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राक्षस ANIRVEDA



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EDITORIAL



Ajit Kumar Thakur
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“
India's march
towards 2047
will depend
less on external
circumstances
and far more
on the strength
of its domestic
capabilities and its
ability to leverage
opportunities amid
intensifying great-
power competition”

INDIA'S MOMENT AMID GLOBAL CHAOS

The geopolitical turbulence continues to shape the global landscape, and a reflection on the past six months of 2026 clearly reinforces the reality that the future will remain unpredictable and fraught with uncertainties. Against this backdrop, the spotlight inevitably turns to the leadership models we are witnessing across the world today.

In today's increasingly complex and disruptive world, leadership decisions have taken an unexpected course. Often blended with rising nationalism, personal ambition and political ego, they have frequently overshadowed clarity of thought, disciplined action and a larger national purpose.

Understanding the rapidly evolving geopolitical landscape, India has infused fresh momentum into its bilateral engagements with France and Europe, Japan and South Korea, the United States and Canada, Australia, New Zealand and the ASEAN nations. A new arc of trust is gradually positioning India at the centre of an emerging strategic architecture. These engagements are evolving into multi-layered strategic partnerships, reflecting not merely deeper cooperation but a qualitative transformation in both perception and execution.

However, India is still bridging the gaps between aspiration and achievement, policy formulation and implementation, swift decision-making and accountability, among others. Moreover, the country's biggest challenge has been the overwhelming dominance of political considerations over economic priorities, the persistent lack of accountability, institutional complacency and half-hearted execution. Developing a new leadership framework—rooted in India's rich intellectual traditions and refined by its enduring civilisational wisdom—may well provide the direction needed to address these long-standing challenges more effectively.

While the military reforms initiated last year have taken centre stage, their pace must accelerate through sustained political ownership, assured financial support and institutionalised military advice. Equally important is the creation of the intellectual and institutional capacity required to translate intent into lasting capability. With a new military leadership comprising the Chief of Defence Staff, the Chiefs of the Navy and the Army, and soon the Air Force, one expects the reform process to gather greater momentum, strengthening India's military deterrence through enhanced indigenous capabilities.

Looking ahead, India must heal not only its self-inflicted wounds and overcome its own delusions to realise the vision of *Viksit Bharat*, but also prepare itself for the next phase of innovation by transitioning from *jugaad* to precision. It must address its chronic research paradox—producing world-class scientific talent without creating sufficient opportunities to absorb and retain it within the national innovation ecosystem.

India must continue to pursue its policy of multi-alignment with strategic realism, supported by economic resilience, patient capital, entrepreneurial conviction and a mature innovation ecosystem, to consolidate its position among top-league innovating nations.

India's future journey will neither be comfortable nor linear. To sustain its growth trajectory, the country must discard decades-old technological mindsets, attract and retain global Indian talent, strategically acquire technology-driven enterprises to accelerate capability development, embrace reverse engineering where appropriate, and invest prudently in frugal innovation to achieve technological sovereignty. India's march towards 2047 will depend less on external circumstances and far more on the strength of its domestic capabilities and its ability to leverage opportunities amid intensifying great-power competition.

At *Raksha Anirveda*, our priority has always been to engage our esteemed readers and foster meaningful discussions among policymakers, strategic thinkers, industry leaders and other stakeholders.

The July–September 2026 edition, with its special focus on India's emergence as a prominent innovation nation and the encouraging rise in its defence exports, examines the country's growing potential to join the world's leading technological and defence powers. Alongside its regular features, in-depth analyses and diverse content, this edition also welcomes new contributors whose perspectives further enrich our editorial discourse.

We believe this carefully curated edition, blending the India Story with the India Way, will resonate with our readers and contribute meaningfully to the national conversation on India's strategic future.

Happy Reading. *Jai Bharat!*

(Ajit Kumar Thakur)



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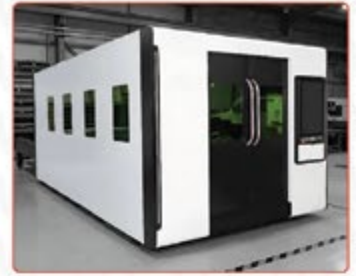
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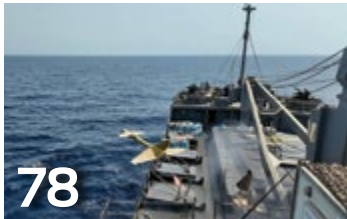
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-Editor

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THE RISE OF A NEW TROIKA

Amidst rapid changes in the realm of geopolitics, India can contemplate forging a new pact with two key allies in Asia — Japan and South Korea

PRANAY K SHOME

The classical realist school of thought asserts that power is the most important currency in the realm of international politics. It is this power search that contributes to states pursuing policies and activities that seek to enhance their survival and overall national power. In the context of the countries of Asia, the situation is no different.

As a continent known for hosting some of the most powerful global players, Asia is no stranger to the cut-throat competition for power, both by Asian state actors as well as actors outside of the region. Ever since the end of the Cold War, Asia has seen the rise of a number of prominent state actors whose rise is seen both in the fields of economics and warfare. Such prominent actors include China, India, Japan, South Korea, and Turkey, among others.

Among these, China has managed to surpass most of its Asian competitors not only in the realm of economic development but also in the realm of military power to emerge as one of the most powerful countries in the world. This trajectory of China's growth has undergone radical changes in the past three decades.

Commencing from the open-door policy of Deng Xiaoping in 1978 and undergirded by the 'hide your strength, bide your time' strategy, China made

rapid strides across every possible indicator in the history of human development. However, analysts and geopolitical pundits made a fatal mistake — they thought that China's rise would be eternally peaceful — it wasn't meant to be.

Since 2012, Xi Jinping, China's Supreme Leader, has turned that policy on its head. Today, China is not only indulging in the aggressive use of force to display its might, but is also concocting fictional claims as far as the dragon's territorial disputes with its neighbours are concerned.

Nowhere is this more evident than in strategic points in the world, such as the South China Sea, Taiwan, and Tibet.

This aggressive behaviour of Beijing necessitates that India and other key state actors in Asia collaborate to take on China.

THE EXISTING RELATIONSHIPS

At present, India has separate but robust relationships with Japan and South Korea. Both countries enjoy strategic partnership agreements with India. In addition, both South Korea and Japan have a common interest in converging with India to fulfil their mission of an open, inclusive and free Indo-Pacific. This aspect of the relationship is strengthened by common dialogues among the troika across different geopolitical platforms such as ASEAN and the Shangri-La Dialogue.



South Korean Minister of National Defence Ahn Gyu with Defence Minister Rajnath Singh

Further, the countries operate separately in their defence sectors through bilateral and multilateral military exercises such as Exercise Malabar, INROKN, among others. However, what is missing is a concrete trilateral compact among them.

A NEW BEGINNING

Given the growing assertiveness of China, globally in general and Asia in particular, these three Asian powers must join hands to take on the dragon. A few suggestions are in order:

First, India must shed its reluctant

attitude. This pertains to New Delhi's historical tendency to shy away from creating, or collaborating with, coalitions that are explicitly martial in their orientation, since the days of the Cold War, particularly after the policy of non-alignment. India, in this context, must be very clear about one thing: China is not our friend. While there is no denying the fact that India and China enjoy a significant relationship across multiple sectors and dimensions, New Delhi must be under no illusion that what China seeks, in the long term, is to systematically degrade India's power profile by waging hybrid warfare. Hence, building explicit military alliances is the need of the hour.

Second, forging a pact is the need of the hour; this pact must involve certain key elements:

Trilateral Partnership: Pooling resources from these countries in the creation of state-of-the-art military assets that can be operated across varied conditions. For example, the K9 Vajra, which India operates, is of Korean origin and was made by India under a Transfer of Technology (ToT) agreement; consequently, similar platforms can be explored for joint production, use, and export.

Supply Chain Security: There is a need to create a common framework for securing the supply chains of critical and strategic minerals. This must manifest itself in joint exploration, mining, refining, and processing of strategic minerals that are vital for the national security and economic growth of the country. Joint explorations, for instance, can be undertaken in the Indian Ocean Region as well as in Japanese waters, particularly the Sea of Japan. Even though they are far away, the ability to bridge the distance is a necessity. In this context, while the former hosts rare earth elements as well as polymetallic nodules, polymetallic sulphides (near the Carlsberg Ridge) that contain rich deposits of copper, zinc, silver, gold, the latter contains large reserves of rare earth elements — particularly around



South Korea and Japan enjoy strategic partnerships with India, and both have a common interest in converging with India to fulfill their mission of an open, inclusive and free Indo-Pacific

the Marcus Island in the Pacific Ocean — as well as in the seafloor hydrothermal vents in the Sea of Japan that contain high deposits of copper, zinc, lead, among others. The concerned parties can divide the proceeds of the findings equitably amongst themselves. This framework must also include developing a secure supply chain through trilateral pacts concerning the manufacturing of critical products that shall be made from these minerals.

Third, this trilateral grouping must institutionalise its defence initiative through regular meetings not just at the top diplomatic and military levels, but also among the strategic studies departments of different universities, defence companies (both public and private) of their respective countries, and other relevant stakeholders in the field.

Fourth, a key part of today's defence strategy for any country is to enhance its economic security. Given the heightened uncertainty in regard to China's outlook towards industries, the troika must develop a common economic policy to invest in each other's economy, thereby utilising their respective strengths and plugging their respective weaknesses. This, therefore, may lead to the development of economies of scale, resulting in the growth of mutually beneficial products and industries.

