India's Evolving Space Concerns and Policy

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Introduction

India's space programme has come a long way since it launched its first US made 'Nike Apache' sounding rocket in November 1963. As India expands its strategic interests and becomes a more influential power in the Indo-Pacific and beyond, how India shapes its policies and programmes on strategic technologies is of understandable interest. India's approach to outer space is one such area. It has seen important policy shifts, along with the expansion of its space programme. How India positions itself will have important implications on a number of issues including the governance of outer space.

When India began its space programme six decades ago, interplanetary or space exploratory missions were not part of the Indian agenda. Neither did India conceive of using space for military and security-related functions. But India has had to adapt its space programme in line with the drastic changes taking place in India's neighbourhood. In addition, other global developments have been important in driving the changes in India's approach to space, which began to see some changes in the late 2000s after China conducted its first successful anti-satellite (ASAT) test in January 2007. This was a wakeup call to the kind of threats that India should be prepared to deal with, one which continues to worry Indian security planners. In March this year, the Indian Air Force (IAF) Chief, Air Chief Marshal V R Chaudhari remarked that India should "develop both offensive and defensive space capabilities to safeguard our assets."[1] He emphasized this in the context of China's aggressive pursuit as well as deployment of an entire range of counterspace capabilities including ASAT weapons—both direct-ascent and co-orbital systems—as well as directed energy weapons (DEWs) and electronic jammers. He also remarked that "with 'on-demand launch' becoming the new normal and growing exploitation of it by private and military stakeholders, space has definitely become the ultimate high ground."[2] Citing the examples of Indian entrepreneurship such as that of Pixxel and Skyroot, the Indian Air Chief added that "It is pertinent that we develop such technology in-house. We can envision indigenous space technology capabilities and affordable access to space for a range of applications in the near future. However, we must be cognitive of the technology to be within the contours of national policy, security and objectives." He also called on the Indian industries to step up capability development across a number of weapon-types including DEWs, lasers, and hypersonics that are seen to "have significant advantages over existing ones in terms of precision, cost, logistical benefits and low detectability."

Nevertheless, even after the Chinese ASAT test, Indian space policy continued to vacillate somewhat, though there now appears to be greater clarity in India's approach to space policy. For one, driven by national security considerations, India is making a more determined push towards securing its space interests. This is an important shift, moving from its traditional policy approach that was driven by morality and principles such as non-militarization of outer space. For another, technological advancements in space have provided useful solutions in addressing terrestrial security challenges also, with a growing role for space assets. But the most consequential change is China's rise and the growing

India-China rivalry that have become compelling reason for change in India's approach to space.

This paper will outline some of the major shifts in India's space approach and the factors that have contributed to these shifts. This will be done by, first, providing a brief overview of the evolution of the Indian space programme, followed by a section on the fairly distinct recent changes in India's space programme. The third section will detail how these changes will drive India's future space trajectory.

India's Space Programme: Early Decades[3]

India's constraints, including resources and technology, shaped the early Indian approach to outer space. India, as a poor post-colonial state, faced many social and developmental challenges. Thus, when the India's civil space organisation, the Indian National Committee for Space Research (INCOSPAR) (forerunner to the currentISRO, the Indian Space Research Organisation), began the Indian space programme, it was done with the main goal of addressing these social and economic development requirements. The objective at this point was not space exploration or interplanetary missions. For the same development-oriented reason, India also articulated a policy of non-weaponisation of space and indeed insisted on the peaceful uses of space. For example, the Sarabhai profile, an early outline of Indian plans for the space and nuclear power sectors, emphasized the use of these technologies for India's economic development.

However, it must also be noted that the political and scientific leadership of the time clearly understood the importance of technology development and demonstration, especially in strategic areas such as nuclear and space. The Indian leadership acknowledged the importance of space and nuclear pursuit as a way to secure a seat at the global high table and be part of exclusive global technology clubs. The Indian leadership also did recognize the importance of space in the context of India's national security, but this was not given much attention until about two decades ago.

