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Beyond Earth, Within Reach: Human Spaceflight and Societal Impact in India

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Abstract: India is preparing to place its own astronauts (vyomnauts) in orbit on an indigenous vehicle. This article examines what that ambition means for India's society, economy and international standing, and why it can be read as a reflection of the country's development framework. It first traces the evolution of Indian human spaceflight through five phases: developmental foundations (1962-1979), the 'Interkosmos' flight of 1984, a long period of capability-building without a crewed mandate (1990s-2013), the decision and design phase of 2014–2019, and the testing and diplomacy phase of 2020 to the present. It then surveys the future roadmap, which runs from the Gaganyaan test series through a national space station to a crewed lunar landing by 2040. Drawing on theories of sociotechnical imaginaries, the capability approach, mission-oriented innovation, embedded autonomy and soft power, the article analyses five channels of societal impact: technological and industrial capability, education and aspiration, the space economy, governance and safety culture, and the feedback to space-enabled development services. It assesses India's geopolitical position in relation to China, the United States, Russia and the wider Global South. Finally, it argues that India should pursue human spaceflight not as a prestige exercise but as an expression of a development model that links indigenous capability, institutional competence, human-capital formation and strategic autonomy. The article also engages the strongest objections, chiefly opportunity cost, prestige-seeking and risk, and proposes policy principles for a human spaceflight programme that is accountable, inclusive and developmentally anchored.

Keywords: Human Spaceflight, ISRO, Space Diplomacy, Indian Astronauts, Gaganyaan, Bharatiya Antariksh Station, Development

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1. Introduction

On 3 April 1984, Squadron Leader Rakesh Sharma lifted off from Baikonur aboard a Soviet Soyuz T-11 mission spacecraft, as part of the Soviet Interkosmos program, and became the first Indian citizen to journey into space. When asked by the Prime Minister, Indira Gandhi, how India looked from orbit, his reply '*Saare jahan se accha*' (Better than the entire world) would eventually enter and capture national memory. Four decades later, Group Captain Shubhanshu Shukla who flew to the International Space Station on a SpaceX Dragon spacecraft as part of the Axiom mission 4 on 25 June 2025, became the second Indian citizen to reach space and orbit the Earth. Between these two flights lies a long and instructive gap of India's space program. Over time, India built a world-class launch and satellite capability, reached the Moon and Mars, and became the fourth country to demonstrate spacecraft docking. Yet it had not independently launched its own astronauts into orbit on its own launch vehicle.

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That changed when the Gaganyaan mission was announced on August 15, 2018. The Gaganyaan program, which is India's first human spaceflight programme, has since expanded to include a national space station, which ultimately aims to give India an independent human spaceflight capability. If it succeeds, India will join the United States, Russia and China as the fourth country to launch a crewed spacecraft of its own (Britannica, n.d.). The decision to pursue this capability is a political, economic and cultural choice as well as an engineering one. A programme that will cost tens of thousands of crores of rupees invites the question that has followed Indian space activity since its beginnings: what does a developing country with persistent human-development deficits gain from sending people to space?

This article answers that question in four steps. First, it reconstructs the history of Indian human spaceflight as a succession of deliberate choices, each shaped by the political economy of its time. Second, it outlines the programme's future ambitions and the state of play as of October 2026. Third, it analyses the societal and geopolitical impact of the programme using a set of theoretical lenses. Fourth, it argues that human spaceflight is a justified and necessary element of India's development strategy, provided it is governed in ways that keep it anchored to public purposes.

The article's central claim is that human spaceflight should be understood as a 'reflector' of a development framework rather than a departure from it. A country's ability to send people safely to orbit and return them depends on what it has built beneath the rocket: scientific institutions, a capable industrial base, reliable public administration, trained personnel and a culture of accountability. A crewed programme is therefore both a test of national capability and an instrument for strengthening it.

2. Methodology

This study adopts a mixed-methods qualitative research design that integrates institutional document analysis, theory-driven thematic synthesis, and digital netnography to evaluate the developmental, symbolic, and geopolitical trajectory of India's human spaceflight program. The methodology links the theoretical frameworks outlined in Section 3 - specifically sociotechnical imaginaries (Jasanoff & Kim, 2009, 2015), the capability approach (Sen, 1999), culture and the capacity to aspire (Appadurai, 1994), mission-oriented innovation (Mazzucato, 2013, 2018), and embedded autonomy (Evans, 1995) - directly to empirical evidence collected from policy records, technical reports, and digital media environments through October 2026.