NO MORE DELAYING

Beijing is determined to emerge as the undisputed hegemon of Asia. By 2049, the centenary year of the founding of the People's Republic of China (PRC), Beijing seeks to transform its armed forces into a highly intelligentised, cutting-edge fighting force. Therefore, the like-minded actors of Asia must fight back. This trilateral framework may emerge as a formidable force in the future if properly developed and institutionalised. ■



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REINVIGORATING NEIGHBOURHOOD ENGAGEMENT

By linking diplomacy with connectivity, energy cooperation, maritime security and its Northeast strategy, India is striving to engage more closely and effectively with its eastern neighbours.

DR ARUNA PRAKASH

India is actively recalibrating its neighbourhood diplomacy to manage significant political upheavals and generational shifts in Nepal, Bangladesh, Sri Lanka, and the Maldives. The policy has shifted from merely fixing problems to actively building infrastructure and trade links such as faster roads, ports and energy grids so that its

smaller neighbours see clear benefits in staying close. This reinvigoration involves balancing security concerns with economic diplomacy, aiming to transform traditional patronage into partnership.

Supporting proactive regionalism, India is now acting as a first responder and regional systems integrator, using tools like UPI and energy grids (cross-border electricity trade) to connect economies.

India is also building maritime

trust by stationing personnel from neighbouring countries on Indian naval vessels, exemplified by the INSV Kaundinya, deployed under the IOS Sagar initiative, and enhanced maritime joint exercises in the Indian Ocean. India is prioritising regional stability and border security over strict governance norms.

SITUATION IN NORTHEAST INDIA

In the Northeast, new peace deals with rebel groups and better border markets have reduced insurgency, making the region a bridge to Southeast Asia rather than a troubled frontier. The Ministry of Home Affairs applies a dual strategy: implementing counter-insurgency measures alongside the Armed Forces Special Powers Act (AFSPA), while simultaneously pursuing peace accords with any rebel groups willing to drop weapons and hold dialogues under the Indian Constitution.

Historically, the political and security landscape of the Northeast has been a complex matrix of ethnic, historic border friction, and lingering insurgencies. While states like Mizoram and Tripura have now successfully transitioned to sustained peace and normal governance, 40 per cent of



Assam and 50 per cent of Nagaland continue to manage active local factions. Manipur faces the steepest hurdles, with nearly 60 per cent of the state heavily affected by deep-rooted ethnic division between valley-dwelling communities and hill tribes. The government is aligning NE's development with the Act East Policy, strengthening border infrastructure to ensure connectivity with neighbouring countries.

Let us look at recent developments in this context—

NEPAL: A NEW POLITICAL ORDER

Following the massive 2025 'Gen Z' protests that saw the fall of old-guard politicians, Nepal is undergoing a leadership transition toward younger and pragmatic leaders. Balendra Shah from Rastriya Swatantra Party (RSP) was elected as the youngest serving prime minister of Nepal on 27 March 2026. India is adjusting to the new government with calls to re-engage on pending issues like the 1950 Friendship Treaty and air overflight rights for new Nepalese airports.

At present, India–Nepal relations are experiencing a pragmatic, cooperation-focused phase prioritising economic partnerships in hydropower, digital connectivity and infrastructure. The existing policy focuses on economic interdependence as a prerequisite for stable relations. Both nations maintain active economic energy and development partnerships, including railway links and integrated check posts.

India remains Nepal's largest trade, investment, and development partner, with a focus on connectivity projects and long-term energy trading. The government is prioritising economic cooperation through digital connectivity (UPI), hydropower and fintech integration. In early 2026, progress was made on high-capacity transmission lines (e.g., Inaruwa–New Purnea) to enhance power trade.

India–Nepal relations are experiencing fresh tension over



Prime Minister Narendra Modi with Maldives President Mohammed Muizzu

India is actively recalibrating its neighbourhood diplomacy to manage significant political upheavals and generational shifts in Nepal, Bangladesh, Sri Lanka and the Maldives

border disputes, specifically regarding the Lipulekh pass and the Kailash Mansarovar Yatra route. However, both nations have expressed commitment to resolving these issues through diplomatic channels.

Despite temporary tensions, the relationship remains strong due to the open border and deep cultural ties. India continues to prioritise partnership through “Neighbourhood First” policy, focusing on infrastructure and development.

SRI LANKA: INDIA'S SAGAR BANDHU

Sri Lanka, after its severe 2022 economic crisis, has tilted toward India for debt relief, energy projects, besides strategic and economic support. India

has strengthened its role as a trusted partner, assisting with financial, energy, and developmental aid.

In the November 2024 parliamentary election, the National People's Power (NPP) won a landslide victory, and Harini Amarasuriya was sworn in as Prime Minister.

India–Sri Lanka relations are currently strong and characterised by high-level economic integration and security cooperation. India has played a crucial role in providing nearly USD 4 billion in emergency aid during Sri Lanka's 2022 economic crisis, extending significant economic and financial support.

Defence ties between India and Sri Lanka are focused on maritime security with the Colombo Security Conclave acting as a key mechanism. India provides significant training to Sri Lankan forces and acts as the “first responder” for security challenges, facilitating maritime surveillance through aircraft and supporting port developments.

Efforts for trade expansion between the two nations are being accelerated and negotiations are active on the Economic and Technology Cooperation Agreement (ETCA) to upgrade the existing Free Trade Agreement (FTA).



Indian Vice President C P Radhakrishnan with Sri Lanka's Prime Minister Harini Amarasuriya

India is one of Sri Lanka's largest trading partners and investors with bilateral trade reaching approximately USD 5.5 billion in 2023-24.

Energy ties between India and Sri Lanka are strengthening, focusing on regional integration, renewable energy, and infrastructure. Key initiatives include renewable energy projects in Sampur, potential oil/LNG pipelines, power grid connectivity, and developing the Trincomalee oil tank farm as a regional energy hub.

India is Sri Lanka's largest tourist source market (~20-22 per cent of total, with over 5.3 lakh arrivals by mid-2025). Connectivity is advancing through resumed flights (Chennai-Jaffna) and passenger ferries (Nagapattinam-Kankesanthurai).

MALDIVES: MARITIME SECURITY FOCUS

The Maldives saw a pro-China President Mohamed Muizzu from People's National Congress (PNC) elected in 2023, briefly straining ties, but India responded with quick financial aid and strategic patrols,

India's neighbourhood policy and its Northeast strategy are deeply interconnected, as stability, connectivity and development in the NE directly strengthen India's ability to engage effectively with its eastern neighbours

offering a \$565 million (approx. ₹4,850 crore) line of credit for infrastructure development and reducing previous debt-repayment obligations, showing it won't cede influence easily.

The "India Out" sentiment and the demand to remove Indian military personnel were resolved by replacing them with civilian technical professionals by mid-2024. The Muizzu administration has shifted from a pro-China stance to a more balanced approach, recognising India as a crucial developmental and security partner. India has solidified this

partnership by gifting surveillance assets, funding ship refits, and conducting joint military exercises to bolster security in the Indian Ocean.

India-Maldives relations have undergone a significant reset and warming, transitioning from intense diplomatic friction to a robust partnership under President Muizzu. This shift is marked by high-level visits, economic assistance and renewed cooperation in infrastructure and maritime security.

India continues to play a central role, with the Greater Malé Connectivity Project and other projects moving forward. Cooperation in maritime security (patrols, surveillance) remains a priority.

Tourism between India and the Maldives is undergoing a recovery phase in 2026, aimed at restoring India as a top source market after a significant dip in 2024 to 1.3 lakh tourists, down from over 2 lakhs in 2023. The Maldivian government is actively hosting roadshows in Indian cities, promoting tourism, and leveraging flights from carriers like Maldivian to boost numbers. An open skies agreement exists, with airlines like Maldivian operating flights to Kochi and Thiruvananthapuram and plans to expand to other cities. The Maldives Association of Travel Agents and Tour Operators (MATATO) and resorts are aggressively targeting Indian travellers with tailored and experiential luxury packages.

BANGLADESH: VITAL FOR REGIONAL SECURITY

The Bangladesh Nationalist Party (BNP) has returned to power amid ongoing tensions between Islamist factions and New Delhi. Tarique Rahman from BNP became the Prime Minister of Bangladesh on 17 February 2026. Soon after the swearing in of the new government, India moved quickly to recognise the new political reality.

New Delhi sent a high-level delegation including Lok Sabha Speaker Om Birla and Foreign Secretary Vikram Misri, to

participate in the swearing-in ceremony. In turn, less than a week after the BNP-led government took charge, Bangladesh's newly appointed Directorate General of Forces Intelligence (DGFI) Maj. Gen. Mohammad Kaiser Rashid Chowdhury made a trip to New Delhi.

Both sides have started restoring visa services since the BNP took office in Dhaka. While Bangladesh recommenced full-scale visa services at its missions in India on February 24, India indicated that it would soon resume various categories of visas for Bangladeshis in phases, including medical, tourist, and student visas.

India's approach focuses on long-term structural interdependence, including enhancing cross-border connectivity and energy cooperation, rather than relying solely on political alliances, to ensure stability on its eastern border. In March 2026, India supplied around 5,000 tonnes of diesel to Bangladesh via the Bangladesh-India Friendship Pipeline as part of an agreement under which New Delhi supplies approximately 180,000 tonnes each year from the Numaligarh refinery in its Northeast. Bangladesh has become a key partner with India investing in its ports and power plants to counter China's influence, jointly managing river waters and border security.

Economic links between the two countries are showing signs of revival. Export growth is particularly strong in footwear (43 per cent), fish (42 per cent), and ready-made garments (17.38 per cent). Bangladesh continues to import roughly \$9 billion worth of goods annually from India, underscoring the scale of cross-border supply chains despite the broader political tensions.