Some of India's early focus areas in space included developing effective telecommunication within the country. Being a geographically vast country, this was a pertinent issue and led to the development of the Indian national satellite (INSAT) series, which is now one of the largest domestic multipurpose satellite systems in the Asia-Pacific. This series of satellites, which includes nine operational communication satellites placed in geo-stationary orbit, played a significant role in telecommunications, television broadcasting, satellite news gathering, weather forecasting, disaster warning, and search and rescue missions.[4]The INSAT series has more than 200 transponders in the C, Extended C and Ku-bands and provides multi-sectoral services.[5]ISRO's communication satellite system includes the INSAT as well as the subsequent GSAT series.

A second area of emphasis was remote sensing or earth observation satellites, which offers services to both regional and global customers. Remote sensing satellites are equipped with state-of-the-art cameras that capture images of the Earth in different resolutions, bands and swaths.[6] Today, India hosts one of the largest constellations of remote sensing satellites in operation, for a variety of applications including agriculture, water resources, urban

planning, rural development, mineral prospecting, environment, forestry, ocean resources and disaster management.[7]

A third area of focus for the ISRO was satellite launch vehicles or rockets. India began this journey in the late 1970s, with the first successful test of its satellite launch vehicle (SLV) in July 1980. Thereafter, India went on to develop the Augmented Satellite Launch Vehicle (ASLV) that could launch payloads weighing up to 150 kg into the low earth orbit (LEO). But the ASLV was not a great success and the ISRO discontinued both the ASLV and the SLV to focus on rockets that could carry bigger payloads. This led to the development of the Polar Satellite Launch Vehicle (PSLV) and Geosynchronous Launch Vehicle (GSLV).

The PSLV is today considered a tried and tested workhorse of the ISRO. The PSLV rocket is capable of carrying a satellite payload of up to 1600 kgs to sun synchronous orbit and 1050 kg satellites in geosynchronous transfer orbit. The PSLV rocket has undergone several modifications to suit the scale of the mission, to improve the payload carrying capacity or to improve the overall thrust and efficiency of the rocket.[8] In fact, India used the PSLV rocket for two prestigious missions – Chandrayaan-1 in 2008 and Mars Orbiter in 2013. Thereafter, India went onto develop its GSLV rockets, which can carry even bigger payloads. GSLV is an important success for India also because India can now stop relying on foreign space agencies for the launch of its heavier payloads. Until the GSLV became ready, India was launching its bigger payloads on the French Arianespace. India currently has started operating GSLV Mk III for launching very heavy communication satellites into Geosynchronous Transfer Orbits (GTO). However, India's GSLV is still a moderate-sized rocket if one were to compare with other heavy rockets of the more established space powers. Thus, India is still some ways behind the other major space powers in heavy-lift capability.

A Small but Ripened Space Programme

India's space programme by the late 2000s had matured to a level that it began to expand to some of previously unchartered areas, such as space exploration, purely for the pursuit of science. This was a natural progression in some ways because it was the result of India's continued advancements in space technology. Some of the high-profile missions of this type include India's Moon mission, called the Chandrayaan, and the mission to Mars, called the Mangalyaan. Both of these were more like technology demonstrators that could undertake some complex missions. Nevertheless, the fact that India managed to get it right on the very first attempt in its mission to Mars was remarkable. It gave the ISRO and the broader Indian scientific community greater confidence in what they could achieve. But these missions brought in both positive accolades and negative aspersions on India's space programme.

India launched its first Moon mission, Chandrayaan 1, in October 2008. This involved sending an orbiter around the Moon. Lunar missions are still undertaken only by handful of countries, which put India in a very select class. For ISRO, the mission was also about generating renewed interest in science and engineering and a broader STEM focus.[9] One of the most significant scientific achievements of the mission was the discovery and confirmation of water molecules on the Moon. The ISRO had used the Minerology Mapper instrument developed by NASA for this. In addition, the mission had carried 11 scientific payloads from several countries including the US, the UK, Germany, Sweden and Bulgaria.

India's successor Moon mission, Chandrayaan 2 in September 2019 was not entirely successful. The Chandrayaan 2 was intended to soft land on south polar region of the Moon. This was the first time that India was attempting to land on a non-terrestrial surface.