For the conceptual framework (Section 3), the study conducted a targeted literature review across four interdisciplinary domains- Science and Technology Studies (STS) and Cultural History, Development Economics and Innovation Studies, International Relations and Space Policy and Indian Space History.

Primary documentary sources were collected and systematically categorized to trace institutional decision-making across the four historic phases of Indian spaceflight (1962–2026). They include State and Cabinet documentation like Department of Space (DoS) Annual Reports (1970–2026), Lok Sabha and Rajya Sabha parliamentary question logs, Cabinet Secretariat approval notes (including the December 2018 Gaganyaan sanction and September 2024 BAS-1 expansion), and the *Indian Space Policy 2023.* As well as technical mission publications from ISRO and Human Space Flight Centre (HSFC) technical bulletins, mission brochures, and press kits covering validation tests (SRE-1, CARE, TV-D1, SpaDeX autonomous docking, and main parachute air drop tests).

Lastly, to capture contemporary public reception, media framing, and real-time commentary surrounding recent milestones - such as Group Captain Shubhanshu Shukla's Axiom-4 mission to the ISS and preparations for the uncrewed G1 flight - the study employed netnographic methods. This includes mainstream technology and defence news portals, digital archives and institutional handles and public science and community forums. A digital news media corpus was gathered across national and international technology and defense journalism outlets (*The Hindu, The Indian Express, Press Trust of India, Ars Technica, SpaceNews*) covering August 2018 through October 2026. Publicly accessible commentary on digital platforms (such as X/Twitter updates from space journalists, official

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YouTube live-stream chats during test launches, and dedicated space forums like *r/ISRO* and *NASASpaceFlight*) was observed to track how civic identity, public trust, and risk perceptions manifest in real time.

3. Conceptual Framework

3.1. Human spaceflight as a sociotechnical and symbolic project

Jasanoff and Kim (2009, 2015) define sociotechnical imaginaries as collectively held and institutionally stabilised visions of desirable futures made attainable by science and technology. And as such, human spaceflight is an unusually potent site of such imaginaries because it places a human body, and therefore a national identity, inside the technology domain. With reference to established global human spaceflight narratives, McCurdy (1997) shows that American spaceflight drew on and nourished a broad cultural narrative about frontier, progress and destiny, whereas Nye (1994) describes the 'technological sublime' through which engineered grandeur becomes a source of civic identity. Furthermore, a closer reference to human spaceflight perspectives from the astronaut personification informs us, through White's (1987) account for instance, of the 'overview effect' which suggests that seeing Earth from orbit can alter an astronaut's sense of planetary belonging, a theme that has often been mobilised in public narratives about spaceflight.

While western human spaceflight narratives have constructed such discourse, in the Indian context, astronauts appear to function primarily as embodied symbols of national aspiration, a pattern visible from Sharma's 1984 flight to the present. A closer examination reveals that in India this symbolism has attained a distinctive grammar. Sarabhai's (1974) founding vision rejected prestige competition with the superpowers and insisted that space technology should serve national development. Whereas Chatterjee (1993) and Prakash (1999) opine that Indian nationalism has always sought to reconcile technological modernity with cultural authenticity. So currently, human spaceflight pursuits in India challenge the older, strictly instrumental view of space, because according to that framework the astronauts do not 'serve' development in an obvious way that terrestrial space applications would for the society. This tension appears to run through for most of the Indian space history until the Ganganyaan mission was announced, which is still however not fully cognizant or incorporated into Indian public imagination.

