ORF ISSUE BRIEF

AUGUST 2019
ISSUE NO. 309

An Indian Space Law: Long Overdue

Rakesh Sood

ABSTRACT India began investing in Space science and technologies in the 1960s, putting in place an administrative structure similar to that for Atomic Energy. However, unlike the atomic energy domain which came under the 1948 Atomic Energy Act (revised in 1962), the country's space activities are yet to be regulated by specific legislation. India's space agency, ISRO, has historically viewed space technology applications primarily for societal development and not for addressing strategic or security objectives. In recent years, space activities have expanded to include defence applications under the purview of the Ministry of Defence; a new range of civilian applications of space technologies, driven by startups, have also emerged in areas such as communication, TV and broadband, earth observation and navigation. This brief calls for the formulation of a Space Law to build a transparent and enabling regulatory environment for the country's expanding activities in the civilian domain.

Attribution: Rakesh Sood, "An Indian Space Law: Long Overdue", *ORF Issue Brief No. 309*, August 2019, Observer Research Foundation.

ISBN 978-93-89094-72-5

INTRODUCTION

The launch of the Soviet Union's Sputnik, the world's first Earth satellite in 1957 is widely regarded as the beginning of the Space Age. Four years later, Vikram Sarabhai, founder-Director of Physical Research Laboratory, presented a paper to the government outlining how the country's nascent space technologies could be harnessed to address India's development challenges. The following year, the Indian National Committee for Space Research (INCOSPAR) was constituted to advise the government on a space policy. By the end of 1963, the Thumba Equatorial Rocket Launching Station was set up and a US-supplied Nike Apache rocket was successfully launched into orbit carrying a French payload. Some years later, in 1969, the Indian Space Research Organisation (ISRO) was established under the administrative control of the Department of Space and INCOSPAR's advisory role was subsumed into a Space Commission.

This administrative model was similar to that used for atomic energy: there was a Department of Atomic Energy, an Atomic Energy Commission, and the Atomic Energy Establishment Trombay (subsequently renamed Bhabha Atomic Research Centre in 1967). There are, however, important differences. An Atomic Energy Act had been passed in 1948 and further amended in 1962 to define the role of government in the field of nuclear power. For space activities, meanwhile, the government is yet to establish a legislative framework. Absent a specific law, ISRO has been guided instead by a set of Mission and Vision statements[1] that declare the use of space technology and its applications for societal needs and national development.

Yet, India's space programme has grown exponentially since its modest beginnings five decades ago. The achievements include the design and development of a series of launch vehicles and related technologies; design and development of satellites and related technologies for earth observation, telecommunication and broadband, navigation, meteorology and space science; applications for societal development; R & D in space sciences; and most recently, planetary exploration.

Today ISRO has some 15,000 personnel in its roster, and its annual budget has crossed INR 100000 million (approximately US$1.3 billion) from INR 60000 million five years ago. Even as its capacities have grown, however, ISRO is unable to answer to every demand for space-based services in India. There is a need, therefore, for private-sector investment to come into the space sector. A suitable policy environment is required to manage these activities and ensure the overall growth of the space sector. The draft Space Activities Bill[2] introduced in 2017 has lapsed, giving government the opportunity to focus on a new bill that will be welcomed by the private sector, both the larger players and startups alike.

SPACE FOR DEVELOPMENT NEEDS: ISRO'S MILESTONES

ISRO's Mission and Vision statements cover both the societal objectives of the country's space programme and the thrust areas that have evolved periodically over time. The first major project, the Satellite Instructional Television Experiment (SITE), was undertaken in 1975-76 by leasing a US satellite for a year and using it for educational outreach to 2,400 villages covering five million people. It demonstrated the potential of satellite technology as an effective mass communication tool. Since then, ISRO has recorded various other achievements in harnessing space technology to answer the development needs of the country.

Telecommunications

The SITE experiment paved the way for satellite communication, with the Indian National Satellite (INSAT) system and the GSAT serving as the backbone for the country's communication, broadcasting and broadband infrastructure since INSAT was first established in 1983.[3] Gradually, bigger satellites have been built carrying a larger array of C, Ku and S band transponders. Today about 200 transponders on Indian satellites provide numerous services to government and the private sector in the fields of telecommunication, tele-medicine, tele-education, TV, broadband, radio, disaster management, and search & rescue missions.