The reopening of diplomatic and intelligence contacts indicates that both Dhaka and New Delhi recognise that prolonged tension in their relationship is simply not an option. Despite some disagreements, the two countries remain closely linked through security concerns, trade, and geography.



Sri Lankan President Anura Kumara Dissanayake with Indian Prime Minister Narendra Modi

The coming months will show whether the momentum observed in the first part of 2026 can be sustained and whether India will be able to transform tactical achievements into a stable regional order

TAKEAWAYS

India's neighbourhood policy and its Northeast strategy are deeply interconnected, as stability, connectivity and development in the Northeast directly strengthen India's ability to engage effectively with its eastern neighbours.

The Union government is showing active engagement with "new-generation" leaders and the focus is on engaging new governments based on shared interests and equality rather than historical ties. Recent developments indicate that India's neighbourhood

policy is entering a new stage. The previous focus on the concept of Neighbourhood First is shifting to a more proactive approach that can be termed Neighbourhood Shaping.

Despite these efforts, India faces significant headwinds in 2026, including the influence of external actors like China, persistent boundary disputes, and the need to manage internal volatility in neighbouring countries. The neighbourhood is, in most respects, the most challenging area of India's foreign policy. The coming months will show whether the momentum observed in the first part of 2026 can be sustained and whether India will be able to transform tactical achievements into a stable regional order.



– The writer retired as a Senior Technical Officer at the Central Salt and Marine Chemicals Research Institute, Bhavnagar (Gujarat), and currently contributes articles to research journals and magazines. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda

RIGHT LEADERSHIP TO SPEARHEAD INDIA'S MILITARY TRANSFORMATION

General NS Raja Subramani's elevation as Chief of Defence Staff and General Dhiraj Seth's appointment as Chief of the Army Staff signal a defining moment for India's military. Both leaders bring exceptional operational experience and strategic vision, arriving at a time of unprecedented transformation across technology, jointness and evolving threat landscapes

LT GEN ASHOK BHIM SHIVANE

The elevation of General NS Raja Subramani to Chief of Defence Staff and General Dhiraj Seth to Chief of the Army Staff mark more than a routine transition at the apex of India's military establishment. It comes at a moment when the Indian Armed Forces face perhaps their most complex period of change since the reforms following the 1962 war.

India's military is not preparing for yesterday's wars. Nor can it afford to prepare only for tomorrow. It must simultaneously maintain deterrence against two nuclear-armed adversaries, absorb disruptive technologies, modernise ageing inventories, integrate three services into a more cohesive fighting force, and do all this within finite budgets and competing national priorities.

The challenges are formidable. Yet if leadership remains the decisive factor in military transformation, India appears to have entrusted the task to two officers uniquely suited for the responsibility.

On May 31, Gen NS Raja Subramani, PVSM, AVSM, SM, VSM, assumed office as India's third CDS. His operational experience may prove equally consequential. General NS Raja Subramani assumes office after serving as Vice Chief of Army Staff during Operation Sindoor, which underscored the importance of joint planning, intelligence

integration, and rapid decision-making. He therefore brings a contemporary understanding of how modern military operations are conducted.

During his distinguished career, he has also commanded several key formations, including a battalion during counter-insurgency operations in Assam; an Infantry Brigade in Jammu and Kashmir; a Mountain Division in the Central Sector of Eastern Command; the GOC UB Area; the Ambala-based Strike Corps; and, later, Central Command. He then moved to Delhi as Vice

Chief before his tenure at NSCS.

But his credentials extend far beyond recent events. One of the defining moments of his career came post-2017 Doklam crisis. As General Officer Commanding in the sector in 2018, following the most serious military stand-offs between India and China in recent decades, he witnessed firsthand the pressures of strategic competition along the Himalayan frontier. India emerged from Doklam firm, resolute and diplomatically secure. The episode underscored the importance of military preparedness,



Chief of Defence Staff (CDS) General NS Raja Subramani



Chief of Army Staff (COAS) General Dhiraj Seth

political resolve and calibrated escalation management.

Those lessons remain highly relevant today. China continues to represent India's most significant long-term military challenge. The Line of Actual Control remains heavily militarised. Infrastructure competition continues on both sides of the border. Future confrontations may involve cyber operations, space-based assets, electronic warfare and autonomous systems alongside traditional military deployments.

General Subramani understands this reality not from academic study alone but from lived experience. His career has taken him from the glaciers of Siachen to counter-insurgency operations in Jammu and Kashmir, from challenging assignments in the Northeast to key command roles along the China frontier and to the position of Corps Commander of a Strike Corps on the western front. Such exposure provides an understanding of India's security environment that few officers possess to the same extent.

For CDS, however, his most complex challenge may not stem from an external adversary but from within the system itself, namely the unfinished journey towards genuine jointness. While considerable attention has been devoted to theatre commands, integration and

India's military is not preparing for yesterday's wars. Nor can it afford to prepare only for tomorrow. It must simultaneously maintain deterrence against two nuclear-armed adversaries, absorb disruptive technologies, modernise ageing inventories and integrate three services into a more cohesive fighting force

structural reforms, the deeper challenge is recognising that military transformation is fundamentally about people, culture and mindset, not merely organisational design. In a multidomain battlespace, the creation of integrated functional commands such as Cyber, Space, Air Defence, Special Forces, C5ISR, and Training & Doctrine Command must precede and complement the evolution of theatre commands.

Each Service has developed its own operational ethos, traditions and

institutional priorities over decades. Harmonising these into a truly joint force will require more than directives; it will demand mutual trust, intellectual convergence, institutional maturity and leadership that inspires confidence across the Services. The success of jointness will ultimately depend on building a shared vision and a unified approach to future warfare.

That is where General Subramani's background is particularly important. Having served as Vice Chief during a period of active operational engagement and later in the NSCS, he understands the practical necessity of tri-service integration. He has seen how intelligence, cyber capabilities, space assets, air power, maritime reach and land forces increasingly operate as components of a single military system. The future battlefield will not distinguish between services; it will reward those who can integrate effects across domains.

No CDS anywhere in the world exercises independent military authority detached from political leadership. Nor should they. In every successful democracy, strategic direction ultimately flows from elected governments. India's military transformation must address three core strategic components: politico-military culture, defence planning processes, and joint service capabilities.

The CDS's role is to provide coherent military advice, align capability development, and ensure the armed forces function as a unified instrument of national power. For that task, professional credibility is more important than formal power. General Subramani possesses it in abundance. He has also had the distinction of serving as the military advisor to the National Security Council Secretariat (NSCS), where he was exposed to the broader strategic construct.

Alongside the CDS, a new COAS has been appointed. General Dhiraj Seth, PVSM, UYSM, AVSM, assumed office as the 31st Chief of the Army Staff on June 30, becoming the seventh Army Chief from the Armoured Corps and the third from the 2nd Lancers. This distinction is significant. Armoured officers are culturally groomed to think strategically as thought leaders, have a good

grasp of technology and operational art, and envision future warfare.

General Seth's professional record is exceptional by any standard. Lieutenant General Dhiraj Seth, an alumnus of the National Defence Academy, Khadakwasla, was commissioned into the Armoured Corps in December 1986. With nearly four decades of distinguished service, he has made significant contributions to operational excellence, strategic planning, capability development and military transformation.

His command tenures have been operationally extensive, spanning an Armoured Regiment in the desert sector, an Armoured Brigade on the Western Front, a Counter-Insurgency Force in Jammu & Kashmir, and the Sudarshan Chakra Corps, one of the Indian Army's premier strike formations. He later served as General Officer Commanding, Delhi Area. As an Army Commander, he led both South Western Command and Southern Command, providing strategic oversight across critical theatres.

He has held key appointments in strategic planning and capability development at Army Headquarters, shaping modernisation and future force structuring initiatives. A graduate of the Higher Command Course at the National Defence College and the Command & Staff Course in Paris, he brings a deep strategic perspective to contemporary military challenges.

The General has taken over at a time when the IA faces several challenges. The first challenge for General Seth is to manage the Army's transition into an era of technology-intensive warfare without sacrificing the fundamentals of soldiering. The wars in Ukraine, West Asia and elsewhere have demonstrated that drones, artificial intelligence and precision weapons are transforming the battlefield. Yet they have also shown that soldiers, not algorithms, still hold territory. Finding the balance between technological innovation and battlespace practicality will define the next decade of military development.

The second challenge concerns force modernisation. The induction of the indigenous Zorawar light tank, the expansion of drone capabilities, the

Military institutions are shaped by the quality of their leaders. General Dhiraj Seth brings unmatched professional accomplishments, command experience and organisational insight. General NS Raja Subramani brings operational credibility, strategic perspective and a deep appreciation of joint warfare, grounded in battlefield experience and at the highest levels of military planning

integration of artificial intelligence into command systems, and the continued emphasis on indigenous defence production will all gather pace during his tenure. These are not merely procurement programmes. They involve doctrinal adaptation, training reforms and cultural change within a large institution.

The third challenge is organisational. The move into the new Sena Bhavan symbolises a broader effort to build a more networked, responsive and integrated Army Headquarters. Transformation is often discussed in terms of equipment. In reality, it succeeds or fails through institutions.

The fourth challenge is perhaps the most sensitive: the human dimension. The recommendations of the next Pay Commission, ongoing issues with military pensions, Agniveers, and OROP, recruitment policies, and veteran welfare will all require careful handling. Armies ultimately fight on morale, trust, and cohesion. A Chief who enjoys credibility across generations of serving soldiers and veterans brings an invaluable advantage. Throughout his career, General Seth has been widely regarded as a top-rate professional and a gentleman, known for being balanced, fair,

and transparent. His integrity and loyalty to the uniform are deeply respected. He is approachable, inclusive, fair-minded, and deeply committed to merit. In an era when institutions increasingly struggle to retain talent and sustain morale, such qualities matter.