3.2. Development frameworks: capabilities, missions and embedded autonomy

Four bodies of development theory help interpret the programme.

a) **The capability approach**: Sen (1999) argues that development should be understood as the expansion of the substantive freedoms people have reason to value, not merely the growth of income. This implies that aspiration, knowledge and opportunity are development outcomes in their own right, and that a national project that widens what citizens can imagine and become has developmental significance. Sen's later work with Drèze (2013) also supplies the strongest critical argument: that India's priorities have sometimes neglected basic human capabilities, such as nutrition, health and schooling, and that high-technology prestige projects ought to be judged against these deficits.
b) **Mission-oriented innovation**: Mazzucato (2013, 2018, 2021) argues that the state/Government has historically been the entrepreneurial actor behind transformative technologies, and that ambitious missions with clear goals can mobilise investment, coordinate actors and generate spillovers across sectors. Here, NASA's Apollo mission is the canonical example that demonstrates how human spaceflight, as a mission with an unambiguous and measurable objective, can accomplish larger development goals. This same narrative is now unfolding for India's Gaganyaan mission as well.
c) **Embedded autonomy:** Evans (1995) argues that effective developmental states combine bureaucratic autonomy with dense links to industry and society. In this understanding, ISRO can be cited as a rare example of a high-performing Indian institution with technical autonomy, stable leadership and embedded relationships with industry and academia, and where a crewed spaceflight programme tests whether that institutional model can scale.

d) **Late-comer catch-up:** Amsden (1989) and Lee (2013) describe how latecomer economies move from imitation to innovation by building learning capabilities in targeted sectors. India's space trajectory, from imported sounding rockets to indigenous cryogenic engines, follows this pattern. And the latest for India's space program is that human spaceflight represents a move from catching up to reaching the technological frontier of a particular capability.

3.3. Space, status and international politics

The international-relations literature treats space capability as both a strategic asset and a marker of status highlighting space programmes as serving military, economic and prestige functions simultaneously (Johnson-Freese 2007). When looking at ISRO in Asia context, experts like Sheehan and Moltz point out that space exploration isn't just about science, but that it is heavily tied to national pride and fierce regional competition among rising Asian powers. Take China, for instance - Handberg and Li note that getting humans into space became a massive cornerstone for the country's national rebirth. This is where Joseph Nye's idea of 'soft power' comes in. It explains how high-achieving, impressive accomplishments can win a nation global influence and respect without ever needing to use force. At the same time, historian Asif Siddiqi cautions not to focus only on a tiny club of traditional space superpowers. Instead, he pushes for a broader global history that recognizes postcolonial nations as active leaders in space, rather than just followers.

4. The Evolution of Human Spaceflight in India

4.1. Developmental foundations (1962–1979)

The Indian space programme began with the establishment of the Indian National Committee for Space Research (INCOSPAR) in 1962, under Jawaharlal Nehru's patronage and Vikram Sarabhai's leadership. Soon after, in November 1963, India launched it's very first sounding rocket from the Thumba Equatorial Rocket Launching Station near Thiruvananthapuram. ISRO itself was officially born in 1969, and just a few years later in 1975, India launched its first satellite, Aryabhata, aboard a Soviet rocket (Raj, 2000; Harvey et al., 2010). Around that same time (1975-76), ISRO conducted the famous SITE program - a massive satellite television experiment that demonstrated space technology's potential for development communication (Singhal and Rogers, 1989). During these early days, sending humans into space wasn't even on the radar. In fact, Vikram Sarabhai famously argued that India shouldn't waste resources trying to race wealthy nations to the Moon or building expensive manned missions. Instead, he believed space technology should be entirely focused on solving real-world, domestic problems. That mindset shaped a unique culture at ISRO: one that was deeply practical, focused on national development, and famous for doing more with less. Eventually, all that groundwork paid off when India successfully launched its own satellite, Rohini, using a domestic rocket, the SLV-3, in 1980.

4.2. The Interkosmos flight (1984)

The Indo-Soviet agreement of 1980 offered India a seat on a Soviet mission. Rakesh Sharma, an Indian Air Force test pilot selected with a backup, Ravish Malhotra, flew aboard Soyuz T-11 and spent about a week aboard the Salyut 7 station, conducting experiments in remote sensing and biomedicine (Sharma, 2023). The flight was a work of Cold War diplomacy as much as it was for science: for Moscow it demonstrated international solidarity, and for New Delhi it brought prestige at a modest cost. Its significance for India at that time is twofold. It established the template of the astronaut as national symbol, but also showed that India's access to human spaceflight, at that time, depended on an international cooperation and foreign space agency launch vehicle. Despite the success, however, no follow-on programme was authorised in India. The 1984 flight remained a singular event, and Indian human spaceflight did not conceptualise into a national programme.

