

Space Reforms in India A Job Half Done

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Takshashila Discussion Document 2024-11 Version 1.0, July 2024 This discussion document delivers a critical analysis of the Indian space reforms and explores pathways for establishing the necessary policy framework to foster the development of space capabilities, with a focus on Indian national interests.

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Executive Summary

A nation's technological capabilities in space are paramount — economically and strategically. India needs to take the space reforms forward by addressing the gaps in the policy regime. The following are the recommendations:

- The policy guidelines on space regulation must take the form of legislation and draw on inputs from academia, policy experts and industry.
- Indian National Space Promotion and Authorisation Centre (IN-SPACe) has promotional functions in its mandate that conflict with its primary role as the space regulator. These conflicts must be addressed.
- IN-SPACe cannot remain an autonomous body under the Department of Space. It needs independence and separation. It should be provided with statutory backing. Additionally, a disputes settlement and appellate tribunal is necessary.
- Government procurement will be a key driver in developing the commercial space industry. The government should serve as an anchor customer to reach and sustain the criticality of demand needed to nurture an emerging private space sector.

This document has been formatted to be read conveniently on screens with landscape aspect ratios. Please print only if absolutely necessary.

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Abbreviations

- DoS Department of Space
- IN-SPACe Indian National Space Promotion & Authorisation Centre
- ISRO Indian Space Research Organisation
- JAXA Japanese Aerospace Exploration Agency
- NSIL NewSpace India Limited
- PSLV Polar Satellite Launch Vehicle
- SSLV Small Satellite Launch Vehicle
- UAE United Arab Emirates
- USA United States of America



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I. Overview of the Indian Space Sector

On 24 June, 2020, the Union Cabinet of India initiated significant reforms in the Indian space domain.¹ These space reforms have a few broad objectives, each closely linked to the rest:

- Boosting private industry's role in the Indian space sector.
- Unburdening ISRO from its routine operation tasks so that it can focus on critical R&D, deep space exploration and human spaceflight.
- Enhancing Indian capabilities in advanced space technology.
- Aiding in advancing India's space ambitions.

An overview of the pre-reform space sector is needed to understand why the government undertook these reforms.

Human spaceflight refers to space travel on spacecraft with passengers and/or crew aboard. India's upcoming Gaganyaan project is a good example of human spaceflight.

Backdrop of the Reforms

Space technology is deeply consequential for civilian and military applications. The size of the global space economy will triple to reach \$1.8 trillion by 2035.² Despite being an elite space-faring nation with significant technological achievements, India's share of this economy is estimated to be less than 2%.³



Figure 1: Global Space Economy² and India's Share³



The Indian government needed to increase the national space capabilities, address growing technology needs, and gain an influential voice in the global dialogues related to outer space affairs. This voice needs to be a resonant chorus emerging from diverse stakeholders in the country operating across various domains. Until recently, this ecosystem was largely missing in India, with almost the entire space sector restricted to one organisation.

Until the 2020 reforms, ISRO held sole responsibility for both promotion and regulation. The autonomy thus extended was beneficial for a nascent space agency during the Cold War period. However, considering the size and potential of the space economy, the old structure was no longer viable. The Indian space ecosystem needed new and independent stakeholders besides ISRO. With their entry into the scene, regulatory mechanisms independent of ISRO would follow — enhancing overall transparency and accountability.

ISRO was also responsible for space commercialisation in India. Being the only launch capable space agency, ISRO was tied up with routine tasks of production and operation in trying to sell its launch services to foreign payloads as well as fulfilling Indian launch needs. That left ISRO limited time and personnel for its more strategic objectives related to human-spaceflight, lunar and interplanetary missions. Global dialogues related to outer space affairs are important. Unlike the countries of the world that have sovereignty, outer space is considered the province of all humankind. It offers significant potential for scientific and economic development. The fulfillment of this potential hinges on preserving outer space as a peaceful domain and addressing the challenges of sharing this domain among all nations. That needs coordinated global efforts.