The appointments of General Seth and General Subramani also reaffirm an enduring strategic reality. Despite growing emphasis on maritime security, cyber operations, drones and space capabilities, India remains fundamentally a continental power. Geography has not changed. The nation still faces active territorial disputes and continues to confront security challenges that ultimately require the credible application of land power.

Finally, military institutions are shaped by the quality of their leaders. General Dhiraj Seth brings unmatched professional accomplishments, command experience, and organisational insight. General NS Raja Subramani brings operational credibility, strategic perspective, and a deep appreciation of joint warfare, grounded in battlefield experience and at the highest levels of military planning.

The years ahead will test India's Armed Forces in ways never seen before. But if leadership remains the most important military capability, the country has reason to be confident it has the right generals at the right time for the right job. ■



—The writer, a PVSM, AVSM, VSM is a reputed defence analyst, a motivational speaker and prolific writer on matters of military, defence technology and national security. He has had an illustrious career in Indian Army spanning nearly four decades. A distinguished Armoured Corps officer, he has served in various prestigious staff and command appointments including Commander Independent Armoured Brigade, ADG PP, GOC Armoured Division and GOC Strike 1. As DG Mechanised Forces, he was the architect to initiate the process for reintroduction of Light Tank and chaired the study on CSISR for Indian Army. The views expressed are personal and do not necessarily carry the views of Raksha Anirveda



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PARADOX OF MODERN WARFARE

The paradox of modern warfare premises that technological precision does not necessarily lead to victory. The US-Israel-Iran conflict has starkly demonstrated the limitations of conventional military superiority against an opponent with low-cost asymmetric capability. The conflict has prolonged despite military edge. Similarly, Operation Sindoor decisively altered the security dynamics between India and Pakistan, but coexistence with indeterminacy defines the art of modern warfare

MAJ GEN G SHANKARNARAYANAN

On May 7, 2026, India reaffirmed the efficacy of Operation Sindoor, underscoring its strategic clarity in cross-border force application in response to any terrorist action or cross-border violation. Simultaneously, the aim was to broadcast to the world that, by confining military action to a quid pro quo, India underscored its non-escalatory posture and respect for established international norms. On the contrary, a recalcitrant Pakistan's retaliatory response was a coordinated drone and missile strikes targeting Indian military installations, bordering on combat escalation to include nuclear sabre rattling. As a counter strike, India, on its part, conducted precision strikes to neutralise systems that had facilitated Pakistani assault and were executed under the guiding principle of "equal intensity in the same domain." This retaliatory response of targeting only those installations directly involved

in the aggression balanced the imperative of selective punitive deterrence with its overarching commitment to escalation control and early de-escalation. In effect, India's calibrated response, Operation Sindoor, has decisively altered the security dynamics between India and Pakistan.

Whereas, despite the severity of the impact of Operation Sindoor buttressed by Pakistan's desperate call for a ceasefire, their military leadership chose to describe their four-day conflict with India 'Marka-e-Haq' as a battle between two ideologies where truth had prevailed. Notwithstanding this tall claim, largely dismissed by the international community, Operation Sindoor has been a watershed not only in its military dynamics but also in establishing a new normal in India's counter-terrorism response. The fact that there has been no major terrorist incident during the past year is a testimony in itself. That apart, Operation Sindoor, even as it is ongoing,



has discarded several longstanding shibboleths in India's strategic and diplomatic thinking. For the first time, New Delhi has made it clear that it will not distinguish between terrorists and those supporting them, and that any future terrorist attack will be considered an 'act of war'.

This parliamentary formulation is momentous, as it explicitly puts the onus on the Pakistani state and society, making it clear that the choices they make in pursuing the policy of terrorism can no longer have 'plausible deniability' and that military action will be escalatory with devastating consequences. Therefore, cross-border terrorism against India will no longer be an impact-drawn rhetoric or a 'cost-free option' but one that will redraw the contours of national sovereignty. A



closer analysis espouses a few derivatives that merit strategic considerations.

OPERATION SINDOOR - MILITARY DERIVATIVES

Militarily, the short but intense campaign showcased the execution of a multi-domain operation of such scale and complexity involving precision strikes and counter strikes by air, drones, supersonic cruise missiles and artillery proactively engaging predetermined targets, specific to Pakistan's non-state action, and intended to obliterate terrorist infrastructure with minimum collateral damage. Further, pursuant to the adversary's retaliation in the conventional domain, similar strikes followed suit as a deliberate reactive counterresponse against military targets aimed at neutralising and degrading

Pakistan's war-waging potential. The fact that air dominance was so preponderant that the scale of degradation and destruction carried out by the Indian military in less than 96 hours forced the adversary to call for cessation of hostilities, knowing fully well that any further escalation would have triggered a full-scale war that Pakistan could ill afford. It demonstrated India's nationalistic resolve to punish the perpetrators and their sponsor, unmindful of the consequences that perhaps could have led to a full-scale war. The underlying fact clearly distinguished India's attack as being terror-specific, while Pakistan's was random retaliation on predictable lines, prompting a full-scale escalation.

However, on hindsight, should the option of a full-scale war have been exercised by Pakistan, the escalation

Operation Sindoor has discarded several longstanding shibboleths in India's strategic and diplomatic thinking. For the first time, New Delhi has made it clear that it will not distinguish between terrorists and those supporting them, and that any future terrorist attack will be considered an 'act of war'

would be in the missile domain where it purports to exercise 'full-spectrum deterrence' to counter India's conventional military advantages. Its short- and medium-range ballistic missiles (Shaheen, Ghauri, Ghaznavi) and advanced cruise missiles (Babur, Harbah, Ra'ad), with recent developments, including the Fatah-III supersonic cruise missile, are likely to be employed against military and civilian infrastructure. What will be of military consequence will be the indiscriminate nature of targeting civilian infrastructure, to include cities and towns, as proclaimed by Pakistan's Defence Minister Khawaja Asif, warning India that in case of a future conflict between the arch-enemies, Islamabad would respond by attacking West Bengal's capital Kolkata.

This follows the stratagem of indirect pressure through humanitarian distress while pursuing a policy of strategic defence across the entire battle space. The operation will also be equally supported by drone warfare of the kind witnessed in the Middle East. Thus, the contours of conventional battle will largely undergo a change of factor in 'full spectrum irrationality' as a key component of conflict with Pakistan, necessitating a rethink in our operational paradigm.

Missile Defence System: Under the circumstances enumerated above, air

defence or an impregnable iron dome concept will have to be put in place across the national capital and large urban centres besides all national assets across the country, particularly those within Pakistan's striking distance. In this matter, India has been quick to implement an air defence umbrella by a multi-layered Air Defence 'Dome' designed to counter drones, missiles, and other modern aerial threats. Dubbed the Capital Dome, the system pairs the Quick Reaction Surface-to-Air Missile (QRSAM) with the Vertically Launched Short Range Surface-to-Air Missile (VL-SRSAM), offering continuous, overlapping protection. Mounted on 8x8 vehicles, the QRSAM can detect and engage targets on the move up to 30 km, while the VL-SRSAM adds 360-degree coverage within a 10-km radius. To complement the engagement cycle, Akashteer, a mobile Air Defence Network, has been developed to digitise air defence control, enhancing situational awareness and operational coordination among air defence entities.

Long Range Interdiction: As part of its offensive capability, India is rapidly advancing its autonomous and targeting systems to enhance strategic deterrence and combat efficiency, particularly in long-range interdiction roles. The enhancement of air power by way of inducting Medium Multi-Role Combat Aircraft (MMRCA) will play a significant role in strategic as well as battlefield interdiction; it will have to be adequately complemented by long-range deep strike cruise missiles. In this regard, the Agni-V missile, equipped with Multiple Independently Targetable Re-entry Vehicle (MIRV) technology, allowing a single missile to deliver multiple warheads, including nuclear warheads, to multiple targets simultaneously, will play a stellar role.

Apart from that, Agni-VI, a highly advanced, nuclear-capable Intercontinental Ballistic Missile (ICBM), is designed to feature an estimated range of 8,000 to 12,000 km with similar MIRV technology to strike up to 10 distinct targets simultaneously. The payload is designed to carry up to 10



nuclear or thermonuclear warheads. As a countermeasure against air defences, it is designed to use decoys and chaff. Its launch mechanism is planned for canister-based, mobile road/rail platforms as well as potential submarine-launch capabilities to ensure survivability and strong 'second-strike' options. These are over and above all the conventional missile systems in India's inventory. It suffices to say that the wherewithal of neutralising Pakistan's long-range assets is well within our capability.

Counter Drone Systems: Recent conflicts have seen the dramatic use of drones to carry out precision strikes against a variety of targets and at varying depths, thereby altering battlefield dynamics. The clandestine employment capabilities and varying payload capacities of these systems have opened a plethora of options for use as a low-cost countermeasure. Therefore, the fact that drones will play a significant role in any future conflict with Pakistan is a foregone conclusion. Suitable countermeasures have to be implicit in our planning. TRIYAM-3D is an indigenous AI-powered autonomous air-defence system

designed to counter drones using Gatling-gun style weapons, featuring acoustic AI threat detection. Presumably, over time, this shield will also be suitably integrated with anti-drone capability.