4.3. Capability-building without a crewed mandate (1990s-2013)

For three decades, ISRO built the technological foundations that a crewed programme would later require, while overtly deferring the crewed goal. The Polar Satellite Launch Vehicle (PSLV) became operational in the 1990s and grew into a reliable 'workhorse'. Geopolitics shaped the path: a 1990s

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agreement to acquire cryogenic engine technology from Russia was curtailed under Western pressure, and sanctions after India's 1998 nuclear tests reinforced the lesson that technology denial regimes constrain dependence on foreign suppliers (Harvey et al., 2010; Moltz, 2014). ISRO responded by developing an indigenous cryogenic stage rocket engine, which flew successfully on the GSLV in 2014. This history of resilience against denial is a key to understanding the later insistence on 'Atmanirbhar Bharat' (self-reliance) in human spaceflight.

During this period India also demonstrated planetary capability with Chandrayaan-1 (2008) and the Mars Orbiter Mission (2013-14). Simultaneously, most significant to human spaceflight pursuits in this era was the Space Capsule Recovery Experiment (SRE-1) in January 2007 which demonstrated re-entry and recovery of an orbital capsule, an early building block for crewed return. However, although studies of a human spaceflight programme began in the mid-2000s, the idea did not secure political approval yet, and by 2013 crewed spaceflight was reported as off ISRO's priority list. The episode illustrates how the developmental framing of Sarabhai's era continued to constrain the case for crewed missions.

While that was the case for India, in the same period elsewhere in the world, Indian-origin astronauts of other nationalities, notably Kalpana Chawla (who succumbed to the Columbia disaster in 2003), and Sunita Williams, became symbols of diasporic achievement. They broadened Indian public familiarity with astronauts, but the same familiarity was absent in its national programme.

4.4. Decision and design (2014–2019)

Three developments converged in this period. In December 2014, the Crew Module Atmospheric Re-entry Experiment (CARE), flown on the first experimental flight of the heavy-lift GSLV Mk III (now LVM3), tested a crew-module prototype's re-entry and recovery. The maturation of LVM3 gave India a launch vehicle capable of carrying a crewed capsule. And, politically, a leadership prepared to invest in national prestige and technological self-reliance emerged.

On 15 August 2018, in his Independence Day address, the Prime Minister announced that an Indian would be sent to space on an Indian vehicle by 2022, the 75th anniversary of independence. The Cabinet approved the Gaganyaan programme in December 2018 with an initial outlay of about INR 10,000 crore (Press Information Bureau, 2018). Following suit, ISRO established the Human Space Flight Centre in Bengaluru in 2019, and four Indian Air Force test pilots were selected as astronaut candidates, who were sent to the Yuri Gagarin Cosmonaut Training Centre in Russia from 2020. The training was managed under a contract signed in June 2019 between ISRO and the Russian launch service provider Glavkosmos. This human spaceflight decision combined the developmental argument with a strategic one- it was framed as an expression of national confidence and also as a catalyst for technology development. The announcement's tie to the 75th anniversary of independence also shows how deeply the programme was embedded in the political calendar of nation-building.

4.5. Testing, delay and diplomacy (2020–2026)

When the 2022 target was missed, owing to the COVID-19 pandemic, the programme steadily moved through a sequence of ground and flight tests. In October 2023, the Test Vehicle Abort Mission (TV-D1) demonstrated the crew escape system, with the crew module separating and descending under parachutes for recovery in the Bay of Bengal. In February 2024, the Prime Minister announced the four astronaut-designates, all Indian Air Force Group Captains: Prasanth Balakrishnan Nair, Ajit Krishnan, Angad Pratap and Shubhanshu Shukla. In January 2025, ISRO's SpaDeX mission demonstrated autonomous docking, making India the fourth country with this capability, a prerequisite for a space station.

In June 2025, Shukla flew as pilot of Axiom Mission 4 to the International Space Station, launched aboard a SpaceX Falcon 9, spending about two and a half weeks on the station and carrying out a set of microgravity experiments. The flight, reportedly purchased by ISRO for several hundred crore rupees, gave India operational exposure to long-duration human spaceflight ahead of its own crewed mission, and made Shukla the second Indian citizen in space after Sharma, forty-one years later. In 2023, India

also signed the Artemis Accords, a step that placed its human exploration plans within the American-led framework of lunar cooperation.

