



TAKSHASHILA  
INSTITUTION

## *Takshashila Policy Proposal*

# The New Space Policy 2020

*Policy Proposal 2020-01*

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# Executive Summary

The New Space Policy 2020 proposes a clear policy and regulatory structure that paves the way for growth of the nascent private space sector in India, thus contributing towards national development and advancing the frontiers of science and technology. Specifically, this paper recommends:

- A) Decoupling the policy, regulatory, and service delivery roles of the Indian Space Research Organisation (ISRO) to create a level playing field for new entrants.
- B) Establishing an independent Space Regulatory Authority of India (SRAI) which would be responsible for setting standards and best practices, licensing space activities, compliance and monitoring of these activities, and liaising internationally.
- C) Establishing a Space Disputes Settlement Appellate Tribunal (SDSAT) which would adjudicate disputes and settle appeals to protect the interests of service providers and consumers in the space sector. SDSAT would resolve any dispute between licensor, licensee, consumer or service provider. Any decision of the SRAI could be challenged in the SDSAT.

Clear regulatory structure and decentralisation of responsibilities would promote private participation in India's space sector and ensure that India leapfrogs into a leadership role in the global space ecosystem.

## 1. Introduction

The New Space Policy 2020 aims to contribute to national development, growth and scientific achievement by creating a policy and regulatory structure that can leverage the strengths of the Indian Space Research Organisation (ISRO) as well as the upcoming private space sector.

## 1.1. Importance of Space Activities

Space technology has brought unparalleled benefits to humankind. India too has gained immensely through satellite-based communication and broadcasting capabilities. Today, Earth observation satellites provide critical information for weather prediction and disaster management. This information has significant applications in fisheries, freshwater and forestry management and can track animal poaching, illegal mining, and forest fires. Satellite-based navigation has propelled multiple industries from ride-hailing services to hyperlocal food delivery. The spinoffs of space technologies have benefitted multiple sectors. Space activities have fuelled our desire for exploration. Space manufacturing, mining, tourism, space solar power, and fast suborbital transport are some potential future applications of space technologies. India should leverage this opportunity to achieve its developmental goals.

## 1.2. Need for a Space Policy

Enhancing access to space is of utmost importance to India. On 15 February, 2017, the Indian Space Research Organisation (ISRO) successfully launched a record 104 satellites in a single flight, onboard its Polar Satellite Launch Vehicle (PSLV-C37) from Satish Dhawan Space Centre SHAR, Sriharikota, India<sup>1</sup>. India's first mission to the moon, Chandrayaan-I, confirmed the presence of water on the moon.<sup>2</sup> With a shoe-string budget of less than \$2 Billion<sup>3</sup>, ISRO has always punched well above its weight. However, today, the Government space agency, by itself, does not have the capacity (in terms of capital, skilled labour, equipment) to develop and exploit all benefits, making a strong case for unlocking the potential of private capital and skills. For instance, DTH operators in India are using 42 transponders from indigenous satellites and leasing about 67 transponders from foreign satellites.<sup>4</sup> The policy needs to focus on creating a competitive and level playing field where new players can enter, receive mentorship and support from ISRO, and flourish.

Space technology typically has long gestation periods and requires significant upfront investments to develop. This leads to most space programmes around the world being dominated by government agencies. India's space ecosystem has also seen major government involvement, with the state-operated Indian Space Research Organisation (ISRO) spearheading research, manufacturing, launching, operating and maintaining objects in space. ISRO has built a formidable legacy and is amongst

the leading space agencies in the world. Up till recently, private sector involvement in space activities was limited to supplying parts and assembling blocks for ISRO. However, an increasing number of private players, who want to go all the way to space, are coming up. A NewSpaceIndia community analysis estimates more than 25 Indian startups across the space value chain.<sup>5</sup> A robust policy environment and enabling regulatory and licensing structures are required for these companies to thrive. The policy needs to define consistent, transparent and effective guidelines for authorisation, registration, and supervision of space activities.

Since international law guides the actions of sovereign states and not private enterprises, the Indian State needs to harmonise international law in state law for it to be applicable to private enterprises and individuals. India is a signatory of the 1967 Outer Space Treaty and a member of the United Nations Committee on the Peaceful Use of Outer Space (COPUOS). India has also signed the Rescue Agreement, the Liability Convention, and the Registration Convention. All national space activities must be in accordance with the aforementioned four treaties, international law in general, and the UN Charter in particular.<sup>6</sup> Article 51 of the Constitution of India mandates to foster respect for international law and treaty obligations.<sup>7</sup> However, the current regulation of space activities in India is disjointed and done on a piecemeal basis. Therefore, a coherent space law which clearly and explicitly lays down rules for space activities, carried out by any person in India, is required.

Section 2 of this document presents the vision and mission of the New Space Policy 2020 and lists the specific objectives of the policy; Section 3 proposes a more decentralised structure of India's space ecosystem; Section 3.1 discusses the composition, powers and functions of the Space Regulatory Authority of India (SRAI) in detail; Section 3.2 discusses the composition, the jurisdiction of the Space Disputes Settlement Appellate Tribunal (SDSAT) and powers of the Chairpersons and members in detail; Section 3.3 examines other important issues pertaining to space policy; Finally, Section 4 reviews existing as well as possible activities in the space value chain and recommends how the regulation, licensing and compliance of each of these activities be carried out, under the structure envisaged in the New Space Policy 2020.