Indrajaal, an indigenous counter-drone multi-layered autonomous anti-drone system deployed to protect key Indian Army and Naval installations, is marking a significant milestone in India's transition towards AI-enabled autonomous airspace defence. At the core of Indrajaal's architecture is its proprietary SkyOS C5ISRT platform, which integrates Command, Control, Communications, Computers, Cyber Defence, Intelligence, Surveillance, Reconnaissance, and Targeting into a single cohesive system, enunciating the paradigm that network centric decision making and execution is a prerequisite to augment speed of precision engagement is an AI driven eco system, which can significantly alter the outcome of any campaign. These AI-based developments are designed to reduce operational costs and improve response times. India is also actively developing AI-based underwater autonomous vehicles and predictive analysis tools for effective border management.

Operational Paradox: The paradox of modern warfare exemplifies the premise that increased technological precision in weapons does not necessarily lead to faster or more decisive victory. In fact, the precision paradox defeats the notion that precision equals rapid strategic victory. Coupled with this is the information-escalation Paradox. In the current digital age, information is weaponised, where a viral false story can trigger escalation as quickly as a physical strike, necessitating a serious focus on perception management. This is equally compounded by the ease of information availability. In this milieu, achieving the desired end state will be more complicated than the traditional conflict outcomes.

In recent times, diplomacy and warfare have often taken a near-simultaneous approach rather than sequentially, with temporary ceasefires being used for tactical readjustment rather than true de-escalation. Given these paradoxical dynamics, modern conventional battle is characterised by a state-on-state, high-intensity combat that

emphasises destroying an enemy's military capability through integrated, precision-guided firepower rather than just attrition in a reasonable time frame. The essence would be to annihilate the adversary before reaching the culminating point.

To do this, the battle space has to be addressed in all tiers in near simultaneously i.e tactical, operational and strategic depth. long-range precision strikes coupled with geographical battlefield isolation by a tri-service force matrix would perhaps set the stage for decisive annihilation as part of a blitzkrieg. Thus, the tenets of erstwhile operational art remain largely relevant except that the means of achieving it in time and space and the components of combat have largely changed. Further, this time-bound strategy has to be technologically driven to achieve the desired combat degradation and operational objectives.

Therefore, doctrinally, the erstwhile 'Cold start' has been rightly metamorphosed to 'Cold Strike' where speed of engagement is paramount. Herein lies the efficacy of long-range interdiction that is crucial to degrade operational

sustainability and decimate reserves in depth. What follows will need the attention of a deliberate manoeuvre force for annihilation. However, this postulate has to be viewed against the backdrop of India's commitment to no, if not, minimum collateral damage. Notwithstanding the above, in an 'all of Nation approach' to defeat the adversary, the effort would be to achieve the political objectives with minimum loss of life and collateral damage. Nuclear option shall predominantly remain as a deterrence rather than a weapon of mass destruction.

CONTOURS OF RECENT CONFLICTS

Viewed in this context, the ongoing conflicts have provided valuable insight into the nature of conflict in the context of precision engagement and, more importantly, the efficacy of a superior force. This phenomenon is the cornerstone of asymmetric warfare, where the operationally weaker force employs unconventional tactics to neutralise the advantages of the stronger opponent to



achieve disproportionate results. A case in point is the ongoing US-Israel-Iran war in the Middle East. To that extent, examination of each of the ongoing conflicts merits value addition.

Ukraine-Russia War: By contrast, the ideological objectives of the Ukraine-Russia conflict are characterised by a profound, irreconcilable clash between Russian neo-imperialism and Ukrainian national self-determination. Russia seeks to enforce a 'historical unity' that denies Ukrainian sovereignty, while Ukraine fights for its survival as an independent, European-aligned state. Russia's core ideological motivation revolves around reconstructing a sphere of influence and reasserting its identity as a great power in opposition to the West.

Ukraine, on the other hand, focuses on ideological goals that are essentially existential, focusing on liberty, sovereignty, and a European future. This imbroglio has resulted in a protracted confrontation where the war has transitioned from a war of impact or special military operation to a long, grinding battle of attrition.

Russia bets on destroying Ukrainian statehood gradually, while Ukraine relies on resilience. Thus, peace negotiations stumble due to these core ideological differences. It revolves around Ukraine's demand for a peace based on international law and full territorial sovereignty, whereas Russia uses negotiations as a tactic to force 'capitulation'. In the process, the battlefield remains dynamic, and the envelopment of targets is predominantly civilian infrastructure, hitherto unheard of in any conflict where the kinetic engagements are unmindful of collateral damage.

The 4-year war has degenerated into one of prolonged endurance-based creeping attrition with huge collateral damage and no sight of conflict termination. It has clearly pronounced the death of the United Nations as a neutral custodian and arbitrator of peace, while the war has become a way of life.

Iran chose to exploit the maritime passage across the Strait of Hormuz to de facto weaponise oil and gas to seek a global response to US irrationality. Iran decided to target the global economic gateway by disrupting shipping in the Strait, using sea mines, fast boats and drone strikes to create a hybrid threat to maritime traffic, calling it the 'Hormuz Toll Tax' strategy

Operations in Gaza: In Gaza, it is prefaced by the brutal annihilation of Hamas, unmindful of the death and destruction of the Palestinians. The ideological and strategic objectives of Israel's operations in Gaza focus on eliminating Hamas's power, reshaping the territory's governance, and establishing long-term security control to prevent future attacks like that of October 7, 2023. These goals are driven by a security-centric ideology to fundamentally alter the Gaza Strip's political landscape, involving the reoccupation of territory to enforce these changes. It entailed dismantling Hamas and removing Hamas as a governing body and its military threat in Gaza, besides establishing a 'security perimeter' to negate the resurgence of terrorist attacks against Israel ever again.

Having set the stage, the next move was replacing local governance by installing a new, non-Hamas civilian administration in Gaza, potentially involving Arab forces or alternative local leadership, rather than returning to Palestinian control. Paramount in all the above was securing the release of all the remaining Israeli hostages, both living and deceased, which in itself has been a major and increasingly difficult political objective.



It is thus obvious that in doing so, an attempt is being made by Israel to reshape regional dynamics. It is viewed as part of a broader, US-backed effort to weaken the 'Axis of Resistance' and force a regional shift towards peace by adopting a 'Super-Sparta' model, characterised by perpetual mobilisation and the use of extreme force to deal with perceived existential threats. This plan largely supersedes the earlier 'Mowing the Grass' strategy, which entailed periodically weakening Hamas and moving towards a goal of full ideological and military elimination of the organisation. However, in real terms, this prolonged yet devastating military operation has resulted in mass displacement, reflecting an ideological push by far-right elements to permanently alter the demographic landscape of Gaza to potentially facilitate the return of Jewish settlements.

Notwithstanding these Israeli operational imperatives, the stark realities are contradictions and challenges that Israel is facing in its operational pursuit. Despite relentless destructive pressure on Hamas and repeated calls for the return of hostages,



the remaining hostages are often used as human shields, complicating military efforts and negotiations. Furthermore, while Hamas has lost control over northern Gaza, it remains a viable fighting force, with its disarmament remaining a stalled demand. Thus, a permanent and lasting peace remains elusive in Gaza. What remains are the ghosts of skeletal buildings and the distant cry of orphaned children echoing the scale of death and destruction unparalleled in human history.

Operation Epic Fury and its

Fallout: The US-Israel-Iran conflict has starkly demonstrated the limitations of conventional military superiority against an opponent with low-cost asymmetric capability. The US-Israel strategic dominance over Iran has met with Iran's strategy of deterrence by denial and deterrence under fire. It relies more explicitly on deterrence by punishment, targeting critical infrastructure, to raise the cost of war while disregarding global military conventions.

Strategically, collateral damage is

inherently inbuilt to seek political and economic leverage. This synthesis would indicate that the efficacy of a conventional battle in the traditional sense is no longer an attempt to destabilise the enemy but to capitulate strategic vulnerability at all costs to not only raise the cost of war but to leverage it for political gains.

In addition, the choice of strategic targets for indirect strikes is not limited to military targets alone but has stretched onto strategic assets, viz., oil fields, water purification plants, etc., that have a compelling effect on the course of the campaign. Iran's targeting of US forces as well as oil fields in the Gulf countries has had a dual impact of not only crippling the combat capability of the US in the Gulf but also militarily stalling its aggressive design despite gross intimidation of the extreme kind, besides strategically imposing an economic cost.

Thus, Iran did not crumble under US or Israeli military pressure despite being a technologically superior force whose application of force, including ground forces, was sharply calibrated to

avoid a confrontation. On the contrary, Iran has emerged more unpredictable, resolute and firm in upholding its national interests despite the capitulation of its leadership, resulting in changing the strategic equation of the region.

A closer look will reveal that the war has been deliberately regionalised. In fact, Iran is not treating the confrontation as a bilateral exchange with Israel or the United States, but as a multi-theatre conflict in which different fronts — Lebanon, Iraq, the Persian Gulf, and maritime chokepoints — are integrated into a single strategic space. This allows Tehran to stretch the US and Israeli resources, complicating their planning and creating a constant operational vacuum and uncertainty of pressure points, thereby capitalising attrition as its war strategy.

In the ultimate analysis, while the US-Israel duo has been the perpetrator, Iran is not seeking a quick end to the war, but is instead trying to sustain pressure over time — militarily, politically, and economically — to alter the adversary's cost-benefit calculus as well as permanently alter the security dynamics of the region. In that sense, the objective is not battlefield victory in a conventional sense, but producing a new strategic equation in which the threshold for attacking Iran remains prohibitive.

