EMPOWERING INDIA'S SPACE STARTUPS

HOW ISRO CAN CATALYZE PRIVATE SECTOR GROWTH

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CSDR
COUNCIL FOR STRATEGIC AND DEFENSE RESEARCH

ABOUT THIS POLICY PAPER

This paper explores the potential for the Indian Space Research Organisation (ISRO) to support India's growing space startup ecosystem in the emerging "Second Space Age." As private sector involvement in space rapidly expands, India's space startups require greater access to infrastructure, financial support, and regulatory facilitation to compete globally. The paper examines recent initiatives, such as the formation of IN-SPACe and NSIL, and the implications of India's 2023 Space Policy, outlining ways ISRO can further catalyze innovation. By shifting focus from manufacturing to research and development, ISRO can empower startups, helping India achieve its ambitious space economy goals by 2040.

ABOUT THE AUTHOR

Rakesh Sood joined the Indian Foreign Service in 1976, serving in Brussels, Dakar, Geneva, and Islamabad in different capacities, and as Deputy Chief of Mission in Washington DC. At the Foreign Ministry, he set up the Disarmament and International Security Affairs Division and led it for eight years. He has served as India's first Ambassador and Permanent Representative to the Conference on Disarmament in Geneva and later as Ambassador to Afghanistan, Nepal and France. After retiring in 2013, he was appointed as Special Envoy of the Prime Minister for Disarmament and Non – Proliferation issues. At CSDR, he directs research on emerging technologies, including space policy and biotechnology.

ABOUT COUNCIL FOR STRATEGIC AND DEFENSE RESEARCH

CSDR is a research-focused think tank founded in January 2020 by Dr. Happymon Jacob (Associate Professor, School of International Studies, JNU), and Lt. Gen. DS Hooda (Former. Northern Army Commander, Indian Army). CSDR combines academic research with policy advocacy and strategic consulting to help governments, businesses, and institutions navigate complex challenges and seize new opportunities in an increasingly complicated world. Our areas of expertise include foreign policy, geopolitical risk, connectivity and geoeconomics, defense and aerospace, military strategy, strategic technologies, conflict resolution, peacebuilding, climate change, energy security, and tech policy. We specialize in the Indian subcontinent, Eurasia, and the Indo-Pacific.

ABOUT CSDR'S SPACE TECHNOLOGIES AND POLICY PROGRAM

The Space Technologies and Policy Program at CSDR examines the complex relationship between technological advancements in the space industry and the policy decisions made by the Indian government. It provides valuable insights into the challenges and opportunities associated with developing and applying space technologies in India, thereby shaping policy discussions related to space matters.

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FOREWORD

The Indian space economy is entering a new era, driven by a significant increase in private industry participation in space activities. Over a hundred space startups offering services ranging from rocket launches to geospatial analytics have emerged in the last five years. In response to these changes, the Union government has boldly reformed the country's regulatory landscape. This aims to foster a vibrant space ecosystem that leverages the core competencies of the private and public sectors, respectively.

Two key initiatives have been instrumental in shaping the transformation of India's space sector. First, the establishment of the Indian National Space Promotion and Authorization Centre (IN-SPACe) in 2020. This entity serves as a single-window agency, regulating all space activities in India and, most importantly, creating a level playing field for the space industry. Second, the Indian Space Policy - 2023 (ISP-23), released in April 2023, and the subsequent Implementation Guidelines published in May 2024, are documents that not only clarify the role of the relevant government agencies but also lay down a predictable policy framework for the private sector, empowering them to thrive in this new era of the Indian space sector.

This policy paper by the Council for Strategic and Defense Research (CSDR) on optimizing the utilization of the space spectrum is part of a series of five policy papers that aim to create a legal knowledge base on India's space policy, existing space laws, and laws and regulatory guidelines that intersect with private sector space activities.

The Telecommunications Act of 2023 permits the assignment of satellite spectrum through the administrative process, marking an essential step in bringing India's regulation of the space sector in line with globally recognized norms. This paper's recommendations for assigning satellite spectrum go one step further by proposing critical measures that the government must take to ensure that satellite spectrum assignment takes place fairly and transparently.