The second major scientific mission that India undertook was the ISRO's mission to Mars, Mangalyaan, in September 2013. This was India's first interplanetary mission, and that India became the first Asian country to achieve this was another achievement. It was also politically and strategically important because China and Russia had launched a joint Mars mission in November 2011, but because of a malfunction, the craft did not leave the Earth's orbit. Subsequently, the Russian and Chinese spacecraft – Fobos-Grunt and Yinghuo-1 burnt up in Earth's atmosphere.[10] While the Indian mission was more successful that the Sino-Russian one, Mangalyaan was significantly less advanced than the US' NAVEN mission. The mission goals and the scale of these two were vastly different.[11]For India, Mangalyaan was more of a technology demonstrator than a routine scientific mission with major scientific goals, beyond reaching Mars. But it must also be noted that the ISRO put together the mission in such a way that it was complimentary to the missions undertaken by other countries, thereby facilitating a greater understanding of the planetary system.

In addition to the growing sophistication of India's space technology, these missions can also be seen as a response to the changing space politics in the Indo-Pacific and beyond. In fact, competition between states in outer space has clearly returned, similar to the rivalry seen during the Cold War between the US and the USSR. In addition, these missions have given the Indian space programme greater prominence, bringing some indirect economic benefits. Having witnessed the Indian ability to undertake complex missions such as the Mangalyaan, more and more countries find India as an attractive destination for satellite launches, thereby enhancing the commercial worth of the Indian space programme.

An important issue facing the Indian space programme has been that of cost versus benefits. On the positive side, the Chandrayaan and Mangalyaan missions gave greater visibility and raise the profile of the Indian space programme as an efficient, cost-effective space programme that could deliver on major programmes despite India being a developing country operating with a small space budget. For many developing countries around the world, India became an aspirational model in terms of their space goals and what they could possibly achieve with small budgets. On the negative, many from around the world as well as within India questioned whether India was engaging in the pursuit of prestige missions when it could use those resources for addressing the large developmental challenges that the country faces. There are, after all, still millions of Indians living below poverty line. Such criticisms are not new, having dogged the Indian space programme for decades. But for New Delhi, the choice may not necessarily as simple. Indian decision makers have seen advanced technology as a necessary component of India's development from the very beginning. In addition, they have also increasingly recognised that some of these missions are necessary for India for it to have a voice in global governance debates. So, gaining a seat and influence at the hightable, which comes along with a demonstration of its space prowess, has also been an important consideration for India. Finally, with the changing security dynamics in the region, India is forced to do a fine balancing act between its multiple agenda.[12]

India's next major space mission is its first crewed space mission, Gaganyaan to be undertaken in late 2024. Until a few years ago, a crewed space mission was not a priority for the ISRO since the ISRO did not think it had much to gain in terms of technological spin-offs from such missions.[13] However, this has changed. A successful crewed mission is now seen as important because it will put India among the world's leading space powers. The ISRO had been engaged in various technological developments that would facilitate such missions.[14] But a major impediment for the slow progress has been lack of adequate financial resources. ISRO reportedly used around INR 600 million rupees from its internal R&D budget to develop some of the technologies.[15]The mission was initially scheduled for 2022 to coincide with India's 75th year of Indian independence, but Covid-19 pandemic created major disruptions.[16] According to the government, because of "lockdowns,disruptions in raw material supply chain from foreign sources anddelays in hardware realization from industries," the mission has been pushed to the last quarter of 2024.[17]According to Dr. Jitendra Singh, Minister of State in the Prime Minister's Office, the mission cost as on 30 October 2022 is INR 3,040 crore, which has already allocated for various activities towards the mission.[18]