Exploiting the Geographic Vulnerability:

Another important facet has been the exploitation of geographic vulnerabilities. At the operational level, Iran chose to exploit the maritime passage across the Strait of Hormuz to de facto weaponise oil and gas to seek a global response to US irrationality. Iran chose to target the global economic gateway by disrupting shipping in the Strait of Hormuz, using sea mines, fast boats, and drone strikes to create a hybrid threat to maritime traffic.

Calling it the 'Hormuz Toll Tax' Strategy, Iran has managed to thwart the US intimidation, besides invoking global outrage on the US-Israel initiated conflict for early termination. It has effectively used it as a bargaining chip for conflict

termination and long-term peaceful resolution in the region.

The cessation of hostilities seems elusive for the time being, but surely the intended economic effect has been significantly pronounced globally, allowing Iran to adopt a hardline stance to any peace proposal not in its favour, besides withstanding US intimidation and shifting the overall momentum to place the United States on the defensive in a sustained way. In that sense, Hormuz has been central to Iran's ability to convert geography into leverage and to widen the war beyond the Middle East.

PARADOX IN THE INDIAN CONTEXT

In the Indian context, Operation Sindoor has been demonstrative of India's military intent and capability, while the cessation of the Indus Water Treaty is a geographical leverage over Pakistan. It is hard to perceive water war as a trigger in a future conflict with Pakistan, given their rhetoric on water ownership; however, a terrorist action will certainly be treated as an act of war. Apart from that, the conflict may also choose to be retributive by way of planning a reunification or annexing PoK, a long-standing political parliamentary resolution of 1994.

Therefore, in the event of a conflict, it is a foregone conclusion that the physical combat engagement of the campaign will be prolonged in nature. It could also perhaps draw a red line to encompass PoK in its current form by military means. Dissecting this further, going forward, both sides will have targeting concerns and have compelling reasons to worry about what the targeting precedents from this conflict (Op Sindoor) might mean for escalation risks in the next one. India's opening salvos hit Muridke — LeT's well-known headquarters — and a major Jaish-e-Mohammed complex in Bahawalpur.

Those strikes told a clear story of proportionality, striking terrorist bases for terrorist violence. But they also exhausted two of the most symbolic, politically sellable sites that had long been on India's short list. Should another attack

India must be prepared for a 'hybridised' battlespace, ensuring rapid air dominance and surgical destruction to secure victory through a swift and decisive ground action. The next war with Pakistan will certainly be a long-drawn conflict of attrition with a questionable sustainability factor

occur, New Delhi may feel compelled to reach deeper into Pakistan to find sites with comparable political and operational value. That apart, the focus will be to degrade Pakistan's war-waging potential to carry out a calibrated attrition battle till its final capitulation.

These anxieties may well shape Pakistani doctrine going forward, nudging it towards earlier mobilisation and, paradoxically, faster escalation in a future conflict. All this will be under the spectre of a nuclear conflagration, which cannot be lost sight of. Thus, India must be prepared for a 'hybridised' battlespace, ensuring rapid air dominance and surgical destruction to secure victory through a swift and decisive ground action. The next war with Pakistan will certainly be a long-drawn conflict of attrition with a questionable sustainability factor.

Civil Defence: The collateral damage caused in all the ongoing conflicts suggests a replication by Pakistan. Therefore, what stands out is the requisite air defence coupled with well-prepared and coordinated Civil Defence measures to such contingencies. Priority has to be prevention and mid-course neutralisation of incoming aerial threats, besides handling the disaster on occurrence through an institutionalised

disaster relief mechanism across the length and breadth of the country. The Civil Defence Corps, raised with ex-servicemen forming the core and integrating several big hospitals, will be an operational necessity.

In conclusion, this synthesis of conflicts presents a very complex stratagem of conflict management. In the quest for using war as an instrument of state policy to achieve political objectives, there seems to be no end state or finality. In that sense, it is no longer tending towards conflict resolution but presents itself as a managed condition of accepted neutrality aiming for temporary de-escalatory gestures for combat regrouping and resuscitation, regardless of human suffering. The fact that the modern battlefield is no longer confined to the kinetic domain but dispersed across technological, financial, informational, and political interpretive arena it requires concerted political calibration to reach the desired end state as soon as possible.

At the political level, the ambivalence of ideological rigidity must give way to compromise through dialogue and diplomacy. It is therefore axiomatic that in this transformed operational theatre, victory is no longer a terminus but a provisional construct, and war itself has become a managed condition without finality, oscillating between perception and reality, action and consequence and across a web of interdependent domains.

War by itself has become a function of sustainability, endurance, flexibility, and interpretive management that constitute vital components of political and ideological leverage. At the macro level, it is the political narrative derived from the quantum of deliverable ordinance that determines strategic effect. It is the capacity to coexist with indeterminacy that defines the art of modern warfare. ■



—The writer is a former GOC of the Indian Army and presently serves as a Strategic Consultant and Principal Advisor. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda.

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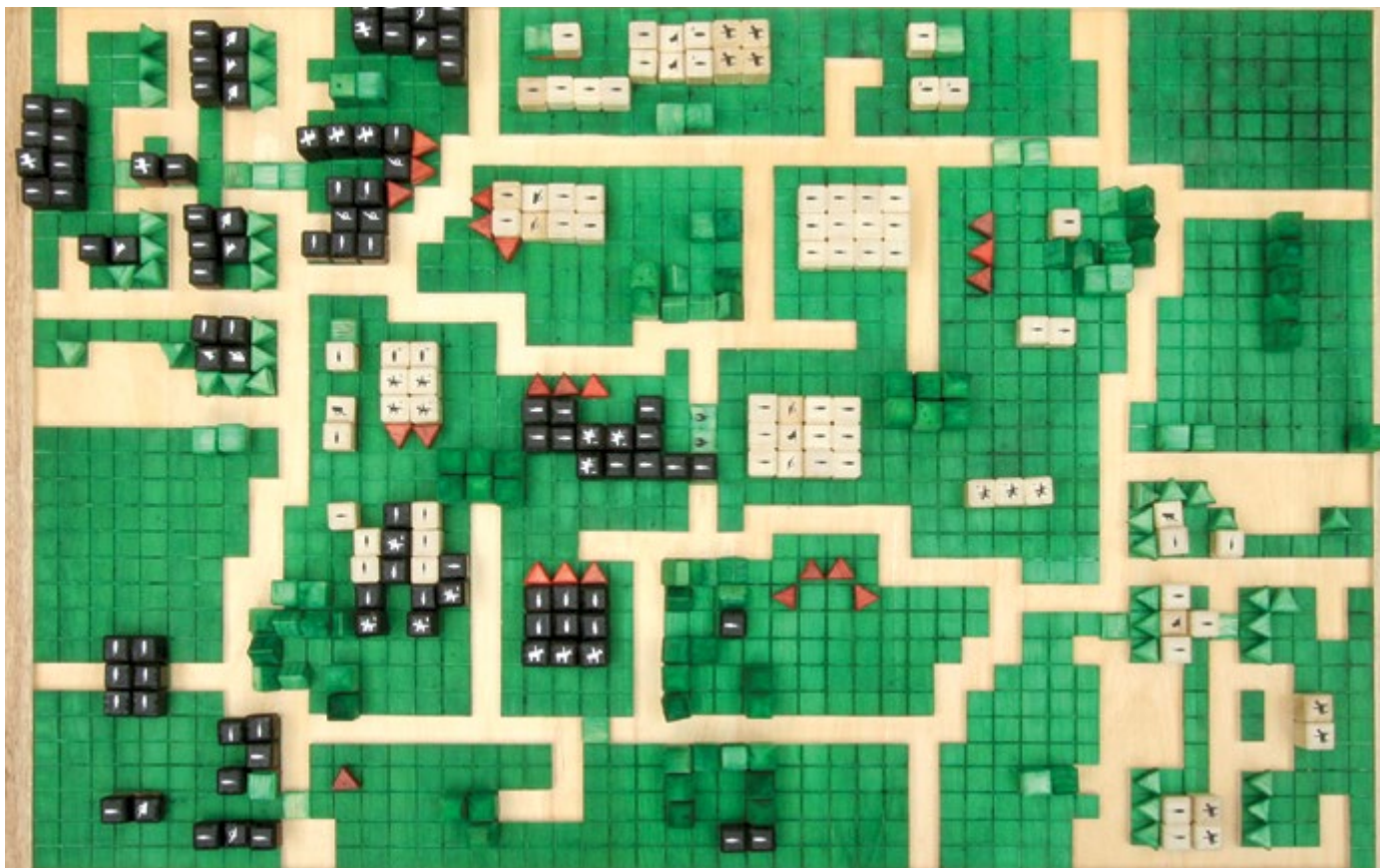


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A reconstruction of battle-chess of Johann Christian Ludwig Hellwig 1780 by Rolf Nohr, photograph by Ralf Wegemann.
Source: <https://commons.wikimedia.org>

THE MAP IS NOT THE TERRITORY

Akin to paper maps, wargames can be credible or distorted replicas of reality. However, without creating false confidence in misleading conclusions, they help defence forces prepare for an unpredictable scenario

COL SAIKAT K BOSE

Recent security-related discourses on Indian television have popularised the term 'wargaming', with several defence experts, think-tanks, universities, and corporations referring to or claiming to have used it. Wargaming, and wargames, have long been popular in the West despite phases of disinterest, but they remain an esoteric art to most

followers of the strategic debate in India, with persisting misconceptions about what they are and what they can do. To many, wargames are little more than snazzy computer simulations, while to others they are predictive super-tools capable of identifying winning strategies.

All such views miss the point.