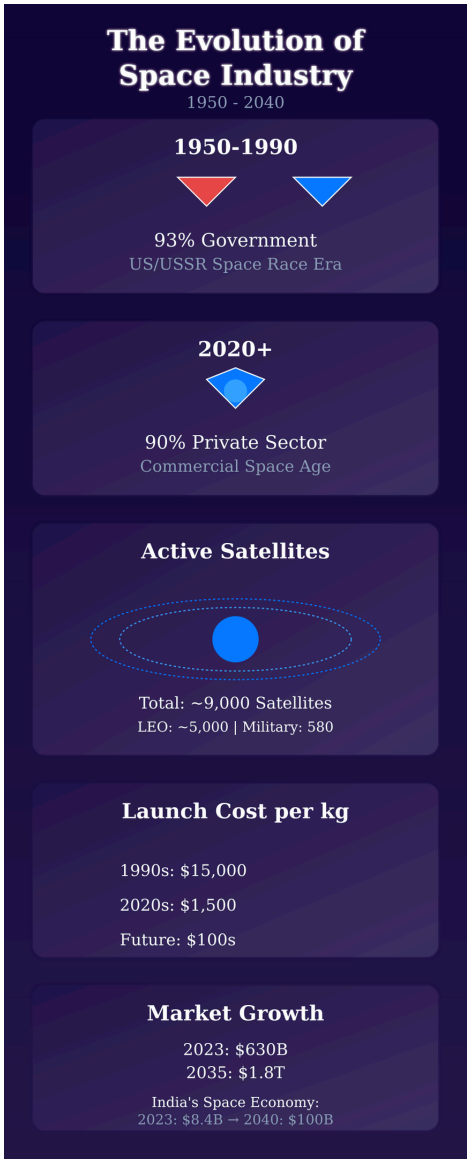
Ananth Technologies is pleased to support CSDR in making these policy-oriented research papers available to the public. I hope these research papers will stimulate a robust discussion among all stakeholders in the Indian space ecosystem, including government policymakers, IN-SPACe, the private space industry, policy experts, and civil society members.

Dr. Subba Rao Pavuluri
President, Satcom Industry Association (SIA-India) and CMD, Ananth Technologies

The decade of the 2020s marks the beginning of the Second Space Age, which has two defining characteristics: the rapid growth of the private sector in the space economy and the increasing democratization of space technology applications among low—and middle-income states.

The Second Space Age

From 1950 to 1990, roughly 93 percent of all space launches were undertaken by the US and the USSR government space agencies.[1] From 2020, the private sector has undertaken 90 percent of all launches. [2]Today, more than a hundred countries operate their satellites, though these may have been fabricated and launched with the help of external partners. The number of active satellites in orbit today has nearly trebled to approximately 9000, of which only about 580 are military satellites.[3] Most of these, almost 5000, are in LEO (Low Earth Orbits).[4] This has been made possible by the sharp drop in launch costs; placing one kilogram in a low earth orbit that cost $15000 in the 1990s has dropped to $1500, and new space entrepreneurs predict it will fall further to the low hundreds.[5]



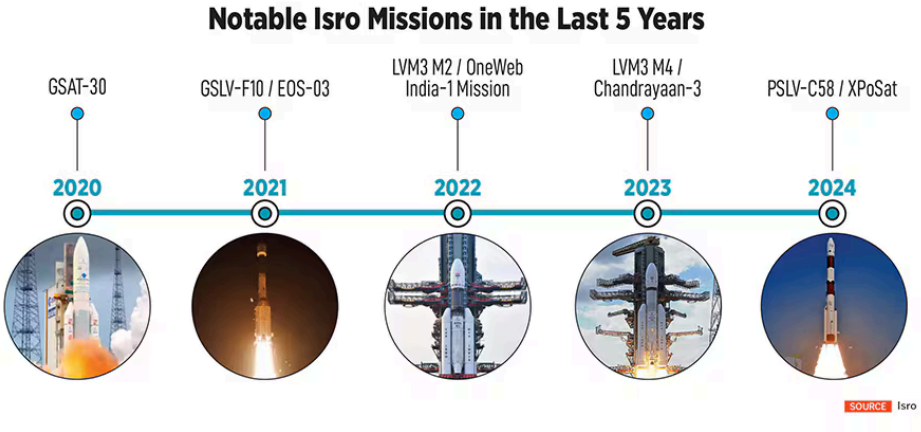
The revolution of the Second Space Age is driven by technological developments in launch systems that permit reusable systems, reducing costs, and in micro-electronics, enabling miniaturized payloads and energy systems. In 2023, the global space economy was estimated at $630 billion and is expected to cross $1.8 trillion by 2035.[6] The share of the Indian space economy was just 2 percent at $ 8.4 billion, but it has the potential to catapult to $100 billion by 2040.[7] However, this would require a radical change in the approach that guided India's space program in the past.