In 1997, a SATCOM policy[4] was issued to guide the utilisation of INSAT capacity by private users on a commercial basis as well as the use of foreign satellites for provision of services in India. The policy also provides guidelines for the establishment and operations of Indian satellite systems owned by private entities. The cap for foreign direct investments (FDI) in the sector was initially fixed at 24 percent, and later liberalised to 74 percent. However, there has not been a single licensee nor has foreign investment come into the area. According to startups who are interested in the small satellite market, the process for securing licences is laborious and lacks transparency. Meanwhile, demand has outstripped supply with the explosion in DTH (direct-to-home) transmission, and advances in telephony and broadband services. As a result, ISRO is able to meet just over half of all demand; the rest is covered by transponders leased on foreign satellites.

Remote Sensing

A second area of focus is Earth observation and using space-based imagery for the growing demands of an emerging economy such as India, ranging from weather forecasting, disaster management, and national resource mapping and planning. These resources cover agriculture, watershed, land resource, and forestry management and with higher resolution and precise positioning, have expanded the scope of application of Geospatial Information Systems (GIS) to cover all aspects of rural and urban development and planning. Beginning with the Indian Remote Sensing (IRS) series in the 1980s, today the RISAT, Oceansat, Cartosat and Resourcesat[5] series provide wide-field and multispectral high-resolution data for land, ocean and atmospheric observations.

In 2001 the government issued a Remote Sensing Data Policy; it would subsequently be amended in 2011.[6] The policy covers the acquisition and distribution of remote sensing data from both Indian and foreign satellites. The 'one window clearance' centralised regulatory authority with the National Remote Sensing Centre (NRSC), which falls under ISRO. All imagery with a resolution of up to one metre is distributed on a non-discriminatory basis while higher-resolution data is screened and cleared on a case-by-case basis.

The policy also provides for licensing of private Indian remote sensing satellites. So far, however, no such application has been entertained, only strengthening NRSC's monopoly as geospatial data provider. In fact, Indian users acquiring high-resolution imagery from foreign satellites are required to route their activities through the NRSC. The irony is that the Department of Electronics and Information Technology (DEITY) issued a National Geospatial Policy[7] in 2016 which is based on wider dissemination and greater use of GIS data, products and services—a task that is hardly possible in a monopolistic policy environment.

Navigation

A third and more recent area of focus of ISRO is satellite-aided navigation.[8] GAGAN, a joint project between ISRO and the Airports Authority of India, augments the GPS coverage of the region, improving the accuracy and integrity, primarily for civil aviation applications and better air traffic management over Indian airspace. This was followed up with the Indian Regional Navigation Satellite System (IRNSS), a system based on seven satellites in geostationary and geosynchronous orbits. It provides accurate positioning service covering a region extending 1500 km beyond Indian borders, with accuracy greater than 20 metres; even higher accuracy positioning is available to the security agencies. In 2016, the system was renamed NavIC (Navigation with Indian Constellation).

ISRO has also started to undertake more ambitious space science and exploration missions, the most notable of which have been the Chandrayaan[9] and the Mangalyaan.[10] A manned space mission, Gaganyaan, is planned for its first test flight in 2021. These missions are not only technology demonstration missions but also meant to expand the frontiers of human knowledge in atmospheric and space sciences.[11]

Launch vehicles

None of this would have been possible without mastering launch vehicle technology. Beginning with the Satellite Launch Vehicle (SLV) and the Augmented SLV, since 1993, ISRO has developed and refined the Polar SLV as its workhorse for placing satellites in low earth- and sun-synchronous orbits. With 46 successful missions (and only two failures) since 1993, the PSLV has an enviable record. In 2017, the PSLV set a new global record by successfully placing 104 satellites in sun-synchronous orbits. Of these, 88 CubeSats belonged to Planet Labs, a US-based earth imaging company which now operates a constellation of 143 small satellites. Each of the CubeSats weighs approximately five kg. With the growth of the small satellite sector globally, PSLV is considered a preferred launch vehicle on account of its competitive cost and reliability. The Geosynchronous SLV programme is still developing, with its Mk III variant having undertaken three missions and now capable of carrying a 3.5 MT payload into a geostationary orbit.[12] Compare this to the French Ariane 5, which has undertaken more than 100 launch missions and carries a 5 MT payload. Ariane 6 is in the pipeline for 2020.