## 2. Objectives of the New Space Policy 2020

The vision of the New Space Policy is to facilitate a globally competitive space sector in India, that promotes national development, advances the frontiers of science and technology, and secures the national interest.

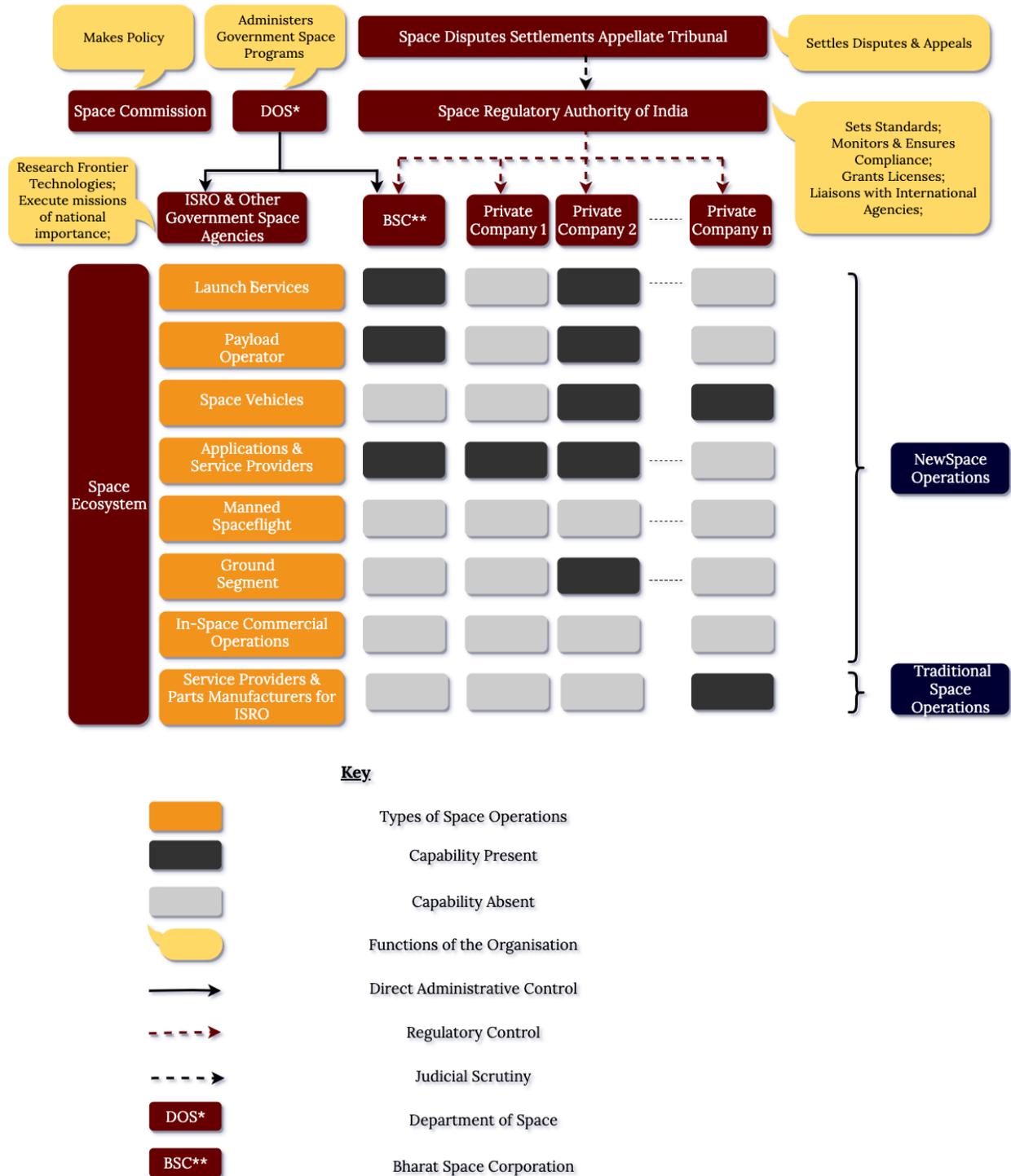
The purpose of this policy is to create a governance framework and policy environment for public and private organisations to explore, harness, and exploit space and celestial bodies, consistent with national goals and international obligations.

The objectives of the policy are as follows.

- Prosperity
  - To solve developmental challenges by using space activities towards more optimal resource management
  - To boost economic growth by using space activities to increase the economic productivity of the country
  - To create new job opportunities and promote entrepreneurship in the space sector
  - To broaden access to space so that the benefits of space activities can be reaped by all
  - To promote international collaboration and manage obligations by providing a legal & economic framework
- Security
  - To acknowledge space as a new domain of security and safeguard India's interests
  - To uphold internal security and to project power by leveraging information and capabilities in space
- Science
  - To advance scientific research by building an enabling environment that supports research of the highest quality
  - To promote exploration of uncharted territories
  - To further technological innovation by building facilities that enable the development of state-of-the-art technologies

- To strengthen education in space science and technology in India through educational institutions and easily accessible public labs/libraries
- To provide thought leadership to the world in space science and technology

### 3. The New Space Policy 2020



Note: The capability present/absent boxes in the above figure are for illustrative purposes only. Any private company and BSC may choose to engage in any space activity as they deem fit.

