# Impact of Operation Sindoor, Shubhanshu Shukla: Emerging opportunities in space, defence

**Explore India's booming space and defence sectors, offering exciting opportunities for engineering graduates in employment, entrepreneurship, and research.**

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O.R.S. RAO


Space and defence are poised for a boom. It is up to the HEIs to groom the students by introducing appropriate inter-disciplinary courses and take up research in collaboration with the industry and premier research agencies such as the ISRO and the DRDO.

The recent Operation Sindoor and Group Captain Shubhanshu Shukla's journey into space have thrown the spotlight on India's space and defence sectors. Both the sectors are strategic to India's "Atmanirbhar Bharat" initiative. The recent policy initiatives of Central and State governments for promotion of investments from private corporates and setting up a vibrant start-up ecosystem are expected to drive growth in the sectors in the next five years and will offer exciting opportunities for engineering graduates in employment, entrepreneurship, and research.

This article presents the current status, synergy between the two sectors, future outlook for them and the opportunities they present to the students.

## Five-fold growth for space sector

The recent success of Shubhanshu Shukla's trip to the International Space Station, launched by the Axiom-4 mission, a collaboration between NASA, Axiom Space, and ISRO, is expected to pave the way to Gaganyaan, India's first human flight mission, expected in 2027. Besides, the Chandrayaan Missions have significantly bolstered India's standing, as a global space power and fueled its ambitious space exploration plans.

The sector, currently valued at about $9.5 billion is projected to grow fivefold to reach $44 billion by 2033. Currently, there are over 400 private companies and 350 startups, employing over a lakh employees. Start-ups successful in this space include Skyroot Aerospace, which was the first private Indian company to design, build, and test a solid rocket propulsion stage, and AgniKul Cosmos, which developed the world's first 3D-printed rocket engine. Other significant private entities include Ananth Technologies, Data Patterns , Bellatrix Aerospace, Dhruva Space, Pixxel, Satellize, and Manastu Space and Corporate groups like Godrej and Larsen & Toubro.

## Govt policy initiatives in aerospace

Indian space sector, historically, dominated by the Indian Space Research Organisation (ISRO), has undergone a dramatic transformation , with the introduction of the Indian Space Policy 2023, which enabled entry of private players into the entire spectrum of space activities, including satellite operations, launch vehicle management, and data dissemination. The ISRO will transition to focus primarily on advanced Research and

Development (R&D) and will gradually transfer the technologies developed by it to Non-Governmental Entities (NGEs) for manufacturing.

In order to promote foreign investment, Indian Government has allowed upto 74% Foreign Direct Investment (FDI) for manufacturing and operation of the satellites. A number of States have launched policies for promotion of Space-Tech related industry activities in the respective states.

## Defence sector to double

India's defence sector, valued at $27.1 billion in 2024, is projected to nearly double to $54.4 billion by 2033. AI-enabled combat and autonomous swarm technologies are seeing accelerated investment, with the domestic drone market, expected to grow to $11 billion by 2030.

In the recent years, private sector's participation in defence sector has expanded in a big way, with over 500 companies and 16,000 Micro, Small, and Medium Enterprises (MSMEs) employing over two lakh employees and contributing about 21% of total defence production. They include startups such as Raphe mPhibr and Alpha Design Technologies ,which manufactured the drones used in Operation Sindoor, and large corporate groups such as Adani, Ashok Leyland , Bharat Forge, Godrej, Jindal, Larsen & Toubro, Mahindra and Tata Advanced Systems.

After its reported use in Operation Sindoor, the BrahMos missile system has generated good interest in exports, wherein over 14 countries are reported to be in talks with India to acquire the supersonic missile. This marks a strategic leap in India's defence exports, growing at over 19% per year, with a vision of reaching $6 billion in the next five years.

## Policy initiatives to promote defence

The Government of India has launched several initiatives and schemes such as the Innovations for Defence Excellence (iDEX), Advanced Defence Technology Innovation (ADITI) and Technology Development Fund (TDF) to promote indigenous development of defence technologies by startups, MSMEs, and academia. The defence sector's growth is further accelerated by the establishment of defence industrial corridors in Uttar Pradesh and Tamil Nadu, designed to promote indigenous production and create a nurturing

ground for startups. A number of State governments, including Andhra Pradesh, Gujarat, Karnataka, Kerala, Telangana, Tamil Nadu, and Uttar Pradesh have unveiled policies to promote investments and create employments in the sector.

## Synergy between defence and space

Operation Sindoor showcased the significance of the synergy and convergence between these two technologies, wherein satellite-aided drone interception played a significant role in the success of the mission. With this backdrop, the government is accelerating its space-based surveillance capabilities by launching 52 dedicated defence satellites by 2029, reflecting formal integration of space into national defence strategy.