Even in its routine operations, ISRO was not self-sufficient. ISRO has grown to a 17,300 strong⁴ organisation and cannot scale disproportionately further, even with weighty resource infusions. ISRO had outsourced parts of its supply chain to the private sector to make up for the limited in-house capacity even before the reforms. While these vendors produced specific components and sub-systems for ISRO, they had limited intellectual property and no end-to-end space capabilities. ISRO has had remarkable successes in its space endeavours and prides itself for its cost-effective space operations. However, the absence of competition from a burgeoning space industry has had a negative impact on driving scale and innovation up while driving costs down. The American space industry has done just that in the US. India needs a SpaceX of its own.

While human spaceflight, lunar and interplanetary exploration offer interesting possibilities for the future, almost all of the benefit from outer space is currently derived closer to home -- from the satellites in orbit around earth. The number of satellites launched and operated by a nation is a crude proxy for the development and scale of its space capabilities. The number of operational satellites of the US and China dwarves India's count. The gap grows larger each year.⁵



Number of Operational Satellites (as of May 2023)

Figure 2: Operational Satellites around the world ⁵

In the light of this reality, the Indian government realised that it cannot remain a domain exclusive to government agencies.



II. Understanding the Reforms

Date	Policy Change
March 6, 2019	NSIL was incorporated to take over ISRO's commercial role. ⁶
June 24, 2020	The Union Cabinet approved the reforms and created IN-SPACe. NSIL's mandate was also expanded. ⁷
April 6, 2023	Cabinet Committee approved the Indian Space Policy. ⁸
February 21, 2024	Government liberalised the FDI policy for space sector. ⁹
May 3, 2024	IN-SPACe released the Norms, Guidelines and Procedures (NGP) for Implementation of Indian Space Policy (2023) in respect of Authorisation of Space Activities. ¹⁰



The following chart shows the organisational structure of the Department of Space within which the newly constituted IN-SPACe and NSIL are placed.



Figure 3: Organisation Structure of DoS¹¹



NewSpace India Limited

The government set up NSIL as a Central Public Sector Enterprise under the DoS.¹¹ NSIL was well positioned to capitalise on the commercial opportunities in the space sector by putting to use ISRO's technological faculties and leveraging the private sector. This process would also nurture the growth of auxiliary industries and infrastructure in India, giving way to positive externalities.

Initially, in 2019, NSIL's mandate was limited to the following: the production of the PSLV through industry; transfer of technology; and, providing other space-based services. The 2020 reforms that created IN-SPACe also enhanced NSIL's mandate. NSIL was now assigned with capital intensive functions where it was to gradually take over the operational part of ISRO's missions. Over and above its original functions, NSIL would now build, launch, own and operate satellites as per market demand.¹²

Heeding its enhanced mandate, NSIL has commissioned the end-to-end production of PSLVs with HAL and L&T consortia. The process, from issuing the Expression of Interest for this project in 2019 to the signing of the contract

PSLV is an Indian launch vehicle designed and operated by ISRO. It has earned the title of 'workhorse of ISRO' from its reliability and versatility.

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in 2022, took three years. The first of the five PSLVs is scheduled to be delivered to NSIL by 2024 with significant support from ISRO.¹³

NSIL also offers launch services. Last year, NSIL facilitated the launch of 62 international and two domestic commercial satellites aboard ISRO's PSLVs, including four dedicated launches. NSIL also commissioned ISRO to build a communication satellite that was launched aboard an Ariane-V rocket, highlighting its commercial and demand-driven nature.¹⁵

In 2022, the Indian government authorised the handover of ownership of 10 in-orbit GSAT satellites to NSIL, which offers satellite communication services by allocating transponders across different frequency bands from INSAT/GSAT and foreign satellites to Indian users.¹⁶ It also manages all the commercial activities of the Indian Remote Sensing Satellites.¹⁶

Additionally, NSIL has signed around 30 technology transfer agreements with the industry until 2023.¹⁷ Furthermore, NSIL is engaged in multiple other projects and contracts related to ground segment and mission support.

Its operational revenue and profits have shown consistent growth year after year, as illustrated in the chart below.¹⁸

The **INSAT** and **GSAT** satellites are Indian satellites used for telecommunications, television broadcasting, weather forecasting, disaster warning among others. They were developed by ISRO.

Remote Sensing satellites are used to gather detailed information about Earth from space like tracking agriculture and resources or conducting military surveillance.

Technology transfer refers to the process of moving knowledge, skills, methods and other facilities of a technology from one organisation to another.