Global Governance of Space: Indian Policy

As the Indian space programme evolved, India was also an active participant in the global governance debates. But India is yet to have an open, declared space policy, which has also meant that India's space policy articulations have to be decoded through its public statements at various international platforms or in the Indian Parliament. In the early decades, New Delhi used UN-related multilateral platforms to convey its policy positions, especially its unambiguous view that space must be used for peaceful purposes only. India repeatedly stated its opposition to militarization of outer space. India was particularly vehement in its criticism of the US 'Star Wars' programmes as well as the ASAT tests that the US and the USSR conducted in the 1970s and 1980s. Pursuing this opposition, the Indian Ambassador at the Conference on Disarmament in Geneva in 1985 called for "negotiations to prevent an arms race in outer space."[19] In 1985, Indian Prime Minister Rajiv Gandhi sponsored a declaration of six non-aligned countries opposing an arms race in outer space and nuclear testing.[20] India's policy position did not alter much until the early 2000s.[21] Even as recently as 2003, an Indian official stated India's opposition to militarization of outer space, and saying that "we must recognise the necessity for world's space community to avoid terrestrial geo-political conflict to be drawn into outer space, thus threatening the space assets belonging to all mankind."[22] The Indian official went on to add that "we would not like to see outer space weaponised as a consequence of the ongoing revolution in military affairs, a development which has then to be chased by follow-on disarmament measures." Much of these Indian space policy position were driven by ethical and sovereignty-related concerns. As Raja Mohan has noted, the Indian positions and debates in the 1970s and 1980s were more focused "on strengthening state sovereignty." In fact, India and several developing countries even "sought to limit the use of direct broadcast satellites based in outer space." India wanted to include concepts like non-discriminatory, comprehensive and universal disarmament even in outer space debates, essentially a reflection of the morality-based concerns driving the Indian thinking on space governance and nuclear issues.

The earlier policy approach worked well for India when India's threat perceptions were quite different. But growing security threats including in outer space and the changing balance of power have created new insecurities for India in the Indo-Pacific and beyond. This has compelled India to take more pragmatic approaches that are more in consonance with India's security calculations than its earlier ethical principles.

In one of the first instances of India's changing position on military space capabilities and missile defenses, India expressed support for the US President Bush's missile defense speech in May 2001. India came to adopt a more calibrated and nuanced approach, one driven by the new threat scenario in the Indian neighbourhood. Specifically, India was beginning to develop an interest in Anti-Ballistic Missile (ABM) systems and technology because of the proliferation of missile technology from China to Pakistan. This was a significant shift, from being one of the fiery critics of the US and the USSR in the 1970s and 1980s to appreciating the utility of the missile defense in 2001. India's ASAT test in March 2019 capped this transition. The test was a clear demonstration of the distance that India has traversed in the last two decades on its approach to space security. This transition was a reluctant one, and clearly owed to the growing space security threats, especially those that emanate from China in the form of ASATs and China's other counterspace capabilities.

While the rapidly changing space security scenario pushed India to develop its own capabilities as a deterrent measure, the changes also involve developing closer defence and strategic partnerships with the US and US allies such as Australia and Japan. The Quad joint statement in 2022, for instance, states that the four countries – Australia, India, Japan and the United States – will consult each other on the rules of road governing outer space.[23] India has also strengthened relations with traditional space partners such as France, including to establish consultations on how to regulate activities in outer space that can impede uninterrupted access to space. This represents a major shift in India's position on global governance of outer space. Traditionally, India partnered with G21 (Group of 21, mostly non-alignment countries) in articulating its traditional position that there should be legally binding verifiable mechanisms that govern activities in outer space. For India to agree to be part of small exclusive groupings like the Quad and outline common principles with such groups represents a remarkable turn-around in a very short period of time. This speaks to how much Indian global partnerships and attitudes have changed as a consequence of the security pressures that New Delhi perceives from China.

Space for National Security

Thus, one of the most important shifts in India's approach to space is the change in its attitudes towards outer space in the national security context. This change is reflected in its space programme as well as in the policy direction and institutions that can bring about greater coordination between the civilian bureaucracy and the armed forces. It must however be added that India's formal policy articulation, such as it is, has not changed that much. But India is using different platforms to convey a more careful and nuanced approach to space governance. As mentioned earlier, one of the more concrete examples of this is India's position within the Quad on space governance issues. More importantly, this change is reflected in what India is doing than its rhetoric. Despite the continuing official policy of non-militarization of space, India's ASAT test was a demonstration of the capability mix that India is developing in order to defend its interests in space. Therefore, even as the rhetoric