The history of wargaming is a complete subject in itself. It shall be sufficient here to say that after experimentation with realistic versions of chess in the seventeenth century, the first game to have

Well-designed wargames help understand why the results emerged, how reality responded to an idea, why participants behaved in a particular way, which assumptions shaped their decisions, where plans encounter friction and what conditions and assumptions caused plans to succeed or fail

broken out of the gridded pattern of chess-type games, Kriegsspiel, was introduced into the Prussian Army in the early 19th century. Over the century, the game was eagerly adopted while various versions worked around its rigid rules, appearing in various armies. Wargaming continued to be exploited through the two world wars; after WWII, its nature changed with the rise of Operations Research and Systems Analysis, and the enhanced availability of computers. The post-war decades also saw a proliferation of wargaming as a highly popular hobby in the West, giving Western armies a decided advantage.

DESIGN AND PURPOSE OF GAMES

Popular understanding conflates wargames with computers, which is really only one of the four broad classes of wargames, the other three being seminar games founded on discursive procedures, matrix games which are a more formalised offshoot of seminar games, and physical games played on maps or dioramas with movable counters representing forces. While physical games are popular with hobbyists, armies have made use of seminar and physical games, and also computer games ranging from simple computer-aided data handling, to elaborate networks of computers with high-end processing. In the parlance of computation, the latter are

close to constructive simulations, which involve “constructed” realities and no physical or real elements.

The other popular misconception of wargames is that they provide answers and predict futures. However, just as any outcome in the real, complex world is one of the many that might have happened, outcomes of well-designed wargames do not tell what will happen but what might happen with varying probabilities. Treating outcomes of wargames as predictions would thus be erroneous. Rather than giving answers, wargames’ strength lies in generating questions. Results themselves are not important; well-designed wargames help understand why those results emerged, how reality responded to an idea, why participants behaved in a particular way, which assumptions shaped their decisions, where plans encounter friction, and what conditions and assumptions caused plans to succeed or fail, what factors proved decisive, or what alternative actions were available. This is why seasoned militaries seldom claim to have ‘validated’ a plan merely by playing it out successfully once in a wargame; indeed, some of the most useful wargames have been those wherein plans failed, revealing vulnerabilities before they were exposed in reality.

The advantages of wargames over other analytical methods, viz. computer models, statistical analysis, and simulations, lie in introducing non-linearity arising from, one, replicating an environment of uncertainty, and two, dynamic and competitive decision-making, neither of which is easy in other analytical modes. A successful wargame leaves participants with a better appreciation of possibilities rather than confidence in one predetermined solution, and a better ability in anticipating, adapting, improvising, deceiving, and innovating.

DOMAINS OF WARGAMING

With rising popularity, wargaming also expanded into domains other than the military. One such domain is diplomacy. International negotiations are rarely linear, as states simultaneously pursue multiple

objectives, adjusting their positions to others’ responses in an environment of incomplete information. Rather than static calculations, diplomatic outcomes emerge from the interactions between a large number of states, non-states, and international bodies, none of which are homogenous bodies but are themselves systems of various competing opinions and stakeholders which complicate decision-making. Well-designed games using organisation theory to model decision-making and frictions within these groups can help explore negotiation strategies, alliance dynamics, escalation risks, and unintended consequences in ways that conventional planning methods often cannot.

The same logic applies to several other domains, viz., Trade and Economic Competition or Public Policy. States compete for access to markets, critical technologies, energy resources, and supply chains, contending with tariffs, sanctions,

INTRODUCING THE THINKING SANDBOX

Wargaming remains a predominantly Western pursuit, with little awareness of its scope and possibilities in Indian society. The greater interplay of military practice, civilian scholarship, and hobby wargaming in the West has created an ecosystem that benefits Western militaries—an ecosystem India lacks.

The Thinking Sandbox, named for the safe space where ideas can be tested before they encounter reality, is a running column aimed at enhancing awareness of wargaming among Indian readers and stimulating its use as a training, planning, research, and policymaking tool.

The column will alternate between modern trends, history, and methodologies, while examining how diverse domains—diplomacy, trade, public policy, technology, and strategic competition—can exploit wargaming to replicate complexities, observe hidden forces, and identify opportunities for innovation and learning.

and other countermeasures. Governments confront interconnected problems of health, infrastructure, energy, migration, climate adaptation, and social stability, with decisions in any one realm having cascading effects in others.

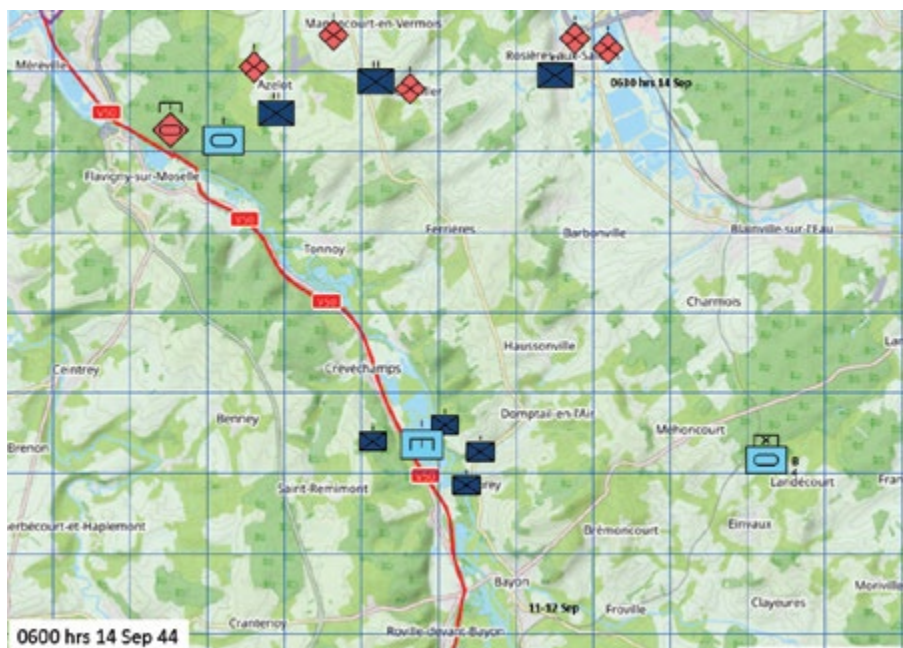
Thus, policymakers must anticipate not only direct consequences but also unintended consequences triggered by complex feedback loops. These and other effects are difficult to analyse and foresee through purely linear methods, but wargaming offers a framework for exploring them by bringing together stakeholders and subject-matter experts, revealing potential aspects otherwise hidden until implementation.

The corporate world has long recognised this value and routinely employs competitive simulations to test strategies, anticipate rival actions, and identify emerging opportunities and threats. Other arenas where wargaming can be employed are internal security and disaster relief.

The US Firefighting Department uses wargames to manage bushfires, where the fire is the enemy. The point is that not only the military but all domains that require decision-making under conditions of uncertainty and the chance of provoking responses can benefit from wargaming.

CAVEATS AND POSSIBILITIES

The rising popularity of wargaming must not obscure its limitations. There is no one universal wargame, for each game must be carefully adjusted to its scale and purpose to create an abstracted replica of reality wherein participants can practice competitive decision-making. Abstraction here is not a flaw — just like a map represents reality but is not reality itself, as famously observed by the philosopher Alfred Korzybski when he said that “the map is not the territory”, a wargame too is a representation made manageable by abstracting the endless variables, interactions, uncertainties, and human factors which can simply not be captured in a model. The abstraction, i.e., simplification, compression, selection, and omission of



Gamestate in the writer's game on the crossing of the Moselle River in WWII run as part of his PhD programme.

variables, must be done very carefully to match the scale and theme of a game, with designers making assumptions about what matters most, and making careful choices about what to include and what to exclude.

For example, a game for the training of junior leaders or examining a tactical battle must focus on manoeuvre and firepower of subunits on detailed terrain models, while another examining geostrategic competition would emphasise political decision-making and the use of instruments of national power, paying lesser attention to manoeuvre or firepower of military forces except for logistic sustenance or impact on public opinion.

All said, a game remains a model, its insights only as reliable as its assumptions, participants, design, and execution. Just like paper maps which can be accurate or distorted, wargames too can be credible or distorted replicas of reality, the latter occurring if critical variables are omitted or if distorted adjudication methods are used.

Good wargames must, without pretending to reveal the future or creating false confidence in misleading conclusions, help prepare for a future that cannot be known and holds surprises. They must model human cognition and friction

in a way that cancels out unrealistic participant behaviour (called gamer mode in wargaming parlance), while assumptions must not artificially ensure the success of a plan or reinforce biases.

It is thus that wargames require humility — experienced practitioners never view a single game as decisive evidence but understand the iterative analytical process. They see wargames as educational rather than predictive — cultivating habits of critical thinking and planning by exposing participants to uncertainty, incomplete information, competing objectives, and adaptive opponents.

Such experiential and experimental learning, which may include failing safely, is increasingly valuable in an era characterised by rapid technological change, geopolitical competition, and increasing uncertainty. ■



—The writer is an Indian Army veteran with three decades of experience in the Indian infantry. He is also a military historian and an avid wargamer. The views expressed are of the writer and do not necessarily reflect the views of Raksha Anirveda



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LEVERAGING TECHNOLOGICAL-INDUSTRIAL CAPABILITIES

India's diversified export menu has them all – from small drones to aircraft carriers. The challenge before policymakers is to determine how India's expanding technological and industrial capabilities can be transformed into sustainable economic strength, strategic partnerships and enduring geopolitical influence

ANSHUMAN TRIPATHI

India hosts the third largest number of unicorns - almost ready to provide windfall returns to their investors. Did you invest in any of them? It's quite a task to find that real soon-to-be-unicorn and invest at the right time. And above all, to have that courage and risk appetite. Investing in startups is a very high risk, high reward game. That investment could even be in "sweat equity" or working for stock in the startup.