The Indian Space Research Organisation (ISRO), is a research centre for space science, a service delivery organisation carrying out launches, manufacturing satellites, building ground systems and launchpads, as well as a regulatory and compliance organisation. It also oversees licensing and monitoring of space activities carried out by the private sector.<sup>8</sup> The Chairman of ISRO is also the Secretary of the Department of Space (DOS) and the Chairman of the Space Commission. The New Space Policy 2020 aims to decouple the policy, regulatory and service delivery roles of the ISRO.

An independent Space Regulatory Authority of India (SRAI), shall be responsible for granting licenses for space activities, setting standards for activities, monitoring and ensuring compliance to the guidelines and regulations, as well as for liaising with international agencies. All private space companies, as well as the newly established Public Sector Undertaking (PSU) called the Bharat Space Corporation (BSC), shall be under the regulatory ambit of SRAI. SRAI shall lay down specific guidelines according to the types of activities in the space ecosystem, as shown in the above figure. The following section talks about the composition, terms of office and conditions of service, powers of the chairperson, and procedures and functions of SRAI in more detail.

An independent Space Disputes Settlements Appellate Tribunal (SDSAT) shall be responsible for settling disputes and appeals in the space sector. It shall be the first recourse for any dissatisfaction against decisions of the SRAI. The composition and jurisdiction of the Tribunal are discussed in detail in subsequent sections.

Space Commission, as before, shall remain the nodal policy making agency for space activities in India. The Department of Space (DOS) shall retain administrative control over all government space programmes including ISRO and other government space laboratories/centres and be the major shareholder in the Bharat Space Corporation (BSC).

### 3.1. Space Regulatory Authority of India

An independent, autonomous Authority, called the Space Regulatory Authority of India (SRAI) shall be established,. The head office of the SRAI shall be in Bangalore.

The Authority shall be responsible for licensing space activities, setting standards and rules, ensuring compliance with the rules, monitoring and auditing space activities as required, and liaising internationally.

### 3.1.1. Composition of the Regulatory Authority

The Authority shall consist of 1 Chairperson, 3 full-time members, and 5 independent, part-time members, all appointed by the Union Government in consultation with the Leader of Opposition and the Chief Justice of India. The above nine members shall form the board of the Authority. The Authority shall be a permanent body. The board shall be dominated by non-executive members through which the board can play the role of the principal vis-a-vis the management (Chairperson and three full time members) which is the agent.<sup>9</sup> The board shall set targets for the regulatory Authority and the Authority shall report these numbers (eg: number of license granted/denied, number of orders challenged in the SDSAT, percentage appeals won by the SRAI etc.). The management shall be accountable to the board for SRAIs performance. The appointments body shall fill the vacancy for the Chairperson or members in the SRAI within 6 months.

### 3.1.2. Term of Office and Conditions of Service

The term of the Chairperson and other members of SRAI shall be 3 years or upto the age of 65 years, whichever is earlier. The Chairperson and the full-time members shall not simultaneously hold any other position in the Government or private sector which may prejudice their decision making. Members after relinquishing their duties with the Authority also shall not hold any position in the Government, which requires involvement with space activities, whatsoever, for 2 years. The salary, perks and allowances of the members and the Chairperson shall be as prescribed by Union Government guidelines.

### 3.1.3. Powers of the Chairperson

The Chairperson shall have the power to set the direction of the regular affairs of the Authority. The Union Government may remove from office any member who has been adjudged insolvent, has been convicted of an offence which involves moral turpitude, has become physically or mentally incapable of acting as a member, has acquired such financial or other interest as is likely to affect prejudicially his

functions as a member or has abused his position in a manner prejudicial to public interest.<sup>10</sup>

### 3.1.4. Procedures of the Authority

All questions which come up before the Authority shall be decided by a majority of votes of the members present. Minutes of the meeting shall be prepared for every meeting and shall be available for public consumption, unless the issue discussed is confidential and poses a threat to national security or any of the parties involved. These discussions shall also be put in the public domain once such threats cease to exist.

The Authority shall be empowered to appoint officers and other employees, for the efficient discharge of its functions. The salary, perks and allowances payable to the employees shall be as prescribed by the board of the Authority, within the guidelines of the Union Government.

### 3.1.5. Functions of the Authority

SRAI shall have regulatory, licensing as well as compliance responsibilities. Its regulatory functions shall broadly include prescribing

- terms and conditions for provision & revocation of licences to service providers;
- measures to facilitate fair competition in the industry
- liability clauses for breaches of contract;
- minimum technical and safety standards, which need to be followed by service providers;
- best practices on quality, safety, technology of service;
- measures to protect the interests of consumers;
- on matters relating to development of space technology and any other matter relatable to space technology in general, to the DOS;

SRAI shall also discharge the following functions

- ensure compliance to terms and conditions of licence;
- revoke licence for non-compliance of terms and conditions;

- monitor service quality and conduct periodical surveys and audits of services provided by service providers;
- inspect used equipment, maintain register of licenses and licensees;
- keep the maintained register open for inspection to any member of the public on payment of such fee and compliance of such other requirements as may be provided in the regulations;
- levy fees and other charges for its services;
- perform other administrative and financial functions;

## 3.2. Space Disputes Settlement Appellate Tribunal

There shall be established, a Space Disputes Settlement Appellate Tribunal (SDSAT), in Bengaluru, to adjudicate disputes between licensors and licensees, two or more service providers, or between consumers and service providers and settle appeals against the decisions of the SRAI. SDSAT shall be an independent quasi-judicial body, empowered to resolve disputes in the space sector, which are becoming highly specialised and technical. Establishment of SDSAT would ensure separation of powers in decision-making by segregating executive functions (licensing and monitoring) of SRAI and judicial functions of SDSAT (dispute resolution).