Figure 4: NSIL's Revenue and Profits since its inception¹⁸

Summary: NSIL will be the commercial arm of ISRO. It will undertake commercial and operational tasks for ISRO. This will be done strictly based on demand to ensure commercial viability. NSIL will also transfer ISRO's technology to the private sector.

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Indian National Space Promotion and Authorisation Centre

IN-SPACe operates under the Department of Space (DoS) and serves as the primary point of contact for space-related organisations, including ISRO.¹⁹ It consists of a 12-member team representing various sectors such as government, industry, and academia.

The organisation is divided into different departments, including Promotion, Programme Management and Authorisation, Technical, and Legal, Finance, and Administrative Wings.²⁰ IN-SPACe is responsible for both regulating and promoting activities related to space. The following chart shows the organisational structure of IN-SPACe.

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Figure 5: Organisational Structure of IN-SPACe²⁰

Regulation

IN-SPACe, as a regulatory body, is responsible for approving all space activities. ²¹ It is responsible for ensuring their compliance with safety, national security, international obligations, and foreign policy considerations.²² Various departments and ministries, such as the Department of Space, Ministry of Information and Broadcasting, Department of Telecommunication, Department for Promotion of Industry and Internal Trade, Ministry of Home 17



Affairs, and Ministry of External Affairs, are involved in the approval process, and IN-SPACe will coordinate among them.²³ To streamline the process, IN-SPACe launched a digital platform in 2022, through which it has received over 450 applications.²⁴

IN-SPACe released the Norms, Guidelines and Procedures for Implementation of Indian Space Policy (2023) in respect of Authorisation of Space Activities (NGP) on 3 May, 2024 to describe the process of this authorisation for the benefit of the private sector. It addresses the regulation of different sectors within space separately, such as satellite communication, earth observation, space transportation, and ground station services. It also outlines the consequences of change in ownership of authorised space objects and companies. It lays out the responsibilities of the space participants based on India's obligations to international space treaties.

Promotion

IN-SPACe has the additional responsibility of fostering and nurturing the environment while aiding private organizations.²⁵ IN-SPACe has to ensure a level playing field in access to all government-owned facilities and satellite data.²⁶

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A Price Support Policy has been implemented to offer technical support from ISRO to the private sector.²⁷

IN-SPACe works with industry and academia to promote linkages between them.²⁸ A total of 50 MoUs were signed with non-governmental entities. To raise awareness in academic circles, a National Committee for Adoption of Space Technology Education was created. IN-SPACe is partnering with the DoS and the MEA to organise connections between the Indian and foreign space industries. IN-SPACe has conducted roundtable meetings with Australia, Italy, and Luxembourg, and intends to work with more countries in the future.²⁹

In-SPACe encourages industry clusters, manufacturing hubs, and incubation centres.³⁰ Start-ups can tap into a seed fund assistance programme

of up to 1 crore rupees. They also offer training, mentorship, and networking opportunities. IN-SPACe has set up a Design Lab and a Technical Centre with computing facilities, test labs and clean rooms for start-ups to use for their missions.³¹ IN-SPACe is collaborating with various states in India to develop industry clusters. One such recent collaboration was with Tamil Nadu Industrial Development Corporation Limited (TIDCO) to establish a space industrial and propellants park.³² Another partnership exists with Gujarat to construct a space manufacturing park.³³

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IN-SPACe also facilitates technology transfers to non-governmental entities. Fifteen technologies developed by ISRO have already been transferred to private companies. Private companies can apply for technology transfer through the website. IN-SPACe is also in the process of transferring the SSLV technology to the private industry.³⁴

The efforts of the government, IN-SPACe, and the private sector have resulted in a significant increase in the number of space start-ups operating in India, which has risen from 1 in 2012 to close to 200 in 2023. Investments in the Indian space sector have also increased from \$6 million in 2019 to \$125 million in 2023.³⁵

Summary: IN-SPACe has both promotion and regulatory functions divided among its three main directorates.³⁶ As a regulator, it will authorise all space activities in the country. IN-SPACe released guidelines to describe these authorisation procedures. As a promoter, it is in charge of nurturing the emerging private space ecosystem in India.

The **SSLV** is ISRO's new small satellite launch vehicle designed to provide quick and affordable access to space for small satellites.