may not sound that different from its earlier policy iterations, India appears to be taking a more determined approach to protect its assets in outer space as well as the ground infrastructure and services connected to space. India's changed space approach is also leading it to develop appropriate deterrent measures to prevent any disruptions to its space activities. There are also growing calls for India to develop counterspace capabilities to increase the credibility of its deterrent measures. Thus, while Indian ASAT test did raise questions about whether India has given up on its policy of non-militarization of space, the reality is somewhat more complex. This is somewhat analogous to the nuclear realm, where India continues to reiterate its desire for nuclear disarmament despite also conducting nuclear weapon tests in May 1998, which New Delhi saw as necessary for it to address the complicated security scenario in the neighbourhood, especially China-Pakistan nuclear cooperation.

India's policy changes in the space domain are also in tune with some of the broader changes within India. India has been making efforts to integrate with the global non-proliferation architecture and move away from being part of the problem to being part of the solution. This effort has seen India now become part of almost all of the global export control regimes – Australia Group, Missile Technology Control Regime and the Wassenaar Arrangement – except the Nuclear Suppliers Group (NSG), which is unlikely to come through because of China's opposition to India's membership. With India's growing role beyond its immediate neighbourhood and as a country that has developed many of the strategic technologies, India is keen to play an active role in how the global rules and norms are shaped, in outer space as well as in nuclear issues.

But many of the policy shifts and capability development within the space domain have not easy for India. India has oscillated on this for quite some time, since such policy changes began to become evident in mid-2001 when the US walked out of the Anti-Ballistic Missile (ABM) Treaty. India went back and forth and has not been comfortable in altering its traditional position of non-militarization and non-weaponization of space. In fact, Prime Minister Vajpayee's enthusiastic support for Bush's Missile Defense speech in May 2001 invited sharp criticism domestically, and therefore India moved back once again to its old comfortable position that space should be used for peaceful purposes alone. But growing concerns about increasing missile threats in India's neighbourhood, especially Pakistan's expanding ballistic missile capabilities, became an important imperative for change. Finally, China's ASAT test in January 2007 pushed India to embrace some big changes in its space policy. While China may be boosting its civilian and military space programmes with a focus on the United States, the reality is that Beijing's growing space prowess has consequences for India and other Indo-Pacific powers. China's growing space capabilities in the last two decades has pushed India to do more both in the civilian and military sectors. India's focus on space exploration and interplanetary missions is also a possible response to China's growing achievements in space. As the India-China competition intensifies, India is likely to continue its policy changes along with capability development, neither of which may be entirely peaceful.[24] As a consequence, India space programme has increasingly been developing a security component.

This can partly be witnessed in some important institutional changes that India has been making. Within the military space sphere, the Indian government first set up an Integrated

Space Cell within the Integrated Defence Staff of the Indian Ministry of Defence in June 2010. This was an important step in creating better coordination between the civilian departments and the Indian military in terms of developing greater understanding on the service requirements of space and a common threat perception in the space domain. In 2019, the government went on to establish a Defence Space Agency (DSA), seen as the possible frontrunner to a full-fledged aerospace command.[25] The Indian armed forces have demanded an aerospace command for about two decades now, but different governments have put off the idea of a full command so far. The DSA is a tri-service institution under the command of the Indian Air Force. An Indian official was quoted as stating that the DSA (like the other two tri-service institutions on cyber and special operations) is "a small beginning to inject jointness and synergy" among three services. The DSA will essentially bring together some of the existing institutions such as the Defence Imagery Processing and Analysis Centre (DIPAC) based in Delhi and the Defence Satellite Control Centre in Bhopal.[26] The DSA, headquartered in Bengaluru in southern India, will be responsible for running the space warfare and satellite-based intelligence assets of India.[27] Soon thereafter, India also established a Defence Space Research Organisation (DSRO), akin to the Defence Research and Development Organisation (DRDO). The DSRO was given the responsibility for all the research and development on the kind of capabilities that are required to implement the strategy formulated by the DSA.[28]Also, in a first, India conducted a space security table-top exercise titled "IndSpaceEx" that saw the participation of different stakeholders including the military, the technical and scientific establishment, and the civilian bureaucracy to conceptualise the emerging space security scenario and how India should be prepared to deal with them. The IndSpaceEx also was a demonstration of the increasingly coordinated approach between India's space agencies and the military.[29]

