space policy has been presented for government approval.

Last year Hon'ble Minister of State for Space announced that the **government is considering opening FDI for the space sector** to facilitate private sector participation in space activities and boost foreign investments. **DoS also entered into an MoU with the newly established financial regulatory body**, International Financial Services Centres Authority (IFSCA) to promote international investments in the Space sector.

On Ease-of-Doing-Business envisage in satellite communication, the Department of Telecommunications has established self-certification for satellite antennas. A major step in lowering the financial burden is the abolishment of NOCC charges of Rs 21 lakhs per transponder. DoT also exempted license fees of Rs 10000 per terminal per year for M2M/IoT devices for captive VSAT licensees.

Adoption of National Geospatial Policy 2022

Department of Science and Technology released the **National Geospatial Policy in December 2022** with one of the visions – "to develop a coherent national framework in the country and leverage it to move towards a digital economy and improve services to citizens". Towards the vision of the policy, Government is developing the National Institute for Geo-informatics Science and Technology (**NIGST**), Indian Institute of Remote Sensing (**IIRS**) and/or any suitable institute(s), public or private, into **Centre(s) of Excellence (CoEs)** - providing specialized courses in the domain of Geospatial Science & Technology, which **can be leveraged by Space Technology Park by affiliating these CoEs under its purview**.

STP can also facilitate capacity development through **MOOCs** offered by **IIRS** and **NPTEL** or proposed online courses by the **iGOT Karmayogi Platform** by the **Department of Personnel & Training**.

According to the policy, the establishment of **Geospatial Incubators**, Accelerators, and Technology Parks are being planned in order to foster synergies and comprehensive development. This will advance the Geospatial industry in the nation by giving companies the necessary resources to innovate and invent all in one location. **Some of these Geospatial Enterprise frameworks could be developed in collaboration with the overarching Space Technology Park to enable further aspects of the development lifecycle.**

The Space Park can have a hub for Geospatial Services centred around Hyderabad, keeping the availability of both Sol as well as NRSC Data Centre as well as the vibrant Services Industry. BISAG, Gandhinagar, could be digitally integrated to Hyderabad as one of the spokes. The hub can offer advanced services such as Cloud based intelligence, crowd-sourced data collection, building information modelling (BIM), 3D modelling of terrain, highperformance computing for hire, and big data analysis of geospatial data using AI/ML. Geospatial services have a wide spectrum of applications.



Source:Geo Facts

www.ispa.space

Amalgamation of Industrial Corridors and IT Parks

As part of the National Industrial Corridor Programme (NICP), which is at various stages of conceptualization, development, and execution, the government has approved the development of 11 industrial corridors with 32 projects to be completed in four phases throughout the nation, connecting various states for the creation of state-of-the-art world-class infrastructure to promote local commerce. enhance investment.

- Delhi-Mumbai Industrial Corridor (DMIC) •
- Amritsar-Kolkata Industrial Corridor (AKIC)
- Chennai-Bengaluru Industrial Corridor (CBIC)
- Vizag-Chennai Industrial Corridor (VCIC)
- Hyderabad-Nagpur Industrial Corridor (HNIC)
- Hyderabad Warangal Industrial Corridor (HWIC)
- Hyderabad Bengaluru Industrial Corridor (HBIC)
- Odisha Economic Corridor (OEC)
- Bengaluru Mumbai Industrial Corridor (BMIC)
- Extension of CBIC to Kochi via Coimbatore
- Delhi-Nagpur Industrial Corridor (DNIC)

Industrial Corridors converged with proposed Space Tech Parks and IT Parks. built by various Governments (Software Technology Park of India, KSITIL etc.) or Large Private Industry which are located throughout the nation, will boost economic growth and employment opportunities across different sectors and provide multi-sectoral support to the space industry in terms of logistics, manufacturing, data sharing, materials procurement, transportation, costreduction, financial feasibility, macroeconomic stability. This will help in tackling regional development and migrant crisis on a much finer level with job creation, especially for rural areas.