As of early October 2026, according to the sources reviewed for this article, the programme's first uncrewed test flight (G1), carrying the female-form humanoid robot Vyommitra, is expected in the fourth quarter of 2026, as stated by ISRO's chairman in June 2026. A main-parachute air drop test in July 2026 qualified the parachute system for that flight. The first crewed flight is now planned for 2027, after two further uncrewed test flights. This record of slipping schedules is itself significant: it reflects the exacting standards of human-rating and the programme's insistence, at least officially, that astronaut safety takes precedence over deadlines. So overall, Table 1 encapsulates the above-mentioned trajectory of India's human spaceflight programme from the inception of the space programme to the current Gaganyaan Mission activities.

Table 1. Milestones in Indian human spaceflight

Year	Milestone
1962–63	INCOSPAR established; first sounding rocket launched from Thumba
1969	ISRO formed
1975–76	*Aryabhata* launched; SITE broadcasts
1984	Rakesh Sharma flies on Soyuz T-11
2003	Kalpana Chawla dies in the Columbia disaster
2007	SRE-1 capsule recovery experiment
2014	CARE crew-module re-entry test; indigenous cryogenic stage flies on GSLV
2018	Gaganyaan announced and approved
2019	Human Space Flight Centre established; astronaut candidates selected
2023	TV-D1 crew escape test; Artemis Accords signed
2024	Astronaut-designates announced
2025	SpaDeX docking; Axiom-4 flight of Shubhanshu Shukla
2026–27	Uncrewed Gaganyaan test flights; first crewed mission targeted for 2027

5. Future Ambitions and Prospects

5.1 The Gaganyaan sequence

The immediate goal is a short crewed mission to low Earth orbit, flown on the human-rated LVM3 after a series of uncrewed validation flights. The test series is designed to qualify the launch vehicle, life-support systems, crew escape mechanism, re-entry and recovery operations before astronauts' fly. The programme thus follows the cautious, incremental logic of established human spaceflight powers.

5.2 The Bharatiya Antariksh Station

In September 2024, the Union Cabinet approved development of the first module of the Bharatiya Antariksh Station (BAS-1) and folded it into a redesigned Gaganyaan programme of eight missions scheduled for completion by December 2028. The expanded scope came with a total programme funding of INR 20,193 crore, including an additional allocation of INR 11,170 crore. The government has described the plan as a station of five modules, with the first module targeted for 2028 and a fully operational station expected by 2035.

The station is intended to provide a national microgravity research facility and to support the technologies needed for longer-duration missions. It also reflects a strategic judgment about the post-ISS landscape. The International Space Station is expected to be retired around the end of this decade, and China already operates the Tiangong station. A national station would secure India's access to a permanent human presence in orbit, rather than leaving it dependent on access to others' facilities.

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5.3 The 2040 lunar horizon and beyond

The official vision sets two long-range goals: an operational space station by 2035 and an Indian crewed lunar mission by 2040. The Cabinet decision of 2024 also approved a Next Generation Launch Vehicle and further robotic missions, including Chandrayaan-4, a lunar sample-return demonstration, and a Venus orbiter. These are consistent with the broader 'Viksit Bharat 2047' aspiration of a developed India by the centenary of independence.

5.4 Prospects and risks

The prospects are favourable in several respects: a mature launch vehicle, an experienced institution, political commitment, a trained astronaut cadre and an expanding private sector under the 2023 Space Policy, with IN-SPACe and NSIL created to enable commercial participation. The risks are equally clear. Schedules have slipped repeatedly. Human-rating demands a safety culture and systems-engineering discipline of a different order from uncrewed missions. Funding must be sustained across political cycles, and a single fatal accident could damage public support. These risks bear on the arguments below.

6. Societal Impact

6.1 Technological and industrial capability

Human spaceflight demands technologies that uncrewed missions do not: environmental control and life support, crew escape, thermal protection for crewed re-entry, medical monitoring, human-rated avionics and rigorous reliability engineering. Developing them domestically builds a deeper industrial and scientific base. Mazzucato's (2018) mission-oriented framework predicts that such demanding missions generate spillovers when public procurement coordinates diverse industrial actors. Gaganyaan's supply chain already involves public enterprises such as Hindustan Aeronautics Limited, defence research laboratories and private manufacturers, and it extends to parts of India's industrial ecosystem that supply precision materials, electronics and testing.