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Figure 6: IN-SPACe functions divided among its three directorates ³⁶



Indian Space Research Organisation

The reforms open up the ISRO's informational, technological and infrastructural resources to the non-governmental entities. In addition to transferring technology to the private sector via IN-SPACe and NSIL, ISRO has enabled open access of its remote sensing data.

ISRO will shift its energies towards more strategic functions, such as R&D into technologies critical from an Indian national interest perspective. The Space Policy identifies a few key areas like space transportation, human-spaceflight, in-situ resource utilisation and extra-terrestrial habitability. These technologies aspire for crewed Chandrayaan missions to set up an Indian lunar base in the coming decades.³⁷

Summary: ISRO's facilities and assets can be used by Indian private companies. ISRO will stop undertaking routine operations and instead focus on developing capabilities at the cutting edge in the Indian national interest. **In-situ resource utilisation** makes space exploration and settlement more practical by using resources from **extraterrestrial** environments like the Moon, Mars, or asteroids instead of carrying all the resources from Earth.

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FDI Liberalisation

On 21st February, the Union Cabinet liberalised the FDI policy for the space sector. The amendment eased automatic FDI entry thresholds for three sets of activities related to satellite operations.³⁸

Set of Activities	% of FDI entry allowed without Government Approval
Manufacturing of components and systems/ sub-systems for satellites, ground segment and user segment.	100%
Satellites-Manufacturing & Operation, Satellite Data Products and Ground Segment & User Segment.	74%
Launch Vehicles and associated systems or subsystems, Creation of Spaceports for launching and receiving Spacecraft. Beyond 49% these activities are under government route.	49%

FDI allows investors from abroad to own equities in Indian companies. It allows Indian companies to attract capital investments from other nations. The FDI entry thresholds refer to the percentage of the companies' shares can be foreign-owned.



Operating in space is capital intensive. Funding is going to remain a challenge for most space companies, particularly the start ups. A large portion of the funding will come from local venture capitalists. As the operations scale, the startups will need a larger and a more patient capital source. The new FDI policy can bring in foreign investors and decentralise investment decisions. However, the Indian industry has to compete globally to attract investments.

Summary: FDI liberalisation paved the way for foreign direct investment in the Indian satellite industry.

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III. A Preview of Space Policies in other Countries

For context, it is useful to outline the policy models of other space-faring countries. This document focuses on the US, Japan, and UAE as they represent three different models of developing the space ecosystem.

USA

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The American space ecosystem is the largest in the world in terms of scale and capabilities. The US enjoyed the first mover's advantage in this domain from the space race during the cold war. The legacy space enterprise model in the US wanted the government to own and manage space assets to reduce risk. It has moved away from this thinking. It currently follows a "exploit what we have, buy what we can, and build what we must" approach as it seeks to actively leverage the capabilities of its private space sector.³⁸

To facilitate a pro-growth environment for the development of a flourishing commercial space industry and create scope for private sector investment into

space assets, the government enacted the U.S. Commercial Space Launch Competitiveness Act in 2015.⁴⁰

The US National Space Policy, 2020 places emphasis on encouraging private space entrepreneurship and innovation in order to preserve the American edge in space operations. The US government seeks to actively identify and invest in commercial technologies that can contribute to the State-led space projects. They do not want to inhibit or compete with the private sector. The government will take it upon itself to develop space systems only when there are no viable options for procurement in the commercial space sector and/or in the interest of national security. The government will be inventive and non-traditional in the process of acquiring commercial space goods and services.⁴¹

This is evident in NASA's Artemis campaign, a key characteristic of it being its industry partners.⁴² In an effort to build autonomy and competence of its industry, NASA bought end-to-end space services rather than hardware components and subsystems from the space companies.^{43 44 45}

Given the strategic imperative of space and the USA's reliance on the private sector in this regard, the government wants to provide a fillip to the American space companies to stay in the US. The government will also safeguard the The **Artemis campaign** is the new American lunar exploration programme that aims to establish a sustained human presence on the moon beginning in the 2020s.

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companies against predatory foreign investment to retain strategic ownership within the country.