Public-Private Partnership

The Public Private Partnership (PPP) in the space sector was opened up by the Government of India in 2020, and it has provided substantial growth since then in the Indian Space Sector enabled by IN-SPACe, ISRO, NSIL and DOS. The establishment of India's first private launch pad (ALP) and mission control centre (AMCC) by Chennai-based space tech startup Agnikul Cosmos at the Satish Dhawan Space Centre (SDSC) in Sriharikota, is a tremendous achievement towards private industry collaboration to ground infrastructure development. In the launch vehicle segment, Hyderabad-based space tech startup Skyroot Aerospace made history by successfully launching India's first private sub-orbital rocket.

For the growth of Technology Parks & Clusters, recycling capital and assets are one of the requirements. By releasing value from public investment and utilising the efficiencies of the private sector for infrastructure delivery, asset recycling and monetisation hold the key to value creation in infrastructure in this setting. The recycling and monetization of several critical infrastructure assets are being steered by the Public Private Partnership (PPP) Vertical. The National Monetization Pipeline (NMP), which was announced in the Union Budget 2021-22, was introduced in August 2021. It is a progressive initiative by the Indian government to create a medium-term pipeline and roadmap for "monetisation ready" assets designated under several infrastructure ministries that will be monetized over time. The NMP is a medium-term roadmap of potential financing options that encourages governmental sponsors and private sector/institutional investors to get ready to fund the infrastructure deficit. This also provides ministries with a platform to monitor asset performance and increase efficiency and transparency in the administration of public resources.

Successful partnerships commonly feature industry initiative and leadership, restricted and well-defined public commitments, explicit objectives, **cost sharing**, learning from ongoing assessments of quantifiable results, and applying the lessons learned to programme operations. Indian Government have committed to the **Sustainable Development Goals (SDGs)** established by United Nations General Assembly in 2015; they are a set of 17 goals and 169 targets for equitable and sustainable development. Building resilient and sustainable infrastructure across all sectors, including both regional and transnational infrastructure, is a goal of **SDG-9** ("**industry, innovation, and infrastructure**").

International Cooperation and Harmonization

International cooperation will open doors for various nations and businesses to enter and expand global markets as well as successfully create space goods, capabilities, and services.

Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) was established in India by the United Nations Office of Outer Space Affairs (UNOOSA) in response to the UN General Assembly Resolution (45/72 of 11th December 1990) endorsing the recommendations of UNISPACE-82, and the resulted project document (A/AC.105/534) envisaging the establishment of Centres for Space Science and Technology Education in the developing countries. CSSTEAP offers nine-month postgraduate diploma courses in **Remote Sensing and Geographic Information Systems, Satellite Communication, Satellite Meteorology and Global Climate and Space and Atmospheric Science**. CSSTEAP could act as an indo-pacific knowledge partner to the Space Technology Parks to be a centre for learning and research that may achieve excellence in the creation and dissemination of knowledge in all areas of space science and technology.

A significant step taken by ISpA towards international cooperation was the formation of **"Association of Space Entrepreneurs in the Indo-Pacific (ASEIP)**", which was announced on 25th January 2023 at the Indian Institute of Technology Madras, with the objective –

"Bring together significant stakeholders in the Space Technology sector to network, promote international collaborations and scientific research innovation, mentor and support emerging entrants to the industry, explore ways to optimize business opportunities and serve as an international lobby to influence government policy in India, the United States and Indo-Pacific Countries."

Multilateral, regional, and bilateral investment (or trade and investment) agreements between nations are multiplying as a result of globalisation and the expansion of international commerce and investment. For example, the National Treatment (NT) principle, which is notably codified in the rules set forth under the WTO's Subsidies and Countervailing Measures (SCM) and Trade-Related Investment Measures (TRIMS) agreements, helps to reduce barriers to investment and discriminatory treatment on the multilateral front. The Financial Action Task Force (FATF), anti-money laundering (AML), and anti-terrorism funding (ATF) guidelines, as well as the EU Code of Conduct, are additional examples of multilateral norms.