Dick and Launius (2007) caution that the measurable spillovers of spaceflight programmes are difficult to attribute and are often overstated in public rhetoric. The appropriate claim is therefore not that every rupee will return a fixed benefit but that the programme deepens capabilities (in systems engineering, materials, biomedical technology and quality assurance) with diffuse and long-term benefits across sectors, including defence, aviation, health and manufacturing.

6.2 Education, aspiration and culture

Sen's (1999) 'capability approach' and Appadurai's (1994) 'capacity to aspire' suggest that aspiration are developmental goods, and that the capacity to aspire is a future-oriented cultural capacity (Appadurai, 1994). Here, visible national achievements can widen the range of futures young people consider possible. A homegrown astronaut programme offers role models, and the 2024 naming of astronaut-designates, the Axiom flight, and school outreach around National Space Day all contribute to a culture in which science and engineering careers appear attractive and attainable. Launius (2003) shows that public support for human spaceflight in the United States has been broad but shallow, rooted in pride and inspiration rather than in specific policy benefits. Indian experience may resemble this pattern.

Cultural production also extends the effect where screen narratives about ISRO convert institutional achievements into shared national stories (Vasudevan, 2010; Kirby, 2010), especially when films and media frame these milestones as shared public stories. Human spaceflight takes this a step further by putting a person at the center of the narrative. Having an astronaut as the main protagonist gives audiences a tangible figure they can identify with and aspire towards.

However, two key challenges need to be considered. The first is representation. Because the initial group of astronauts consists exclusively of four male Air Force pilots, it creates a narrow picture of who gets to go into space. Opening future selection to women, civilian scientists, and people from diverse regional and background communities would make the space program far more inclusive and meaningful for the nation as a whole, increasing the programme's developmental meaning. The second issue is that national pride alone does not automatically create new scientists. Unless government policy actively supports this inspiration with accessible education, targeted scholarships, well-equipped labs, and qualified teachers, widespread excitement or aspiration eventually fail to translate into real opportunities for young citizens.

6.3 The space economy and employment

The 2023 Indian Space Policy and the creation of IN-SPACe opened the sector to private firms, and a vibrant start-up ecosystem has emerged in launch services, satellites and space applications. With official forecasts predicting significant growth for the nation's space economy over the next decade, human spaceflight provides the critical anchor demand needed to sustain this momentum. Government contracts for life-support systems, specialized crew gear, training simulators, and ground infrastructure offer reliable early revenue, while a future space station promises ongoing demand for supply logistics and in-orbit research. As economist Mariana Mazzucato observes, this kind of mission-oriented public investment is precisely how state vision builds durable private-sector capability (Mazzucato, 2013).

While the direct jobs generated by these high-tech ventures will mostly benefit highly skilled professionals (making the overall employment footprint relatively modest) the wider economic payoff lies elsewhere. The real value comes from upgrading the technical capabilities of domestic suppliers and providing world-class opportunities that keep top Indian scientific talent at home, directly tackling the long-standing problem of 'brain drain'.

6.4 Governance, safety culture and public trust

Human spaceflight introduces a distinctive discipline into public administration. The lives of astronauts raise the cost of failure and force transparent testing, rigorous documentation and clear lines of accountability. If this culture of safety and quality assurance diffuses into the wider industrial and administrative environment, it constitutes an important institutional spillover. Evans's (1995) concept of embedded autonomy suggests that islands of institutional excellence can, under favourable conditions, become models for other parts of the state.

Public trust is the other side of the coin. Human spaceflight programme puts the state's credibility on public display. And adhering to transparent communication about delays, test failures and risks will strengthen the relationship between ISRO and citizens (while a pattern of over-promising, as in the missed 2022 target, risks eroding it). The approach adopted since 2023, of qualifying hardware through staged tests before committing to dates, is consistent with building such trust.