ISRO's Space Journey

India's modest entry into the First Space Age in the 1960s with the setting up of INCOSPAR (Indian National Committee on Space Research) paved the way for ISRO (Indian Space Research Organisation) and the Department of Space in 1972.[8] Three distinct scientific elements that could contribute to India's socio-economic development guided India's civilian space program – satellites for communication and remote sensing, space transportation systems, and application programs. The gradual development of domestic capabilities and its demonstrated success in all three areas has served the country well, and today, India is well-placed to emerge as a major player in the Second Space Age. The challenge for the government is to create a supportive regulatory ecosystem that can nurture the growth of new space startups and tap into growing private sector capabilities.

Over the last decade, the annual budget of the Department of Space budget has varied between .05 to .06 of the GDP; in absolute terms, it has hovered between Rs 11000 and 14000 crores

($ 1.5 to $ 1.9 billion).[9] To reach the target of 9 percent of the global space economy, ISRO must undergo an identity transformation. Some policy steps in this direction have been taken but must be backed up with appropriate regulations and legislation. The pace of change is rapid, and if new space has to become a growth driver just as IT was in the 1990s, government needs to be agile and responsive. Since 2014, when there was one new space startup, there are now over 190, with over a hundred set up during 2023-24.[10] As per 2022 data, these startups have raised over $250 million.[11] In addition, there is a network of nearly 1500 MSMEs who are well-placed with the requisite technical skills to contribute to new space.

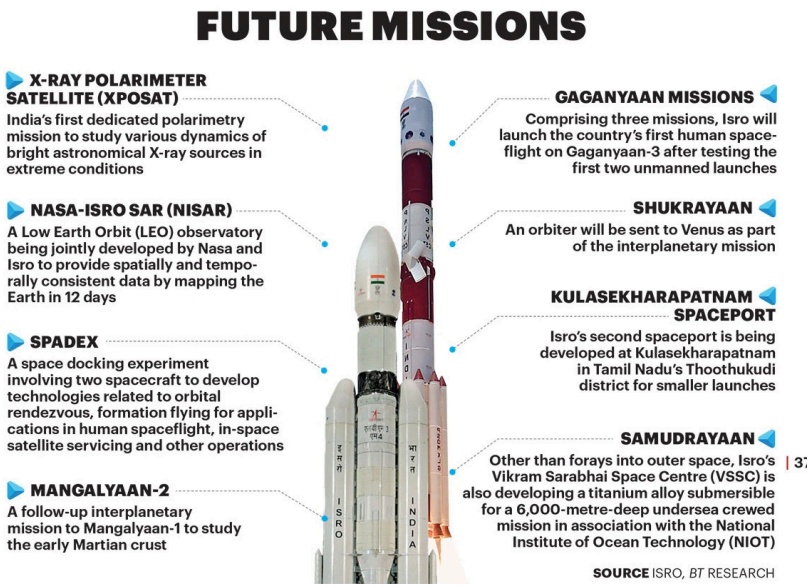


In 2021, Prime Minister Modi announced the government's intention of bringing in the private sector to meet the growing demand for space services. Two new organisations, IN-SPACe (Indian National Space Promotion and Authorisation Centre) and NSIL (New Space India Ltd), were set up. IN-SPACe "shall function as an autonomous government organization, mandated to promote, handhold, guide, and authorize space activities in the country" by the government and non-government entities.[12] It is expected to create a level playing field as ISRO, the sole player in this field with a manpower of 15000, today owns and manages in-house facilities for fabrication, assembly, testing, integration, tracking and telemetry, and launch. NSIL, a public sector undertaking, has been made the commercial arm of ISRO to serve the needs of government and non-government users and commercialize ISRO's space platforms and technologies.

This was followed up with the India Space Policy in 2023 (ISP-23). In para 3, the document mentions IN-SPACe's responsibilities, inter-alia, "encouraging and promoting greater private sector participation in the entire value chain of the Space Economy," highlighting "support to space sector startups" as an area of focus. Para 5 emphasizes the need for a level playing field "for the utilization of all facilities created using public expenditure" and the need for formulating appropriate procedures for prioritization between government and non-government entities.[13]

However, the Norms, Guidelines, and Procedures for Implementation of Indian Space Policy 2023 (NGP) concerning the authorization of space activities released in May 2024 does not spell out a transparent set of rules, priorities, or financial costs for private companies to access facilities, as mentioned in ISP-23.[14] The NGP touches upon the framework required for establishing and operating a private launch facility. Still, it will take time before private players can set up such facilities. The Indian case differs from the U.S., where new space companies like Space-X and Blue Origin have deep pockets, and startups have multiple options.