The U.S. Space Force Commercial Space Strategy is also in direct support of the U.S. National Space Policy, as are the Department of Defense (DoD) Commercial Space Integration Strategy (2024), United States Novel Space Sector Authorisation and Supervision Framework (2023), and United States Space Priorities Framework (2021).⁴⁶

Japan

The Japanese Space Policy initially restricted its focus to research and development under the Education Ministry. It operated with smaller budgets. The Plan for Space Policy, 2020 overhauled the system by recognising the latent value of space for national economy and security. Public-private partnerships in the space domain took priority over the government-led initiatives. One of the major principles of the new space policy is to maximise procurement from the private sector.⁴⁷

Japan became the fourth country to implement a Space Resource Act in 2021 allowing the private entities to explore, extract, and utilise resources in outer

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space, including water, minerals, and other natural resources existing in outer space. This legislation is expected to spur private investment and development in the space sector.⁴⁸

In 2023, Japan set up a fund of \$6.7 billion for 10 years. This will fund JAXA's investments in budding space startups and technologies that can take a long time to bear commercial fruit.⁴⁹

UAE

The UAE is a relatively new entrant into the space domain. The UAE Space Agency was set up in 2014 followed by a National Space Policy in 2016.⁵⁰ To implement the policy, a Space Regulation Law was enacted in 2019.⁵¹ The law sets out provisions for regulating space activities including space resource utilisation. The National Space Strategy in 2019 lists the strategic goals of the UAE space programme and the initiatives to achieve them. One of the key goals is to develop local capabilities in the space technology value chain.⁵²

Due to the lack of technical skill and know-how given that the foray into space in very recent, the UAE has focussed on setting up an suitable regulatory environment, infrastructure and financial assistance to attract space startups

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into the country. There are express permits for certain space activities. The UAE has established several dedicated space-tech hubs under the Space Economic Zones Programme. These hubs aim to provide the private industry with necessary infrastructure, business-friendly environment and investment opportunities.⁵³



IV. Recommendations for Indian Space Governance

The Indian space reforms offer significant potential for monetisation, infrastructure development, employment generation and arresting brain drain.

ISRO has been unburdened of its routine operations and can now focus on the cutting edge. Its day-to-day tasks are handled by NSIL, which hopes to depend on the private sector to help in various parts of the value chain.

With the private sector now involved in space activities, IN-SPACe has been set up at the national space regulator. Given the nascent nature of the private space ecosystem, IN-SPACe has promotional roles as well.

To facilitate greater capital investments and reduce dependence on government funding, the doors to greater FDI inflow have also been opened up.

Having taken these significant steps for reform and improvement, there are a few more improvements that the government should make.

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- 1. Address the gaps in the NGP
- 2. Pass a Space Activities Act
- 3. Recondition the conflicting responsibilities of the government agencies
- 4. Make the regulator independent
- 5. Create an Adjudicatory and Appellate Body
- 6. Improve Government Procurement

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1. Address the gaps in the NGP

The NGP describes the process of authorisation for the different areas of space-based technologies like satellite communication, rocket launch services and earth observation. Yet, key areas of these space-based activities like scientific missions don't find a mention. Additionally, the satellite systems that enable technologies such as the Global Positioning Systems (GPS) and Air Traffic Control are also missing from the NGP.

Space-based services include a variety of different technologies supplied from space. This ranges from telecommunication services, military applications,

cybersecurity and so on that fall under different ministries and departments in the Indian government. Even though IN-SPACe is called a "single window agency" for authorisation of space activities, private players have to seek separate clearances and approvals from each of the relevant ministries even after getting a provisional authorisation from IN-SPACe. Thus, the process of authorisation is not truly a single window experience and may suffer from the delays of multi-ministry approval procedures.

There are other burdens that are placed on the industry that should have been handled by IN-SPACe. These range from learning about global best practices to verifying customer information.

Some sections of the NGP require more elaboration and clarity. For instance, the NGP makes it hard for companies catering to the masses to stop their services. They might have to give a notification in advance, which could be as lengthy as six months, prior to discontinuing their services. There is a possibility of incurring penalties for ending the services. These regulations may deter companies that may otherwise have been willing to provide useful services to many Indians. There should be greater clarity on the specific circumstances that would require extended notice periods and potential penalties.

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Additionally, certain exceptions are given to the Indian Space Research Organisation (ISRO), National Remote Sensing Centre (NRSC), and other government agencies in the NGP. This conflicts with the government's assertion that both government and private space agencies will be partners in the nation's space exploration efforts.