In other policy changes, in order to augment India's space competitiveness, the Indian government has made allowance for a critical actor – the private sector – to contribute to India's space growth. While the ISRO has done reasonably well so far, the growing demand on India's space programme clearly cannot be met by the ISRO alone. Given that India has been blessed with a talented private sector in the form of start-ups, small and medium size enterprises, as well as big established industrial houses, it will be a pity if India did not utilize those capabilities to spur India's space power. India is still at a nascent stage in its embrace of the private sector, but the government announcements over the last couple of years to provide a larger opening in the space ecosystem for the private sector is likely to strengthen India's space capabilities. In order to facilitate greater private sector participation, the government has established institutions such as Indian National Space Promotion andAuthorization Centre (IN-SPACe) and New Space India Limited (NSIL). IN-SPACe has emerged as the single window processing agency for "usage of dedicated ISRO facilities by Non-Government Entitiesengaged in space activities."[30]

Recent success stories involving private sector actors including Pixxel and Skyroot can help India's space capacities. This is important for two reasons – first, in order to address India's own growing demand including for the military and two, to capture a sizeable chunk of the global commercial space market. Given that Indian private sector appears relatively much more efficient and energetic than the public sector, the trend towards bigger private sector participation including start-ups and small and medium size enterprises is likely to continue. The mushrooming of young talent in India primarily comes from ISRO's own initiatives such

as the Indian Institute of Space Science and Technology (IIST) in Kerala. The ISRO may have engaged in such programmes of talent creation for its own benefit, but many of the most talented that come out of such institutions, even if initially working with ISRO, are seeking more independent opportunities and setting up their own start-ups that can feed into the Indian space requirements. The ISRO was in the beginning not very enthusiastic about accepting such talent from the private sector, but recent government steps are facilitating a bigger role for them. Skyroot Aerospace's recent success in working with the ISRO has resulted in huge expectation for the private sector in the country's space programme. The private start-up firm created history when ISRO partnered with it to launch India's first privately built rocket, the Vikram-S.[31] Earlier, Alpha Design Technologies, a Bangalore-based medium-size enterprise was contracted by the ISRO to build a satellite for India's indigenous NAVIC navigation system.[32]This is not to suggest that the ISRO had never engaged the private sector prior to these recent engagements. In fact, some of India's large industries such as Larsen & Toubro, Godrej, and Walchandnagar had received contracts from ISRO to develop specific systems and components for the Indian space programme. However, this was limited because these were components that was entirely designed by the ISRO, with the private sector responsible only for fabrication. Outsourcing and contracting out to the private sector had remained the ISRO way but the new start-ups and smaller firms are also engaging the ISRO successfully. The recently set up institutions such as the NSIL is likely to be able to facilitate ISRO and such smaller private firms working together.[33]

Conclusion

India's space programme has gone through some major transformations in recent decades. A space programme that had modest beginnings with assistance from international partners such as the US, France and the Soviet Union, India's space programme matured to one that is comprehensive with a fairly sophisticated rocket launch capability and major space exploratory programmes to its credit. The most significant change in terms of the programme and policy has been its national security aspects, which is quite new for India. After being a vehement critic of the US and the USSR for their military space programmes and ASAT tests, India finally acknowledged the utility of such systems in a rapidly changing geopolitical context of the Indo-Pacific. Unfortunately, outer space has not remained untouched by the terrestrial security competition and rivalry. And in the absence of clear rules, regulations and norms, India cannot afford to ignore the unbridled competition that is going to be adversely impacting India. The current state of global politics and tense great power relations suggest that it is unlikely that new rules of the road will be formulated any time soon. Thus, the new security compulsions have compelled India to be realistic and adapt to the evolving security conditions in outer space and focus on developing appropriate deterrent measures.

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