The space economy value chain covers upstream, downstream, and auxiliary activities. Upstream activities traditionally involve satellite design and fabrication, launch services, space transportation, and associated infrastructure. Downstream activities encompass using satellite-generated data for a broad and expanding range of applications covering communications (TV, broadband, and mobile telephony), earth observation and multi-spectral imagery analytics (terrestrial and maritime GIS for resource mapping, climate, meteorology and disaster monitoring, and urban management) and PNT (position, navigation, and timing). The auxiliary segment consists of services and technologies that support space operations and enable customized solutions for expanding user demands (insurance, education, health, etc.).



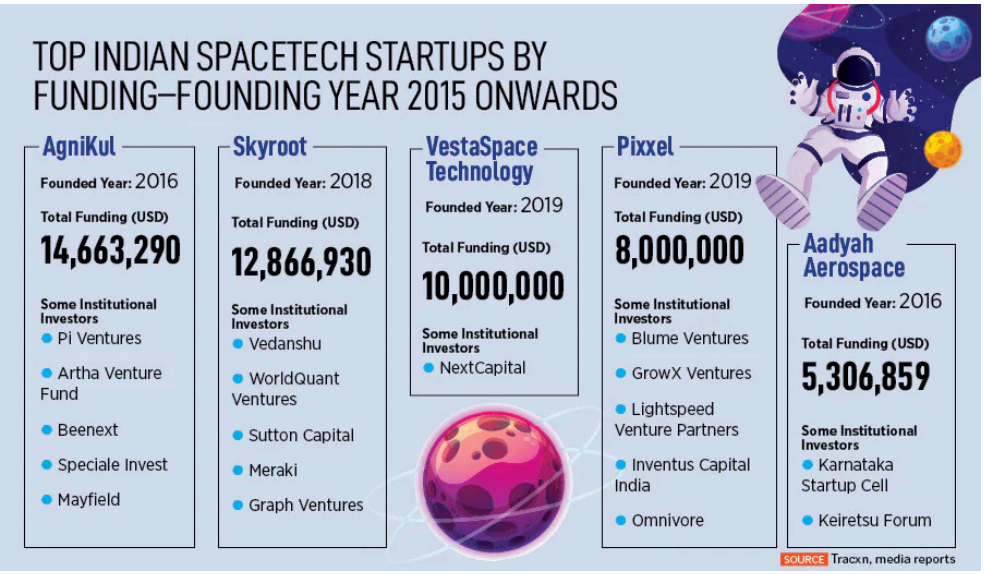
Traditionally, ISRO has worked with a few public sector undertakings like Hindustan Aeronautics Limited (HAL), Mishra Dhatu Nigam (MIDHANI), and Bharat Electronics Limited (BEL) and with large industrial conglomerates like Godrej, Larsen & Toubro (L & T), and Walchandnagar Industries. Access, security clearances, and financial and legal requirements have been managed ad hoc. These entities often had dealings with the Ministry of Defence and the Services and were more adept at dealing with bureaucratic processes. The industry conglomerates have multiple revenue streams, and the ISRO-related work constitutes a small part of their balance sheet.

What Startups Need

The situation differs for startups as they depend on a single sector and need deep pockets. For new space startups, access to AIT (Assembly, Integration, Testing) facilities and infrastructure is essential. Today, in addition to ISRO facilities, there is only one in the private sector (Ananth Technologies) for large satellites.Innovation and product development is an iterative process in a complex domain like space technology, particularly in the upstream segment where timely access to such facilities can make a difference between success and failure for the startup. Using AIT facilities abroad could be financially unviable for resource-strapped startups. Further, access should be based on open and transparent procedures.

Security agencies in the Ministry of Home Affairs (MHA) and the Ministry of Defence (MoD) have now become significant users of space imagery for surveillance requirements and secure dedicated communications. Currently, Indian agencies find the coverage provided by ISRO inadequate and infrequent because of the limitations of satellite resources. ISRO has 53

operational satellites, of which 42 are for communication and earth observation, eight are dedicated to navigation (NavIC), and three have dedicated scientific payloads.[15] Given current resources, ISRO undertakes an average of four to five launches annually. In 2019, the Ministry of Defence established a Defence Space Agency (DSA) with a dedicated Defence Space Research Agency to provide R & D support. DSA has a dedicated satellite control centre and an image processing and analysis unit.[16] In time, DSA is expected to evolve into a Defence Space Command. In addition, state governments too are emerging as significant consumers of GIS data.