5 action areas that countries should adhere to in investment agreements are outlined in UNCTAD's Roadmap for International Investment Agreements (IIAs), published in the UNCTAD 2015 World Investment Report:

- Safeguarding the right to regulate, while providing protection to investment
- Promoting and facilitating investment
- Ensuring responsible investment
- Enhancing systemic consistency in the treatment of investment
- Reforming investment dispute settlement mechanisms

Academic Infrastructure & Partnership



Source: SvN Architects & Planners

The proposed Space Park will be centred around the institutions of academic excellence which are ideally equipped to provide the necessary intellectual capital for the success of this venture. The key educational institutes surrounding Space Park are institutions of repute and have been nationally ranked highly for their educational and research capabilities.

The nodal universities will have a significant depth and breadth of Bachelors, Masters and Doctoral courses in areas of relevance for the Space Park. The nodal universities will support Startups through COEs and Innovation Incubation centres.

STP would leverage the entrepreneurship and research ecosystem created by some of the Government funded centres such as **Atal Tinkering Labs (ATL)**, **Innovation Hubs (i-Hub)**, **ISRO Space Technology Cells**, etc to ensure the maximum use of the available infrastructure, research capacity, knowledge, and experience in the region and pursue cutting-edge research in fields pertinent to the long-term programmatic and technological requirements of the Indian Space Programme.

This will provide our young with the abilities necessary for the 21st century, such as innovation, critical thinking, ethical leadership, design thinking, logical analysis, creativity, social, interpersonal and cross-cultural collaboration, etc.

Further Support required from Government

Financial Enablement

The various financial incentives which could be considered are as follows:-

- Tax structure, policy and advocacy for availing Service aspects of space program broadly covering communication, remote imaging, consultancy, design manufacturing, rocket launch services, etc.
- Policies to promote and encourage indigenous space programs. This would include the following:-
 - Crowdfunding for hobby launches.
 - Exclusive R&D funding for deep tech.
 - Exclusive funding for Education, training, skill augmentation etc. programs.
- Tax holidays, rebates etc. This could include the following:-
 - Tax holidays to all Indian-owned and based companies in R&D, assembly, integration and manufacturing to be given by Central and State Governments with R&D, education, and CSR funding for Private and Public companies to the tune of 2% min- 6% max allowed on yearly basis for the duration of 6 years for any specific technology or product deemed "Space-Based Application" applicable in Space, Ground Segment in Hardware, Software or integration.
 - Incentives linked with employment, investment committed on R&D, education, manufacturing, servicing, technology/ innovation etc.
 - **GST incentives** (criteria based, such as niche/critical technology) for revenue of the Space Sector. Exemptions/ reduced GST on procurements by sector to avoid blockage of funds.
 - **Duty deferment schemes** on capital procurements in light of the long gestation period.
 - **Sharing of duty-exempted assets** and infrastructure should be allowed for optimum utilization.
 - **Low-interest and long-term loans** need to be enabled to improve the financial viability of the sector.
 - **Consideration to create a contributory insurance pool for companies** with government support. The cost of insurance subscriptions could be a major determinant of business growth in this sector.
- FDI Policy: A **Special FDI Policy as proposed by IN-SPACe** to facilitate, promote and inspire investors to bring high-value investments in India.
- **Exports support**: Line of credit from the Government of India or special funding agreement between friendly countries as deemed by the Government of India to be provided for Business Development and Business Revenue.

Legal & Policy Framework

Certain enabling legal and policy initiatives would bring clarity on various aspects, as needed. The following aspects merit attention in this regard:

- Evaluate multiple agency **launch rules and regulations for commercial launch** operations at STP and other India launch and reentry sites to "streamline commercial space launch activities" **in near future**.
- Create Government indemnification and commercial launch liability regime, directing new evaluations of how insurance requirements should be determined and how state and local government-owned space transportation assets should be most appropriately addressed in the liability and indemnification regime. This could take a cue from how Nuclear Liability is being handled by creating a National Fund Pool. Similar steps could be adopted by Space Industry.
- Additional legislation to address an identified regulatory gap in meeting India's international treaty obligations is likely in the near future to remove a potential bureaucratic obstacle to commercial activities in Earth orbit and beyond. The "streamlining" review may also lead to additional clarification of roles and responsibilities at STP.
- Show-casing and promoting services that can be availed from the Indian space eco-system through **international conferences**, **long term exhibition centres**.
- Alignment of all legislations like FEMA, customs, GST, Foreign Trade Policy, State laws etc. to avoid inconsistency.
- **Specialized incentives for investment in R&D**. Government can engage with top R&D centres/ institutes.