### 3.2.1. Composition of the Appellate Tribunal

The Tribunal shall contain 1 Chairperson and 2 members, appointed by the Collegium. The Chairperson shall be a present/former judge of the Supreme Court or the Chief Justice of a High Court. The members shall also be present/former judges of the High Court. The Chairperson shall hold office for a term of 3 years or the age of 70 years, whichever is earlier. For members, the term shall be 3 years or the age of 65 years, whichever is earlier.<sup>11</sup> A member shall not be reappointed for another term with the Tribunal. The salary, allowances, terms and conditions of service of the members shall be according to Union Government standards. The collegium shall appoint capable members as and when vacancies are generated in the Appellate Tribunal. A member of the Tribunal shall be removed from position on the following grounds: i) insolvency, ii) moral turpitude, iii) physical or mental incapacity, iv) acquiring interests prejudicial to function and/or, v) abuse of position.<sup>12</sup> The removal shall be carried out only after an inquiry by the Supreme Court of India.

### 3.2.2. Jurisdiction of the Tribunal, Powers of the Chairperson & Members

The Chairperson shall have the power to constitute, reconstitute benches and transfer cases. The decisions shall be taken on the opinion of the majority. The Chairperson and members shall also request the Union Government to appoint staff for the Appellate Tribunal. The salaries and allowances of staff shall be as prescribed by the Union Government guidelines. No civil court shall have jurisdiction to entertain any suit or proceedings in respect of any matter which the Appellate Tribunal is empowered to determine and no injunction shall be granted by any court or other Authority in respect of any action taken or to be taken by the Tribunal.<sup>13</sup>

The Appellate Tribunal shall have the same powers as vested in a civil court and every hearing before the Tribunal shall be considered as a judicial proceeding. Every appeal against any order of the Tribunal shall be placed before the Supreme Court, no later than 90 days from the date of decision. Supreme Court may entertain the case post 90 days, if it ascertains that the appellant has sufficient cause.<sup>14</sup> An order passed by an Appellate Tribunal shall be executable as a decree of a civil court.<sup>15</sup> If a party willfully contravenes the order of the Tribunal, it shall be liable to fines as prescribed the Tribunal. The penalties shall increase with second or continued violation.

The Union Government, State Government, local Authority or any person aggrieved by the decision or order of the SRAI may make an appeal to the SDSAT, within a period of 30 days<sup>16</sup> of the decision or of the order being received. SDSAT may entertain an appeal post 30 days also, if it ascertains sufficient cause.<sup>17</sup> SDSAT shall strive to dispose of the appeal within 90 days from the date of receipt.<sup>18</sup>

## 3.3. Other Issues

### 3.3.1. Managing International Treaty Obligations

India is a signatory of the 1967 Outer Space Treaty and a member of the United Nations Committee on the Peaceful Use of Outer Space (COPUOS). India has also signed the Rescue Agreement, the Liability Convention, and the Registration Convention. All national space activities must be in accordance with the aforementioned four treaties, international law in general, and the UN Charter in particular.<sup>19</sup> Article 51 of the Constitution of India mandates to foster respect for

international law and treaty obligations.<sup>20</sup> Furthermore, international law provides directions for the actions of sovereign states and not private enterprises. Private enterprises and individuals are governed by state law.

“States bear international responsibility for national activities in outer space...,whether such activities are carried on by Governmental agencies or non-Governmental body corporate by the state concerned.”<sup>21</sup> The responsibility to further ascribe liability to the private party lies with the concerned state party. Therefore, determining financial responsibility, in case of a mishappening is an important function of the state. SRAI shall conduct a Maximum Probable Loss (MPL) analysis to determine financial responsibility that the licensee has to cover. This would consider pre-flight and flight damage to any Government party or third-party. The liability will mostly be fulfilled by the private party through an insurance. Space Commission, in consultation with SRAI, shall prescribe upper caps for Government property and third-party liability, guidelines for MPL analysis, and indemnification clauses. The Union Government shall cover loss incurred above the capped insurance value. This would provide the private sector confidence in investing in space ventures. SRAI shall also devise a regulated claims mechanism.

Article V of the Outer Space Treaty regards astronauts as ‘envoys of mankind’ and directs state parties to provide assistance in the event of an accident or emergency landing and safely and promptly return the astronauts to the state of registry of their space vehicle.<sup>22</sup> Section 86 of the Civil Procedure Code, 1908, grants immunity from prosecution to a foreign state or diplomat in India<sup>23</sup> as prescribed by the 1961 Vienna Convention on Diplomatic Relations and the 1967 Vienna Convention on Consular Relations. However, section 86 of the Civil Procedure Code has not been amended to include astronauts on the list of persons granted immunity.<sup>24</sup> Although the situation has never arisen till now, this is an important aspect that the Space Commission needs to consider and incorporate in law.

Article II of The Outer Space Treaty, 1967, states, ‘Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.’<sup>25</sup> Many states, including the United States of America and Luxembourg are passing legislation, unilaterally, allowing their citizens to own and sell the minerals they mine from asteroids and the moon. India should be cognisant of these developments and the

Space Commission should recommend legislation that guides such actions by Indian private players.