The new space startups in the upstream sector are less than 30, but these are critical in developing innovative solutions for technical challenges. They are designing and building components and sub-systems for launch vehicles that need static test facilities, casting facilities for novel solid propellants, integration facilities, fuel composition testing, launch pad, and interface with telemetry. Satellite design, development, and fabrication need AIT, but before that, vibration testing, thermo-vacuum testing, software testing, ground-based testing, and trajectory analytics are necessary to validate the design. Satellite operations require telemetry and verified ground stations that ensure cyber integrity. A separate Joint Programme Implementation Plan has to be concluded by the startup with IN-SPACe for each facility, creating avoidable delays and duplication.

The second challenge these startups face is assured demand from government agencies. This creates a chicken and egg situation. Government agencies have complex tendering processes and prefer to deal with entities with an established track record. Entering into long-term agreements with startups runs contrary to their procurement procedures. Startups need more hand-holding as they move from design and proof of concept to value propositions and a prototype. Ministry of Defence has therefore set up iDEX and, in 2022, launched a Mission Def Space spelling out 75 challenges based on its user requirements.[17] Other government departments, especially ISRO, need to learn from the iDEX experience how to deal with new space startups.

The Way Ahead

Para 6.8 of the ISP-23 directs that ISRO "transition out from the existing practice of being present in the manufacturing of operational pace systems. Hereafter, mature systems shall be transferred to industries for commercial exploitation," leaving ISRO to focus on R & D in advanced technology. [18] L & T has had experience in building to specs for ISRO, has formed a consortium with Hindustan Aeronautics Ltd, and successfully concluded an Rs 860 crores deal with NSIL for building four PSLVs (Polar Satellite Launch Vehicles) with a complete transfer of technology from ISRO that has flown over 50 successful PSLV missions.[19] This is a successful example but only demonstrates that ISRO finds it easier to deal with large conglomerates. So far, startups have found it challenging to get ISRO contracts that can provide them the financial stability to engage in technology development.

IN-SPACe is mandated to promote, hand-hold, guide, authorize, and regulate space activities while creating a level playing field between government and non-government entities. However, non-government entities come in different shapes and sizes. The needs of startups are very different from those of established conglomerates like Tatas, L & T, and Godrej. To fulfil its ambitious mandate, IN-SPACe must be empowered by suitable legislation to be truly autonomous.