Open-Source Science Commitment

Open-source science is a dedication to the free exchange of software, data, and knowledge, methodologies, algorithms, papers, documentation, supplemental information. It also allows for **fiscally responsible**, **streamlined**, **and transparent research spending**. Thus lowering the barriers to entry into scientific exploration, and deepens participation and encouraging greater collaboration in research activities.

European Space Agency Under its open-source policy provides an online web portal, **European Space Software Repository (ESSR)**, which contains a list of projects with general information such as License Type, Owner, Creation Date, and Version Control System to promote the reuse of previously developed Space Software by European investment. This also makes licencing schemes and legal aspects of European products more visible.



NASA with the White House – joined by 10 federal agencies, and a coalition of more than 85 universities, has already declared the year 2023 as the **"Year of Open Science**". Last year, NASA committed **\$20 million to advance open science**, under its **Open-Source Science Initiative (OSSI)**.

India has already taken major steps towards open science under Digital India Initiative, such as releasing data and codes through **OpenForge** and **Open Government Data (OGD)** Platforms through **National e-Governance Division (NeGD)** and **National Informatics Centre**, respectively.

In Space Sector, ISRO has made some space vertical data available through **BHUVAN** and **BHOONIDHI**, etc. Portals. But to catalyze community collaboration to engage in scientific debate and take part in discovery and innovation and to create a more equitable system, India should also focus on **Citizen Science Projects** and **Open-Source Policy for Space Sector** as already done by NASA & European Space Agency (ESA).

Conclusion

Space Technology Parks are a significant establishment for attracting investment and technology, given that some of the major criteria that affect investment decisions are the availability of land, infrastructure, quality services, and proximity to crucial markets. The potential for technology transfer that foreign investment, in particular, can bring to an economy is essential for increasing production capacity through the frequently linked shift from labour-intensive to technologyintensive manufacturing.

To achieve policy stability and success, a strong long-term government investment policy commitment is required, as well as appropriate communication and collaboration channels between the central, state, and local governments, involving the private sector and civil society. Creating technology parks that encourage new investment, industries, jobs, connections, and growth is frequently driven primarily by the desire to contribute to regional and national development.

The raw resources and supplies of an economy can flow to an industrial park for processing, forming backwards and forward links in the process, facilitating production, employment which promotes structural change, and diversification of production into areas of comparative and competitive advantage.

The development of the STP ecosystem will generate a thriving ecosystem of small, medium and large commercial organisations as well as nurture innovative startups that work on new space technology areas. The Indian government and Industry would be able to leverage, in developing and enhancing products and services related to the Space industry.

The creation of local demand is very important to facilitate the growth of the indigenous Space Industry which would include the adoption of products made by own companies by Government Agencies. ISpA could work in close coordination with the Government to facilitate the same. Some identified areas where Government Support would help could include Services such as Remote Sensing, GIS, photogrammetry, Communication backhaul, navigation etc. for India-specific markets. E.g. On road Fleet, ocean vessels, fisheries, land survey, navigation, media/data communication etc.

With the predicted market in Space Industry expected to grow faster, especially in the area of satellites, components and defence requirements, this Space Technology Park will strategically be well positioned with the vision of "Make in India".

In order for the nation to develop further as one of the world's leading space technology nations, this Space Technology initiative will accelerate the nation's ambition. The core policy principles of Governance Framework, Components, Benefits, Support Infrastructure and Desired outcomes will ensure the success of this program.

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