Both sectors are critical pillars of national security. Space assets provide crucial Intelligence, Surveillance, and Reconnaissance (ISR) capabilities, enabling real-time situational awareness over adversary territories and critical regions like the Indian Ocean. The strategic synergy is characterized by shared dual-use technologies, such as artificial intelligence, cyber security, drones, and advanced satellite systems, fostering interdependencies and collaborative environments crucial for national security and broader economic development.

The development of advanced materials, such as titanium alloys and super alloys by companies like Mishra Dhatu Nigam Limited (MIDHANI) serves both missile and spacecraft components. Propulsion engineers design and test engine components for both aircraft and space launch vehicles. This convergence fosters a symbiotic relationship, leading to a more robust and self-reliant technological base for the nation.

## Collaboration between academia, industry and research agencies

Industry-premier research centres-academia collaboration is a cornerstone of India's strategy for promotion of innovation and manufacturing excellence. The collaboration between ISRO and DRDO, and their engagement with private industry and academia, allows for shared knowledge, infrastructure, and expertise.

Government policies explicitly emphasise fostering these linkages to enhance the overall ecosystem. The iDEX and the Technology Development Fund (TDF) initiative actively engages R&D institutes and academia to develop innovative defence technologies.

Establishment of Incubation Centres is critical for nurturing talent and fostering advanced research. IN-SPACe aims to establish technical incubation centers for startups, providing technical assistance and handholding. DIAT, Pune, has successfully incubated companies, demonstrating the practical outcomes of such initiatives.

## Opportunities for HEIs

India's higher education system has been swiftly responding to the growing industry demand in both the sectors introducing new branches and courses of engineering in space and defence technologies. The Indian Institute of Space Science and Technology (IIST), Trivandrum offers B.Tech in Aerospace Engineering and M.Tech in Aerodynamics and Flight Mechanics to meet national R&D requirements. Specialised government institutions such as the Defence Institute of Advanced Technology (DIAT), Pune, and Rashtriya Raksha University, Gujarat, offer defence-focused courses such as Missile Technology and Drone Technology, UAV systems and electronic warfare.

Other prominent institutions such as the IITs and NITs also offer aerospace engineering courses, and minors in Space Technology and Defence Electronics, combining satellite design, control systems, and sensor integration to prepare the engineering graduates for diverse roles, like satellite systems engineers, propulsion engineers, space scientists, and data analysts.

Recently, major private higher institutional groups such as Symbiosis, Amity and Manipal have launched Under-Graduate, Post-Graduate and integrated programs in defence and aerospace technologies, whereas some institutions are offering them, as minor branches, along with major branches in core engineering disciplines and Computer Science. Some of them offer programs in collaboration with the nodal agencies such as the ISRO, DRDO and HAL.

## Opportunities for collaborative research

Collaborative Research Programs are integral to the major national missions. The Gaganyaan program, for instance, is a national effort designed to involve significant participation from academia and national agencies, establishing a broad framework for collaboration between ISRO, academia, industry, and other scientific organizations. The ISRO has set up nine Space Technology Cells at premiere institutions, such as the IISc and

the seven IITs, and started a Joint Research Programme with Savitribai Phule Pune University.

The DRDO has set up research labs at IISc Bangalore in avionics, space systems, and drone tech and established a Centre of Excellence at IIT, Hyderabad, with a focus on advanced additive manufacturing. The Department of Science and Technology, ISRO and DRDO have been offering a number of schemes for academic research in cutting edge areas of technologies.

## Employment pathways

The burgeoning defence and space sectors offer a wide array of employment opportunities for fresh engineering graduates across various organizations and specialized roles. Besides Armed Forces, government and public sector organisations, large corporates and start ups have been recruiting the fresh engineering graduates.

India's space and defence sectors are going through an unprecedented transformation, driven by ambitious growth trajectories, robust policy support, and a strategic shift towards indigenous innovation and increased private sector participation. This dynamic evolution is creating an expanding landscape of opportunities for fresh engineering graduates, in terms of employment as well as entrepreneurship.

More than just career paths, they offer a unique chance to be at the forefront of technological advancement, contributing directly to India's journey towards technological sovereignty and global leadership. Now, it is up to the Higher Educational Institutions to groom the students by introducing appropriate inter-disciplinary courses and take up research in collaboration with the industry and the premier research agencies such as the ISRO and DRDO.

*(Prof O. R. S. Rao is the Chancellor of the ICFAI University, Sikkim. Views are personal)*

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