ISRO's ethos

Dr Sarabhai, who laid the foundations of the Indian space programme and headed ISRO until his demise in 1972, as well as his successor Prof Satish Dhawan who led ISRO till 1984—built the organisation as a civilian entity.

In the early years, the organisation prided itself with its transparency: indeed, none of its files or correspondence, for instance, was classified. Locating the headquarters in the scientific and technical milieu of Bangalore, rather than in bureaucratic Delhi, helped shape ISRO's open culture. It also contributed to building a strong association with industry, particularly the public-sector undertakings (PSUs) like Hindustan Aeronautics Ltd HAL, Mishra Dhatu Nigam Ltd MIDHANI and Bharat Electronics Ltd BEL and large private sector entities like L & T, Godrej and Walchandnagar Industries. However, most of the private sector falls in the category of Tier2/Tier3 vendors, providing components and sub-systems and services. The Assembly, Integration and Testing (AIT) role have remained ISRO's preserve.

Antrix, the commercial arm of ISRO, was incorporated in 1992 as a wholly owned government company under the administrative control of the Department of Space. It markets ISRO's products and services and interfaces with the private sector in transfers of technology partnerships. Antrix's core activities include provisioning of transponders, providing launch services on Indian launch vehicles like the PSLV, marketing of remote sensing data and providing other mission support services. Its annual turnover currently stands at just over INR 20000 million (US$300 million).

UTILISING SPACE FOR SECURITY

After its establishment, ISRO benefited from international cooperation arrangements with a number of countries including the US, Russia and France. However, after the Missile Technology Control Regime (MTCR) came into being in 1987, ISRO had to rely on its own resources for developing launch vehicle technologies. During the early 1990s, ISRO's agreement with Glavkosmos, a Russian entity to acquire cryogenic engine technology led to it being sanctioned by the United States (US).[13] Tightening dual-use technology controls also restricted access to high-end electronic components like radiation-hardened chips.

After India conducted its first nuclear tests in 1998, the country's position on export controls changed. As India strengthened its own export control mechanisms, some of the sanctions on ISRO were eased. The situation changed qualitatively, with India becoming a member of the MTCR in 2016 and the Wassenaar Arrangement the following year.

As a responsible nuclear weapons state committed to deploying a triad of vectors, India's interest in using its space capabilities for defence and security has been growing. While some of the earlier remote sensing satellites also acquired high-resolution imagery for use by the defence forces, there was growing interest in having dedicated defence satellites for secure communications as well as other potential military applications.

In 2008, an Integrated Space Cell was established in the Integrated Defence Staff at the Ministry of Defence to consolidate the growing needs for intelligence gathering using signals, geospatial, cyber and imagery sources as well as for secure navigation and communications. The first dedicated defence communication satellite for the exclusive use of the Indian Navy was launched in 2013; more dedicated satellites for other services are in the pipeline. The Indian Regional Navigation Satellite System (IRNSS), deployed in 2016, provides an encrypted restricted service for navigation accuracy over India and in the 1500-km region around the country's borders, which is the area of core strategic interest.

As defence services have begun to call for increased space-based assets to assist in surveillance, communications, navigation and intelligence, the natural corollary is ensuring protection and resilience of these space-based assets, especially in the context of escalating tensions. Some countries are also actively pursuing counter-space capabilities which could deceive, disrupt or degrade an adversary's space capabilities. At present, there are a few international legal instruments that guide the conduct of space activities—such as the 1967 Outer Space Treaty and the 1979 Moon Treaty. These, however, pre-date the increasing militarisation of space. These agreements, to which India is party, prohibit the deployment of weapons of mass destruction (i.e., nuclear weapons) in outer space, moon and other celestial bodies.

The idea of a ban on anti-satellite (ASAT) weapons has been raised occasionally but no negotiations have taken place. The US, Russia, China and Israel are known to have developed ASAT capabilities. Such technologies are not highly different from missile defence technologies. In fact, in some ways, tracking incoming missiles is more difficult as compared to satellites which move along predictable trajectories, although satellites are often at higher altitudes. The US launched the Strategic Defence Initiative in the early 1980s and has consistently rejected any negotiations that might constrain its options. Russia and China, for their part, have proposed negotiating a prohibition of placement of all weapons in outer space and simultaneously refraining from threat or use of force against space objects. This idea has failed to attract support.