Endnotes

[1] Based on Cumulative Space Launches by Country data, available at: "Space Environment: Total Payloads Launched by Country." Aerospace Security, Center for Strategic and International Studies, https://aerospace.csis.org/data/space-environment-total-payloads-launched-by-country/. Accessed 11 Oct. 2024.
[2] Space Foundation Editorial Team. "The Space Report 2023 Q4 Shows Record Number of Launches for Third Year in a Row, Technological Firsts, and Heightened Focus on Policy." Space Foundation, 23 Jan. 2024, https://www.spacefoundation.org/2024/01/23/the-space-report-2023-q4/. Accessed 11 Oct. 2024.
[3] Active number of satellites in total: National Space Operations Centre, UK Space Agency, and Ministry of Defence. "The Future Space Environment." GOV.UK, 1 Dec. 2022, https://www.gov.uk/government/news/the-future-space-environment. Accessed 11 Oct. 2024; Union of Concerned Scientists. "Satellite Database." Union of Concerned Scientists, https://www.ucsusa.org/resources/satellite-database. Accessed 11 Oct. 2024; World Population Review. "Military Satellites by Country 2024", https://worldpopulationreview.com/country-rankings/military-satellite-by-country. Accessed 21 Oct 2024.
[4] Pretz, Kathy. "The LEO Satellite Industry Needs More Engineers: IEEE Is Holding Educational Workshops About the Field." IEEE Spectrum, 7 Jan. 2024, https://spectrum.ieee.org/leo-satellite-needs-more-engineers. Accessed 11 Oct. 2024.
[5] Autry, Greg, and Alexander William Salter. "GOP Platform Lays Out Aggressive Space Agenda to Counter China." SpaceNews, 17 July 2024, https://spacenews.com/gop-platform-lays-out-aggressive-space-agenda-to-counter-china/. Accessed 11 Oct. 2024.
[6] "Space: The $1.8 Trillion Opportunity for Global Economic Growth: Insight Report." World Economic Forum, April 2024, https://www3.weforum.org/docs/WEF_Space_2024.pdf. Accessed 11 Oct. 2024.
[7] Tembhekar, Chittaranjan. "Indian Space Market Can Reach USD 100 Billion Dollars by 2040." The Times of India, 27 July 2023, https://timesofindia.indiatimes.com/india/indian-space-market-can-reach-usd-100-billion-dollars-by-2040/articleshow/102153702.cms. Accessed 11 Oct. 2024.
[8] "About ISRO." Indian Space Research Organisation, Department of Space: Government of India, https://www.isro.gov.in/profile.html. Accessed 11 Oct. 2024.
[9] Singha, Anand. "Budget 2024 | Space Sector Boosted with ₹13,042.75 Crore Allocation." CNBC TV18, 23 July 2024, https://www.cnbctv18.com/india/science/budget-2024-space-sector-allocation-nirmala-sitharaman-isro-19446952.htm. Accessed 11 Oct. 2024.
[10] PIB Delhi. "India Has Witnessed Investment of Over Rs. 1,000 Crore in Space Startups in Last Nine Months of the Current Financial Year from April to December 2023, Says Union Minister Dr. Jitendra Singh." Ministry of Science & Technology: Press Information Bureau, 17 Dec. 2023, https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987449. Accessed 11 Oct. 2024.
[11] V, Akhil. "More Fuel for India's Spacetech Startups—Skyroot Aerospace Raises $27.5 Million in Pre-Series C Round Led by Temasek." CNBC TV18, 30 Oct. 2023, https://www.cnbctv18.com/startup/more-fuel-for-india-spacetech-startups-skyroot-aerospace-raises-27-5-million-dollars-in-pre-series-c-round-led-by-temasek-18188841.htm. Accessed 11 Oct. 2024.
[12] "Indian Space Policy-2023." Indian Space Research Organisation, Department of Space: Government of India, https://www.isro.gov.in/media_isro/pdf/IndianSpacePolicy2023.pdf. Accessed 11 Oct. 2024.
[13] "Indian Space Policy-2023." Indian Space Research Organisation, Department of Space: Government of India, https://www.isro.gov.in/media_isro/pdf/IndianSpacePolicy2023.pdf. Accessed 11 Oct. 2024.

Endnotes

[14] Jain, P.K. "Norms, Guidelines and Procedures for Implementation of Indian Space Policy-2023 in Respect of Authorization of Space Activities (NGP)." Indian National Space Promotion and Authorization Centre, Department of Space, Government of India, 3 May 2024, https://www.inspace.gov.in/sys_attachment.do?sys_id=5d532e37877102503b0f0d060cbb35cf. Accessed 11 Oct. 2024.
[15] PIB Delhi. "Union Minister Dr. Jitendra Singh Says, ISRO Has Launched a Total of 129 Satellites of Indian Origin and 342 Foreign Satellites Belonging to 36 Countries Since 1975." Department of Space: Press Information Bureau, 10 Feb. 2022, https://pib.gov.in/PressReleasePage.aspx?PRID=1797196. Accessed 11 Oct. 2024.
[16] Agrawal, Vaibhav. "India Beyond Earth: India's Status in Space Military Race." Financial Express, 31 July 2022, https://www.financialexpress.com/business/defence-india-beyond-earth-indias-status-in-space-military-race-2582187/. Accessed 11 Oct. 2024.
[17]PIB Delhi. "Space Defence Mission." Ministry of Defense: Press Bureau of India, 9 Dec. 2022, https://www.pib.gov.in/PressReleasePage.aspx?PRID=1882082. Accessed 11 Oct. 2024.
[18] "Indian Space Policy-2023." Indian Space Research Organisation, Department of Space: Government of India, https://www.isro.gov.in/media_isro/pdf/IndianSpacePolicy2023.pdf. Accessed 11 Oct. 2024.
[19] Shukla, Ajai. "HAL-L&T Consortium Bags Rs 860-Crore ISRO Contract for Five PSLVs." Business Standard, 5 Sept. 2022, https://www.business-standard.com/article/companies/hal-l-t-consortium-bags-rs-860-crore-contract-to-build-five-pslv-rockets-122090501111_1.html. Accessed 11 Oct. 2024.

All views expressed are those of the author in their personal capacity. The Council for Strategic and Defense Research (CSDR) does not take institutional positions on any issues.

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