### 3.3.2. Intellectual Property Creation

As more and more private players are venturing into space activities, protecting their innovations has become vital. The Space Commission shall prescribe Intellectual Property Rights (IPR) and protections afforded to entities in India, within the framework of international space law.

An IP generated by a private entity shall remain with the originator, as the private entity should have the right to exploit the 'spoils of its creation'. This 'right to exclude' would also incentivise creation. The European Space Agency provides a good model to incorporate, in cases where the Government funds the IP creation. If the creation is fully funded by the Government, the IP rights shall remain with the originator, but the originator is expected to make available the IP free of cost to the Government, to academia and research organisations under a free license for scientific purposes as long as it doesn't run counter to commercial interests of the originator<sup>26</sup>. Also, any IP created by an employee of ISRO or any other Government space organisation shall remain in the joint name of the scientist and ISRO. However, only ISRO or the respective Government space organisation shall have the right to commercially utilise it. The organisation shall pay a commission to the scientist on sale.

Space Commission should also take regular cognisance of international developments in the space ecosystem and legal developments in intellectual property rights and incorporate them in national legislation to provide clear directions to private players.

### 3.3.3. Promoting Investments

Space technologies can often have high upfront investments and/or long gestation periods. Unlocking private capital as well as increasing Government financial support through investments are essential in building a sturdy space ecosystem.

In such cases, Government support can catalyse upcoming businesses. NASA's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programmes provide valuable insights for India. ISRO shall allocate a proportion of

its budget to set up a fund to support innovative startups.<sup>27</sup>This fund shall allocate funds stagewise - for idea generation, prototype development, and commercialisation. This shall be an annual affair and ISRO shall publish a list of areas of interest where it would be looking to invest.<sup>28</sup>ISRO could also set up a general purpose fund for bright ideas which do not directly fall in its published areas of interest. ISRO shall devise transparent, fair and efficient rules and guidelines to undertake this programme.

The Government of India shall put in place tax benefits to promote space activities. It shall also look at building space parks, which shall have space tech startup incubators, accelerators, and manufacturing units. These shall also be designated as Special Economic Zones.

Bharat Space Corporation (BSC) shall explore Public-Private Partnership (PPP) models for building satellites, launch vehicles etc. This will help drive private capital and solving some capacity constraints.

### 3.3.4. Increasing R&D and Education in Space

Setting up the Indian Institute of Space Science and Technology (IIST) to train young students in space science and technology was a step in the right direction. Space Commission shall look and recommend creation of more avenues to advance education and research in space science and technology by introducing specialised undergraduate, postgraduate and doctoral courses in aerospace, avionics and related fields of engineering. These degree programmes shall be introduced in existing premier institutions like IITs or new ones like other IISTs. GOI shall also invest in existing space science and technology centres of excellence. ISRO and other research labs under DOS shall also work in collaboration on research projects with these institutes and centres of excellence.

ISRO and other space laboratories under the DOS shall open some portions of their labs and research facilities for tinkering by researchers and space enthusiasts. They can charge nominal fees for it.

ISRO shall try to increase its public outreach, especially among young school students to inspire them towards taking space science and technology as a profession. 'School Labs' initiative taken up by the German Space Agency can act as

a good template.<sup>29</sup> Young people shall get an opportunity to learn about ISROs operations, experiments done by its scientists under various projects. A social media strategy with regular engagement on websites like YouTube, Twitter, Facebook showcasing achievements, launches, experiments shall go a long way. ISRO shall also open its launch pad at Sriharikota, for public viewing during launches.<sup>30</sup> ISRO could charge fees for viewing with special discounts for students.

### 3.3.5. Mentorship and Collaboration with the Government

ISRO is regarded as one of the leading space agencies in the world and has been at the forefront of cutting-edge research in space science and technology. ISRO should now actively mentor talented startups and entrepreneurs, to build a robust Indian space ecosystem. ISRO should build a mentorship network where entrepreneurs/scientists building new products can liaise with and gain from the experience of veteran ISRO scientists. This can be done through holding regular expos, competitions, knowledge sharing sessions etc. The DOS should also consider opening more lateral entry positions within the department.

Taking inspiration from successes such as the National Association of Software and Services Companies (NASSCOM, the trade association for the information technology industry), the space industry in India needs to create an independent voice through a dedicated association that can specifically create a platform for opinions and also interface with the Government for commercial space activities in India.<sup>31</sup> DOS shall encourage these efforts and strive to engage with the industry associations.

### 3.3.6. International Partnerships

Due to the dual-use nature of many space technologies, an export control regime in India prescribes the goods and services which can/cannot be exported/imported. While it is important to curb export/import of lethal weapons, it is also essential that commercial goods and services be allowed to trade easily. SRAI shall be the compliance body which shall authorise the flow of space goods and services to/from India, according to the conditions set in the export control regime. It is important to relook at the list from time-to-time as technology progresses. SRAI shall work with the Union Government to set clear rules for export/import. SRAI shall strive to

advance international partnerships between foreign companies/Governments and Indian industries.

## 4. Types of Space Activities

The New Space Policy 2020 looks at the space sector holistically to create an enabling regulatory environment for all space activities in the value chain. All of these activities have different regulatory, licensing and compliance requirements depending upon, among other things, their safety risks, financial risks, and operational risks. This section explains how the new structure envisaged under the New Space Policy 2020 would work for different space activities.