Meanwhile, in February this year, US President Donald Trump announced the establishment of a Space Force, the sixth arm of the US military (the other five being the Army, Navy, Air Force, Marines and Coast Guard). Much earlier, in 2009, the US has set up a Cyber Command. In 2015, Russia announced the integration of air and missile defence forces with a Space Force creating a Russian Aerospace Forces command. China set up its PLA Strategic Support Force in 2015 to integrate Chinese capabilities in electronic warfare, space and cyber domains. On 13 July this year, France announced the establishment of a high command for space that will be integrated with its air force.

On 27 March 2019, India successfully carried out a kinetic kill ASAT test,[14] the preparations for which were conducted over six years. This was followed up in June with the announcement of setting up a tri-service Defence Space Agency to assess space-based threats and identify strategies for protecting Indian interests and assets in space. It will bring together the Defence Imagery Processing Centre located in Delhi and the Defence Satellite Control Centre in Bhopal. A Defence Space Research Organisation (DSRO) will be set up by the end 2019 for identifying and developing defence applications across the entire spectrum of space technologies.

THE POTENTIAL OF SPACE ECONOMY

The current juncture provides an opportune moment for bringing about a separation between civilian and military applications of space applications. Hiving off the defence and military activities pertaining to space from ISRO and bringing it under the Ministry of Defence is a positive development that should enable ISRO to focus on its core competencies and concentrate on developing an enabling space ecosystem with greater participation of the private sector.

Today, the global space industry is estimated at US$350 billion and with a compound annual growth rate of 5.6 percent, is expected to cross US$550 billion by 2025. Despite ISRO's impressive technical capabilities, India's share is estimated at US$7 billion (or two percent of the global market), covering three broad areas: telecommunication including TV, earth observation imagery, and satellite-aided navigation. Over two-thirds of the value comes from DTH television, broadband and the rapidly growing OTT (over-the-top) services delivered through the internet. DTH today covers 70 million homes out of a total 175 million TV owning homes, indicating the growth potential. The remote sensing data and GIS markets today are worth some US$500 million and can mature quickly. The potential is enormous with declining costs of high speed connectivity and large-scale computing.

In the navigation market dominated by Google Maps, India may be a beginner with GAGAN but has great potential to expand. Under the 12th Five-Year plan, ISRO had set an ambitious target of doubling the transponder capacity from 200 to 400 and even as it struggled to meet the goal, the demand expanded to nearly 800. With HD services and 5G on the rise, ISRO/Antrix will have to depend on leasing foreign transponders, unless India's private sector comes in. Private capital and enterprise is necessary to rectify the current situation. It also means that the government will first have to acknowledge the shortcomings of current policies (SATCOM and Remote Sensing Data) and amend them.

Developments in artificial intelligence (AI) and Big Data analytics has led to the emergence of New Space – a disruptive dynamic driving the space sector to a more business and services-oriented approach using end-to-end efficiency concepts. New Space entrepreneurship has emerged in India with about two dozen startups who are dissatisfied with the traditional vendor-supplier model but see value in exploring end-to-end services in the B2B/B2C segment. These startups have come up during the last few years but have yet to take off in the absence of clarity in regulations. In the traditional vendor-supplier model, private-sector entities cooperated with ISRO for reasons of national pride but ISRO business did not comprise a significant proportion of their overall turnover. For Larsen & Toubro, for instance, which builds solids and interstages for launch vehicles, the ISRO business of US$14-20 million is a small fraction of their annual US$20 billion turnover. The situation will be different for New Space entrepreneurs and therefore needs a new model.

Many of the New Space startups see a synergy with the government's flagship programmes like Digital India, Start-Up India, Skill India and schemes like Smart Cities Mission. Demand for GIS applications exists in many areas and will only grow as Earth Observation data gets integrated into the digital economy. These areas include infrastructure monitoring, crop insurance, watershed development, forest fires and flood monitoring and forecasting, and asset mapping. These startups see an opportunity as a data-app builder between the data seller (ISRO/Antrix) and the end-user, taking advantage of the talent pool, innovation competence and technology know-how, provided there is an enabling eco-system. This needs a culture of accelerators, incubators, venture capitalists and mentors; these are now emerging in certain cities in India.