6.5 Feedback to development services

Indian space activity has always had a service dimension: communication satellites for broadcasting and telemedicine, remote sensing for agriculture and disaster management, meteorological satellites for cyclone warnings, and navigation services through NavIC, to name a few. Human spaceflight does not directly produce these services, but it reinforces the institutional and technological base from which they are delivered. Microgravity research in biology, materials and pharmaceuticals will eventually yield applications in health and agriculture, and the Indian experiments carried on the Axiom flight, in fields such as biology and crop science, signal an intention to link crewed missions to research with developmental relevance. How strong this connection ultimately becomes will depend on real-world outcomes, suggesting that the program will benefit from setting explicit research priorities and actively tracking its impact over time.

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7. Geopolitical Standing

7.1 Joining an exclusive club

Only three countries have independently launched humans into orbit. India's entry would carry symbolic weight beyond its technical content. In the political imagination of the post-colonial world, such capability marks a country as a full member of the community of advanced technological powers. Moltz (2014) shows that Asian space programmes are partly driven by regional competition, and India's human spaceflight ambition is unavoidably read against China's, whose crewed programme began in 2003, has produced a permanent space station, and aims at a crewed lunar landing around 2030. India's programme is smaller, later and more frugal, and Indian officials generally avoid the language of a 'race'. Yet the Chinese example sets the benchmark for regional status.

7.2 Strategic autonomy and the politics of dependence

India's history of technology denial, in the cryogenic engine saga and the sanctions after 1998, explains why the programme stresses indigenous capability. Gaganyaan uses an Indian launch vehicle and an Indian crew module, although it draws on foreign expertise, notably Russian training and, for the Axiom flight, American commercial access. This blend reflects India's wider foreign-policy posture of multi-alignment: cooperating with Russia on training and heritage technology, with the United States on lunar exploration, science missions and commercial flights, and with other partners including France and Japan, while preserving autonomy. The joint NASA-ISRO radar satellite NISAR and India's signing of the Artemis Accords illustrate the American dimension, while Soyuz-era ties underpin the Russian one.

7.3 Soft power and leadership of the Global South

Nye (2004) argues that attractiveness stems from culture, values and policies as well as from material power. India's space narrative of frugality, reliability and development orientation offers a distinct brand, especially to countries in the Global South that see in ISRO a model of what a developing economy can achieve. The launch of the South Asia Satellite (GSAT-9) in 2017 as a regional public good, and ISRO's commercial launch services for foreign satellites, show how space capability can be turned into diplomatic goodwill. A successful crewed flight would deepen this appeal, and a future national station open to foreign researchers could extend India's role as an international convener in orbit.

7.4 Norms, security and responsibility

Status carries responsibilities. India is a party to the Outer Space Treaty (United Nations, 1967) and has an interest in the stability of the space environment. Its 2019 anti-satellite test generated controversy over orbital debris and the militarisation of space, a reminder that the dual-use character of space capability cannot be wished away (Johnson-Freese, 2007). A credible human spaceflight programme requires a safe orbital environment, which gives India a direct stake in debris mitigation, traffic management and norms of responsible behaviour. India's leadership in these areas would enhance its standing as a responsible space power.

8. Why India Should Pursue Space Ambitions: Space as a Reflector of the Development Framework

8.1 Five arguments

a) **Capability and sovereignty**: In a world where technology access is politically conditioned, the ability to build and operate critical systems domestically is a form of sovereignty. Human spaceflight is the most demanding of such systems, since it integrates propulsion, materials, avionics, life support and recovery. Developing it indigenously is the culmination of the self-reliance strategy that ISRO's history of technology denial made necessary (Harvey et al., 2010; Amsden, 1989).

b) **A mission-oriented engine of capability**: Ambitious, time-bound missions with precise technical targets are uniquely effective at mobilizing investment and streamlining coordination, far more so than broad, diffuse developmental goals ever can (Mazzucato, 2018, 2021). Human spaceflight acts as exactly this kind of forcing function for the Indian innovation system, driving rapid advancement across advanced manufacturing, biomedical engineering, materials science, and complex systems integration.

c) **Human capital and aspiration**: If development is the expansion of capabilities and freedoms (Sen, 1999), then a national project that raises young people's sense of what is possible has real developmental value. The ability to inspire one million school children to study physics is difficult to measure but is arguably as important as any measurable output.

d) **Strategic autonomy and standing**: In an increasingly multipolar world marked by China's rapid rise and a shifting post-ISS landscape, maintaining independent access to orbit acts as an essential strategic safeguard for India. Owning end-to-end spaceflight capabilities not only preserves national autonomy, but it also gives India far stronger leverage in international partnerships and solidifies its credibility as a key voice in shaping global space governance and norms.

e) Integration in a plural federation: Space achievements spark a rare sense of pride that cuts across regional and linguistic boundaries, while the physical presence of ISRO facilities spread across multiple states gives local populations a direct stake in the national space enterprise. In a nation as diverse as India, high-visibility projects with broad public appeal help bind the country together, serving a unifying role that naturally complements formal federal institutions (Anderson, 2006; Billig, 1995).