### 4.1. Launch Services

A 'launch vehicle' is an object (or any part thereof) intended for launch, launched from Earth, or returning to Earth which carries payloads or persons, or both.<sup>32</sup> Launch vehicles, thus, would include expendable, reusable and air launch vehicles.

SRAI shall be responsible for regulating and licensing all activities, including launching and re-entering from/to Indian land, operating and maintaining a launch/re-entry site in India, in a time bound manner. A company/entity registered under the laws of the Indian state, would also have to take authorisation from the SRAI to launch, re-enter a vehicle outside of India, or to maintain a launch/re-entry site outside India's borders. SRAI shall issue licenses for operating a launch/re-entry site (spaceport) for a fixed period and renew the license after a fresh evaluation after the term is over. The regulation guidelines of spaceports would be similar to airports.

SRAI shall lay down terms and conditions for issuance and revocation of launch licenses. These would include detailed parameters for safety reviews, environmental impact reviews, financial responsibility determination, and establishment that the agency is not acting against India's national and foreign interests, international obligations, and public health and safety. SRAI shall also define revenue sharing and license costs and agreements. SRAI shall also, from time to time, issue prescriptive guidelines about the best practices and performance standards in different segments of the space value-chain.

SRAI shall also be the compliance agency and be responsible for inspecting reliability of safety systems, procedures and processes of launch agencies, measuring air/water/noise pollution caused due to launch, scrutinising liability insurance records, and ensuring compliance with domestic and international interests and obligations. Payloads at launch stage, should have requisite licenses and permissions, depending on their nature, motives and uses. While the payloads would not be investigated for the above parameters at this juncture, SRAI would determine the safety aspect of the payload with regard to the launch. SRAI shall maintain a register of all launches and levy fees and other charges for its services.

**Role of ISRO:**

Manufacturing, maintenance, and operation of launch vehicles built on legacy technologies, shall be done by an independent, commercial body of ISRO, which shall compete for launch contracts in domestic and international markets. This body shall work as a Public Sector Undertaking (PSU), called the Bharat Space Corporation (BSC). The PSU shall be opened to 50% FDI under the approval route, for now, with provision to shift to automatic route, in future. The top management of the PSU shall have functional autonomy to determine the activities best suited for the company to pursue and shall be held accountable to the shareholders for its performance. ISRO shall remain a research focussed organisation, working on frontier technologies, and executing missions of national importance.

## 4.2. Space Vehicles

Space vehicles are machines which carry payloads into and in space. Space vehicles can be classified as non-intervening, intervening non-destructive, and intervening destructive. The regulatory structure envisioned for these types of space vehicles would be different.

### 4.2.1. Non-Intervening Vehicles

Non-intervening space vehicles would include satellites, inter-planetary orbiters, space stations. SRAI shall be the licensing, and regulatory body for private space vehicles from India. SRAI shall prescribe safety and technical requirements, sustainability practices (end-of-life plans, de-orbiting strategy and debris mitigation measures), liability, insurance and indemnification requirements.

SRAI shall also grant licenses to private players if they comply with the established requirements. SRAI shall conduct audits to ensure the players are adhering to its directions, and revoke licenses and levy fines & penalties if it observes non-compliance. SRAI shall also maintain a register of all space vehicles from India.

#### 4.2.2. Intervening Non-Destructive Vehicles

Intervening non-destructive space vehicles would be space tugs, orbital refill probes, space robots. Since these vehicles would contact other space assets, and could potentially affect their safety and operations, regulations on these vehicles would be more rigorous. SRAI shall be the licensing and regulatory body. These vehicles shall be subject to more intense safety and technical requirements and have higher insurance and liability obligations.

#### 4.2.3. Intervening Destructive Vehicles

Intervening destructive space vehicles have the potential to terminally damage a space asset or make it unusable. These can include Anti-Satellite (ASAT) Missiles, space debris, launch vehicle fairing stages or dead satellites.

ASAT missiles have exclusive defence functions and are designed to destroy satellites. Only the Indian state, through the Ministry of Defence, would be the sole operator of ASAT missiles. Rules and regulations with regard to ASAT missiles would be developed by MoD.

Space debris, dead satellites and fairing stages, generated through civilian space activities, are not meant to dismantle space objects, but pose substantial threat, due to potential collisions. SRAI shall formulate sustainability guidelines, which would mandate space vehicles to report their end-of-life plans and debris mitigation strategies. SRAI shall also monitor adherence to these guidelines and levy penalties in case of non-compliance.

### 4.3. Payload Operator

Payloads are mounted/stored in space vehicles which are put into space by launch vehicles. This section would talk about payloads with applications in remote sensing, telecommunications, navigation services, and other non-conventional payloads. Other payloads refer to landers, rovers, orbiters, interplanetary probes, etc. For

remote sensing, telecommunications & broadcasting, and navigation payloads, SRAI would provide licenses for payloads as well as space vehicles together. Companies operating other payloads, would have to take separate clearances for payloads and space vehicles.

#### 4.3.1. Earth Observation/Remote Sensing

Remote sensing is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance from the targeted area.<sup>33</sup>

SRAI shall be responsible for setting guidelines for data collection & dissemination, copyrights and patents, insurance & liability requirements, and safety requirements. It shall also recommend technical & quality standards and best practices for remote sensing activities. SRAI shall also be updated about technical and economic developments around the world and recommend developments in remote sensing ecosystem.