Equally important is the setting of clear rules and regulations. In 2017 a draft Space Bill was discussed in Parliament but failed to pass and lapsed. The bill sought to retain the dominant role of ISRO as operator, licensor, user, rule maker and service provider. ISRO needs to take a look at how Apple and Google made their platforms (iOS and Android) available to independent players for App development. These millions of Apps created by independent players have revolutionised smartphones and are now transforming media, entertainment, payments, and other areas of digitisation.

CONCLUSION

As outlined in this brief, the administrative structure for space science and technology in India is similar to the one adopted for nuclear science and technology. The space sector must now move on a different path. The Atomic Energy Act of 1962 places all nuclear materials, activity and technologies firmly under the purview of the Department of Atomic Energy (DAE). The Secretary of the DAE (under the direct charge of the prime minister) is the ex-officio Chairman of the Atomic Energy Commission which oversees the DAE. Even after the separation of the civilian and strategic nuclear fuel cycle and its activities, the same person controls both. This approach has resulted in the comparative absence of the private sector in DAE's activities, except as Tier2/Tier3 suppliers. This posed little challenge to the nuclear sector, as priority has always been accorded to the strategic dimension of the nuclear programme. The absence of the private sector in setting up and operating nuclear power plants has never been perceived as a major shortcoming.

The situation with ISRO is different. ISRO is primarily a civilian organisation and is best placed to concentrate on the challenge of national development while letting MoD look after the military dimensions of space technologies. ISRO can continue to fabricate and launch satellites for MoD but then it should be handed over to the Defence Space Agency. ISRO, with its budget of US$1.3 billion and Antrix with a turnover of US$300 million, need to unleash the potential of the private sector if India aims to achieve 10 percent of the global space economy by 2030. This means moving from the current levels of US$7 billion to over US$70 billion. While this may be achievable, ISRO must shed some of its activities and focus on what it can do best with its limited budgets. It may also need to cut the umbilical link with Antrix to avoid conflicts of interest caused by overlapping roles of supplier, intermediary, policy formulator and arbitrator. This is where ISRO needs to part ways with the DAE administrative architecture. It should look for a Space Activities Bill that embraces its partnership with the private sector, particularly with the entrepreneurial players in New Space.

A vibrant startup culture is emerging in India on the heels of the IT boom making use of data, mobile telephony and identity-based Aadhar. With more than 30000 startups today, India boasts of a score of unicorns. Years ago, ISRO launched the idea of Village Resource Centres to work in collaboration with local Panchayats and NGOs but only 460 pilots have begun. Expanding this is a formidable challenge but has the potential to transform rural India if properly conceived as a part of the India Stack[15] and the Jan Dhan Yojana.[16]

New Space startups have been nurtured by both the US space agency NASA and the European Space Agency by using the incubator approach; this can be explored by ISRO. Moreover, ISRO needs to develop Tier-1 vendors and original equipment manufacturers. Fortunately, there is movement in this direction. There is the idea of commercialising the tried and tested PSLV launch technology. A small satellite revolution is underway. Globally, 17000 small satellites are expected to be launched between now and 2030. The number of global space launches has more than doubled over the last three years, with SpaceX leading the way with lower launch costs. ISRO is also developing a small satellite launch vehicle (SSLV) expected to be ready this year. Designed with a capability to place a payload of 500 kg in a low earth orbital of 500 km, the SSLV is aimed at the commercial small satellite launch market. It is a prime candidate, along with the proven PSLV, to be farmed out to the private sector. This will require giving private entities responsibility for AIT activities.

India needs a suitable Space Activities law backed by appropriate rules and regulations. This will support and enable the growth of the current US$7-billion space economy to a US$70-billion-dollar space economy by 2030, as the country aims to become a major space power. ORF

ABOUT THE AUTHOR

Rakesh Sood is a Distinguished Fellow at Observer Research Foundation.

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20, Rouse Avenue Institutional Area, New Delhi - 110 002, INDIA
Ph. : +91-11-35332000. Fax : +91-11-35332005.
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