At its core, the source of these disparities come from the fact that all the policy formulation is being done by the government instead of the parliament. These guidelines need to evolve into acts by the parliament.

India needs a Space Regulation Act that addresses the gaps and inconsistencies in the NGP. The formulation of these laws should involve gathering input from all stakeholders through a consultative process. By working together, these regulations have the potential to make the Indian space governance system more democratic and provide the legal clarity that the private sector requires before engaging in ventures as risky and tightly regulated as the space sector.

2. Space Activities Act

The next logical step in the reforms is to formulate the NGP within the broader context of the Space Activities Bill to be approved and enacted by the

Parliament. The Act should establish a liberal regulatory environment that can instil confidence in the commercial space sector. With market-friendly provisions related to resource utilisation, liability and insurance, the act has enormous potential to complement the Space Policy and FDI reforms. The act is a potential signal to the companies and investors in the world about the Indian space ambitions.

At present, most Indian space startups are incorporated in the US and Europe to take advantage of the more conducive startup environment and to attract better capital and talent.⁵⁵ While the National Space Policy and FDI liberalisation can improve India as a destination with respect to these factors, the Act is required for the legal teeth it provides to the policies.

3. Recondition the conflicting responsibilities

ISRO was tasked with numerous and often discordant responsibilities. The reforms remedied this but only partially. Cases of incongruous roles still exist.

IN-SPACe is currently responsible for promoting, enabling, authorising as well as supervising the space sector.⁵⁴ These tasks are incongruous and should not be done by a single entity. As a regulator, IN-SPACe may have to scrutinise and

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disallow certain private companies that it was trying to enable and encourage as a promoter. Additionally, these private sector enterprises might rival ISRO and the government with their own space-related services. These contradictions in its duties cast doubts on IN-SPACe's ability to remain effective in both its promotion and regulatory duties. Osborne and Plastrik's ideas from Banishing Bureaucracy are relevant here.⁵⁶ They recommend the separation of policy-framing and compliance functions in a bureaucratic institution. Along these lines, the government must consider splitting IN-SPACe's various directorates into regulatory and promotional groups..

Similar incongruity exists in NSIL as well. NSIL acts as a promoter as well as a service provider. In the due course of its duties of advancing the private industry, a scenario is likely to emerge where the private industry may become NSIL's competitors.

4. Make the regulation independent

As a regulator, IN-SPACe has to govern the activities of all the participants in the space sector in India, including ISRO. Presently, IN-SPACe is an autonomous agency under the Department of Space. The Secretary of the DoS

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is also the Chairman of ISRO. This means that IN-SPACe is essentially in charge of regulating its own head.



Figure 7: IN-SPACe is tied to ISRO and DoS¹¹

Institutional independence and impartiality is paramount in the regulation of a sector as important as space. The regulatory side of IN-SPACe should get statutory backing outside of the DoS to allow effective discharge of its duties.



5. Create an Adjudicatory and Appellate Body

As the Indian space ecosystem grows, an institutional mechanism to handle disputes between the licensor (IN-SPACe) and licensees (private sector/government agencies) are likely to surface. The settling of such disputes cannot be arbitrary.

According to the NGP, when private players apply for an authorisation to IN-SPACe and are rejected, they are allowed to resubmit the application for review. However, this review is done by IN-SPACe again, effectively making IN-SPACe a judge in its own case.

The statutory mechanism for IN-SPACe must also create an Indian National Space Dispute Settlement and Appellate Tribunal. The tribunal can handle the adjudicatory and appellate functions.

6. Government Procurement

The government has a big role to play in creating demand in the commercial industry. A shift from make approach to buy approach is essential here. The Indian government is spending public funds to make things on its own and



therefore building ISRO's capabilities. What it should be doing instead is spend the same public funds to buy things from the private sector and allow the growth in capability to accrue in the society.⁵⁷ These contracts will spur competition resulting in vital R&D and innovation, ultimately shoring up Indian space power.

There are enormous positive externalities in investing in this domain, the dispersed benefits of which accrue to the society as a whole. The Indian needs to reimagine the way it engages in this sector by further optimising the regulatory environment and streamlining government procurement. The goal should be to lay ground for multiple, highly capable space companies to thrive.

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