SRAI shall be the nodal body for licensing payloads, for ensuring compliance and for monitoring payload activities. Prior to licensing a payload, SRAI shall ensure the said payload operator complies with data collection and imaging requirements, design and operational specifications and orbital parameters for parking, transfer and final orbits. SRAI shall also maintain a register of all remote sensing satellites licensed in India and levy fees and other charges for its services. SRAI shall also levy fines, cancel licenses and take other necessary actions in case of violations.

Private enterprises shall be able to claim Intellectual Property rights on the specialised products they create.

#### **Role of ISRO:**

The operation of Indian Remote Sensing Satellites (IRS) which use legacy technology and generate regular, civilian-use data shall be done by the Bharat Space Corporation. The raw data generated by these satellites would be available as a 'public good'. This data would be hosted in human and machine-readable form on a regularly updated portal, maintained by the BSC. BSC would be compensated by the Union Government for operating satellites and hosting data. BSC shall also add value to this raw data to create data products and sell in the domestic and international

markets. The revenue generated from selling data products would be part of BSCs earnings. The nature of data products to sell shall be decided by the management of BSC, according to market considerations. BSC shall also sell this raw data for commercial use to institutions/organisations which want to add value to it and use it for business purposes. The revenue from selling raw data would go to the consolidated fund of India. The resolution and quality of data disseminated and sold shall be according to the regulations laid out by the SRAI. NRSC shall focus on research activities and enhancing remote sensing technology.

#### 4.3.2. Satellite Communications

Satellite communications is the use of artificial satellites to provide communication links between various points on earth.<sup>34</sup> Satellite communication satellites enable various applications like hand-held mobile devices, Direct-to-Home (DTH) television, as well as aircraft communication.

SRAI shall be the regulatory and licensing body for communications satellites in India. SRAI shall take over the responsibilities defined for DOS under the SATCOM policy and the Norms, Guidelines & Procedures for Implementation of SATCOM in India. It shall assume the responsibilities of authorisation for the establishment and operation of Indian Satellite System, and the authorisation for the use of foreign satellite system for satellite communication purposes. SRAI shall execute these responsibilities in a time-bound manner. SRAI shall be the nodal body and shall coordinate with all agencies for granting a satellite system license. It shall coordinate with members of Wireless Planning and Coordination Wing(WPC) of the Department of Telecommunications (DOT), which shall represent private players before International Telecommunications Union (ITU) for registration of orbital slots and frequencies. The structure defined above shall help in achieving timely, single-window clearance for satellite communication licences. SRAI shall also prescribe rules for leasing transponder capacity from foreign satellites.

SRAI shall also be the compliance and monitoring agency for satellite communication activities. It shall be responsible for supervision of activities of the Indian satellites and shall impose penalties in case of violations.

**Role of ISRO:**

The responsibility of allocation of INSAT capacity for commercial purposes shall be transferred to the Bharat Space Corporation. The revenue generated from leasing this capacity shall go into the consolidated fund of India. ISRO shall pay a fee to BSC for managing the leasing process. BSC shall grant licenses in a transparent and time-bound manner. ISRO shall focus on developing newer technologies and systems related to satellite communications.

### 4.3.3. Navigation Services

A satellite navigation service uses satellites to provide autonomous geo-spatial positioning. It allows small electronic receivers to determine their location (longitude, latitude, and altitude/elevation) to high precision using time signals transmitted along a line of sight by radio from satellites.<sup>35</sup> This system can provide positioning, navigation, tracking for aerial, terrestrial as well as marine transportation and precise timing using on-board atomic clocks. Navigation payloads either provide standard position services or augmentation services (improving the accuracy, precision and reliability of signals provided by other navigation satellite systems).

For Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) for aircrafts, the International Civil Aviation Organisation (ICAO) Council requires that in implementing Global Navigation Satellite System (GNSS), state Authority must be preserved in the coordination and control of communications and in the necessary augmentation of satellite navigation systems, to preserve the sovereignty of the country.<sup>36</sup> The liability framework for signal service providers and augmented service providers should be established by the DOS. The imagery from Global Positioning System (GPS) is available free-of-cost to everyone in the world. Therefore, fully private navigation payloads in space are unlikely in the near future. However, public-private partnerships (PPP), where private sector assembles, tests and manufactures subsystems and components should be promoted. Also, there are downstream business opportunities like sale of receivers and value-added navigation services like Google Maps. These should also be promoted.

**Role of ISRO:**

India has established its own Indian Regional Navigation Satellite System (IRNSS). Navigation by Indian Constellation (NavIC), as it also known as, would be available for

civilian use by 2020<sup>37</sup> and provide positioning and navigation services, in India and the region extending up to 1500 km from its boundary.<sup>38</sup> ISRO, jointly with Airports Authority of India (AAI) also operates GPS Aided Geo Augmented Navigation-GAGAN payload as a Satellite Based Augmentation System (SBAS) for the Indian aerospace.<sup>39</sup> IRNSS provides general service to all users and restricted service only to authorised users (military, Government agencies etc.). Payloads which are mainly used for Standard Positioning Systems (SPS) and utilise legacy technology shall be managed by BSC. BSC shall explore PPP with deserving private players. 25% of the development of IRNSS- 1H was completed by a consortium led by the Alpha Design Technologies.<sup>40</sup> The Union Government shall compensate BSC for its services. ISRO shall focus on researching and building advanced technologies related to navigation services.