8.2 The strongest objections

a) **Opportunity cost:** The most serious objection comes from the critics of prestige-driven investment. Drèze and Sen (2013) argue that India's persistent deficits in health, nutrition and education demand priority, and that spending on high-profile technological projects can divert attention and resources. The programme's cost, about INR 20,193 crore for the expanded Gaganyaan programme over several years, is small relative to the social-sector budgets of the Union and states, but the objection is not purely arithmetical. It concerns the political attention that spectacular projects absorb. The response has two parts. First, the choice is not strictly either/or. The programme's budget is a small fraction of public spending on social programmes, and a developing country can and should invest in both foundational services and frontier capability. Second, the historical record of ISRO suggests that space investment has been developmentally productive, through communication, remote sensing and disaster-warning services, though this justification applies more clearly to satellite applications than to crewed flight. The honest conclusion is that human spaceflight needs its own justification, which rests on capability, industrial learning, aspiration and strategic autonomy rather than on direct welfare outputs. It also needs accountability, so that its claims about spillovers are tested rather than assumed (Dick & Launius, 2007).

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b) **Prestige-seeking:** A related objection holds that the programme is mainly about status. The honest response is that status is a legitimate strategic good in international politics (Johnson-Freese, 2007; Nye, 2004), but a programme justified only by status is fragile. Prestige should be a by-product of demonstrated capability rather than the primary objective.

c) **Risk and safety:** Human spaceflight is undeniably risky, and a major accident could severely set back the program while shaking national morale. Managing this risk comes down to institutional discipline: rigorous staged testing, independent safety reviews, clear communication about the inherent dangers, and an unyielding commitment never to compromise astronaut safety for political or symbolic deadlines.

d) **Equity:** The astronaut cadre and the benefits of the programme must not be concentrated among a narrow elite. Broader selection, public engagement and the use of the station for research relevant to national needs would improve the programme's equity credentials.

8.3 Space as a reflector

The word 'reflector' is chosen deliberately. A successful human spaceflight programme cannot be willed into existence by political decision alone; it reflects what the country has accumulated - scientific institutions, an industrial base, public-sector competence, skilled labour and a culture of reliability. The ability to fly astronauts safely into space is therefore a revealing indicator of developmental depth. It follows that pursuing human spaceflight is not an alternative to the development agenda but a way of testing, and stretching, the underlying capabilities on which broader development depends. The converse also holds where shortcomings in the programme, such as delays, cost overruns or safety lapses, would reveal weaknesses in India's institutional and industrial capacity that deserve attention in their own right.

9. Conclusion

India's journey from Rakesh Sharma's 1984 flight to Gaganyaan shows a country that deferred human spaceflight for decades, built the technological and institutional foundations patiently, and then decided to go ahead when its capabilities and political conditions aligned. The programme's trajectory, from a first uncrewed flight to a national space station and a lunar landing by 2040, represents the most ambitious phase of the Indian space story. Its societal impact will be felt in industrial capability, scientific research, education and aspiration, governance culture and international standing. The argument that India should pursue these ambitions rests not on prestige alone but on the view that human spaceflight is both a mirror of a country's development framework and a tool for strengthening it. That justification is conditional. It holds if the programme is governed with transparency, safety discipline and a commitment to inclusion, and if its claims of benefit are tested against evidence. The objections raised by critics of prestige-driven investment are serious and should shape the way the programme is run rather than being dismissed. The success of Gaganyaan mission will demonstrate for India that a large, democratic, developing country can reach a technological frontier on its own terms, while still working on the unfinished business of human development. The measure of success will be not only whether Indian astronauts fly but whether the capabilities, aspirations and institutions built along the way make life better for the many millions who will watch from the ground.

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