#### 4.3.4. Other Payloads

Other payloads, in this document, refer to payloads which are not commonly used until now, but would find increased usage in the near future. This would include landers, orbiters, interplanetary probes. SRAI would come up with specific regulations and licensing requirements for these, once they achieve critical mass in terms of adoption. Till then, SRAI would license and regulate these payloads on a case-case basis.

### 4.4. Applications and Service Providers

Applications and service providers would be organisations or individuals who generate, use or sell analytics, insights and products/services from space vehicles, ground segment or satellite generated data. The data can be generated from any space object ranging from earth observation or navigation satellites to rovers, orbiters. The applications of this data may also be found in a wide variety of fields from Internet of Things (IOT), meteorology to monitoring of forest fires and illegal mining.

There will be no/minimal regulation on the above described end-users of data. If a space object, collects or generates sensitive data, dissemination of that data would be regulated at the source.

## 4.5. Human Space Flight

Human space flight is the next step in India's space journey. ISRO has started working on India's maiden manned space flight Gaganyaan, which would send 3 astronauts to space for a minimum of 7 days, by 2022.<sup>41</sup> Commercial human space flight aspirations among Indian entrepreneurs and enthusiasts are also developing and we might see an Indian company tapping into this market in the near future. Therefore, legislation and specific regulations to address the need when it will arise, are required.

SRAI, in consultation with the Space Commission shall come up with a comprehensive framework for licensing and regulation of private human space flight, in a year. Since, human space flight poses significantly higher risks as compared to unmanned space flights, the regulations, licensing and monitoring would be much more stringent and rigorous. The regulations shall delineate safety and technical requirements of the space vehicle, liability and insurance requirements for the company as well as participants. The regulations shall expound qualifications and training required to undertake a space mission. The regulations shall ensure that participants are cognisant of the health risks, financial consequences and legal recourse available and provide 'informed' consent. SRAI shall update the requirements at regular intervals of time, recognising international practices and operations.

## 4.6. In-Space Commercial Operations

In-space commercial operations like space manufacturing, trading, asteroid mining are rapidly gaining interest. Some space enthusiasts are also working towards building permanent space settlements. Article I of The Outer Space Treaty, 1967, states, 'The exploration and use of outer space, including the moon and other celestial bodies, shall be the province of all mankind.'<sup>42</sup> Article II of The Outer Space Treaty, 1967, states, 'Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.'<sup>43</sup> However, the United States has granted its citizens the right to own, use and sell asteroid or space resource they mine.<sup>44</sup> Luxembourg has also passed space mining law granting similar rights to its citizens.<sup>45</sup> Infact, the Luxembourg law places much lesser restrictions than the US law. With states acting unilaterally and going against international treaty obligations, it is

highly likely that international commitments with regard to ‘non-appropriation’ in space might not last.

India should think about these developments proactively and design enabling policy framework to retain strategic advantage in space activities. As the technology for space exploration and commercialisation progresses, the demand for property rights in space is expected to become stronger. India should be flexible to safeguard the economic interests of its citizens. The Space Commission of India shall take cognisance of these developments and prescribe policy guidelines and review them every two years. SRAI shall write sub-legislation and specific regulatory and licensing frameworks, drawing from the policy guidelines by the Space Commission.

## 4.7. Ground Segment

Ground segment refers to all ground-based elements required to keep spacecrafts operational. Ground segment would include earth stations used to communicate with spacecrafts, mission control centres which collect and analyse spacecraft telemetry and give appropriate commands, ground networks which connect different ground elements and transfer data, and remote terminals.

SRAI shall prescribe regulations on how to implement telemetry, tracking and command functions. It would formulate rules on what kind of data can be collected and analysed by ground stations in India from Indian/foreign satellites, and what data can Indian satellites provide to foreign ground stations. It will also set down rules on sharing of data between ground elements within the international ground network. These rules would be determined within the provisions of international space law. SRAI shall also stipulate operational requirements for installed hardware and software and fallback mechanisms during failures. Other environmental and safety requirements shall also be prescribed by SRAI. SRAI shall take cognisance of international developments and amend the rules when required.

SRAI shall also be the compliance and monitoring body for ground segment in India. It shall authorise all ground segments in India if they comply with the requirements laid down by it. It shall levy a fee for its services. SRAI shall also engage in regular audits of the facilities within Indian borders and impose penalties for non-compliance with rules.

## 5. Conclusion

The space ecosystem in India is centralised around the Indian Space Research Organisation (ISRO). ISRO is a research organisation, service delivery establishment, regulatory, licensing and compliance agency as well as a disputes settlement body. The recommendations in this document aim to achieve greater decentralisation and promote private participation. We recommend the establishment of an independent Space Regulatory Authority of India (SRAI) to act as a regulatory, compliance and licensing body for private space activities in India. We also propose the establishment of Space Disputes Settlement Appellate Tribunal (SDSAT) to resolve appeals and disputes between licensors, licensees. We also look at mechanisms to promote investments in space activities, increase R&D and education in space, improve collaboration and mentorship avenues with Government space programmes, and promote international partnerships. Managing International Treaty Obligations and Intellectual Property Rights are also discussed. Finally, we propose approaches to regulate activities across the space value chain. The above recommendations will ensure that India leapfrogs into a leadership role in the global space ecosystem.

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