A PIB (Press Information Bureau) release published in April this year, showcased a lot of data spread across the various government incentive schemes for startups. The data revealed that the list of such soon-to-be-unicorns has steadily increased over the years. These statistics provide a perspective on the startup ecosystem in India. But a startup cannot be successful on government incentives alone. To be viable they not only require a steady revenue stream but also need to showcase a highly profitable future. The larger the estimated RoI (return on investment), the higher the chances of private funding. That RoI also has another prerequisite – be more than what the market provides at lesser

risk. Only then would the investor risk investing for the returns. Without such an RoI, the startup would never wean off government support. Global statistics show a strong majority of startups disappear in that gap.

This warrants the question: how do the commandos of the investment world – the venture capitalists (VCs), succeed in such high-risk environment? They spread their risk across a portfolio of startups. For example, say a VC shortlists and invests one lakh rupees each in ten startups with the expectations that each startup would give a 50% return or more. But unfortunately, six of them fail, and thus six lakhs are lost. But the remaining

Last year, for each new startup receiving private funding, 69 new startups were registered. For defence startups, technology alone is not enough; sustainable business models remain the key to long-term success



four become successful, as predicted, and give 200%, 300%, 200%, 100% returns, respectively. And the VC still profits.

The best-known VC investment ever was in 1997, by an American VC firm named Benchmark Capital in the then upcoming startup, eBay. That investment over a two-year period gave a return 750 times the investment, an annual return of 2,632% per annum.

The Indian Venture Capital Association (IVCA) reported, last year Indian startups (growth stage) received US\$16B in funding, behind China at US\$ 43B and the US at US\$ 375B. The data also revealed that 803 seed stage investments were made last year, only 47 more than the previous year. During a



The grey area differentiating viable low-return startups from MSMEs is still a government policy shy. The defence sector witnesses many such MSMEs masquerading as startups

similar time period, the PIB stated that DPIIT recognised more than 55,200 new startups, a 51% increase year on year. Implying, last year, for each new startup receiving private funding, 69 new

startups were registered.

Apart from non-serious, fake and pseudo-startups – built for other purposes – the viable but unfunded startups thus lack the potential for a VC to risk investing. These low-return startups are no more than micro, small and medium enterprises (MSMEs). The grey area differentiating these viable low-return startups from MSMEs is still a government policy shy.

DEFENCE ECOSYSTEM, STARTUPS, MSMES AND THE VENTURE CAPITAL CHALLENGE

Unfortunately, the defence sector witnesses many such MSMEs masquerading as startups.

Many defence sector startups today leverage open-source solutions and/or a sizeable number of imported components in their bill of materials. This reduces the level of original Intellectual Property (IP) leveraged by the startup. It also increases competition and exponentially decreases the potential for VC funding. Entrepreneurs often quip that the components are not manufactured in India – well then, the real gold rush opportunity is in making those components.

Moreover, the defence sector has only a handful of customers, if not just one or two and their order quantities are also limited and aperiodic. Therefore, worldwide defence startups are advised to look at dual use business models and sustain from a civilian revenue stream.



Without the civilian component many def-tech startups/MSMEs do not have a long-term sustainable model. The most viable growth trajectory for the one-trick-pony startups/MSMEs is to get acquired by a larger company once their product has reached a level of maturity or once the defence orders get harder to obtain.

An example can be found in a poster child of the drone industry, ideaForge. Since its IPO in mid-2023 its shares are yet to go past their initial listing price. Full disclosure, I am not aware of the complete reasons for its share price performance. Nevertheless, ideaForge is in a very crowded marketplace. And the fact that it did not take the VC route but preferred an IPO, tends to follow the above hypothesis.

Such wild west brutality is expected in the startup world and hence the government provides the best support it can. While the startup/MSME ecosystem continues to thrive, it bodes well for the indigenisation effort of the Indian defence sector. Just a decade ago India was a net importer; today its defence exports surpass ₹ 38,000 crores.

AIRCRAFT CARRIER DIPLOMACY: INDIA'S MISSED OPPORTUNITY?

Meanwhile India seems to have overlooked a golden opportunity to boost its defence exports by two or three orders of magnitude. As India takes pride in its indigenously built aircraft carrier, INS Vikrant, it also stresses to sustain the ecosystem that built the carrier. Official data shows, over 650 OEMS and MSMEs contributed towards building INS Vikrant. The subsequent order, to replace the INS Vikramaditya might be over a decade away. By then this ecosystem might be lost.

In the meantime, another ship building superpower made multiple efforts towards its own carrier of the INS Vikrant tonnage, but in vain. That was South Korea – worthy of an aircraft carrier diplomacy. A multi-billion-dollar co-development and training programme would not only have taken defence exports off the charts and sustained the ecosystem but also given India a geopolitical ally for life. After at least two false starts over the recent years, Seoul course corrected towards a smaller

UAV carrier instead.

Nevertheless, all is not lost as in 2024, another nation published its desire for an aircraft carrier in a peer reviewed paper at a European international conference, later published by Elsevier. The paper researched and analysed several aircraft carriers the world over, and shortlisted the INS Vikramaditya, as one of its top three choices. That nation is Brazil. Today exploring an aircraft carrier diplomacy with Brazil is worth a serious deliberation.

To conclude, it is very apparent, the startup/MSME ecosystem is maturing, enabling India to come of age in the defence export market. The inventory ranges from the smallest of drones to the largest of warships.

Jai Hind!



—The writer has global experience in implementing entrepreneurial ecosystems in emerging technologies. He is also a former member of the National Security Advisory Board. The views expressed are of the writer and do not necessarily reflect that of Raksha Anirveda

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BUILDING SIMULATORS TO TRAIN TOMORROW'S WARFIGHTERS



As warfare grows more complex and technology-driven, Tecknotrove Systems is redefining military training through next-generation simulation ecosystems designed to build collective readiness for future multi-domain conflicts

The character of warfare is undergoing a profound transformation. Military operations are becoming increasingly interconnected, technology-driven and multi-domain in nature. Cyber operations, electronic warfare, information campaigns, autonomous systems and artificial intelligence are now shaping military outcomes alongside traditional combat power.

At the same time, commanders are required to process larger volumes of information, coordinate a wider range of assets and make critical decisions

within increasingly compressed timelines. As warfare becomes more complex and ambiguous, the cognitive demands on military leaders and operators continue to grow.

This evolving battlefield reality is compelling defence forces worldwide to rethink how they train and prepare for future conflicts. Training is no longer limited to individual skills or platform familiarisation. The emphasis is shifting towards collective readiness, mission rehearsal, adaptive decision-making and integrated training ecosystems.

Recognising this shift, Tecknotrove

Systems is leveraging its expertise in simulation, digital technologies and training systems to build next-generation training ecosystems that prepare armed forces for the realities of future warfare.

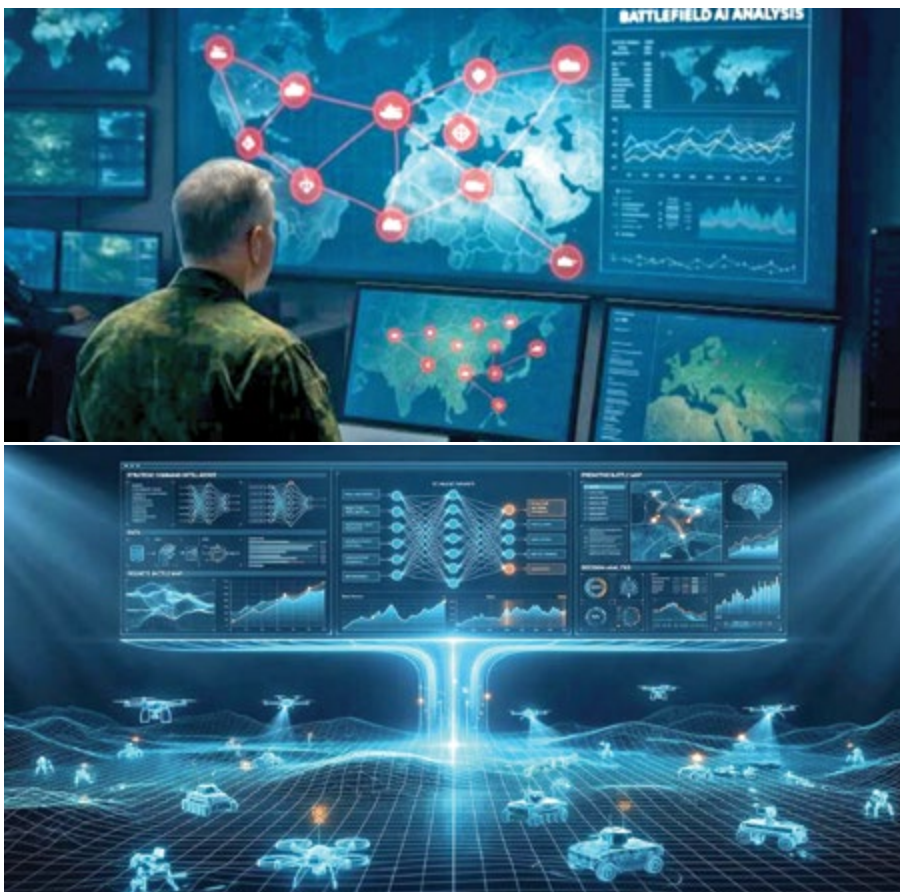
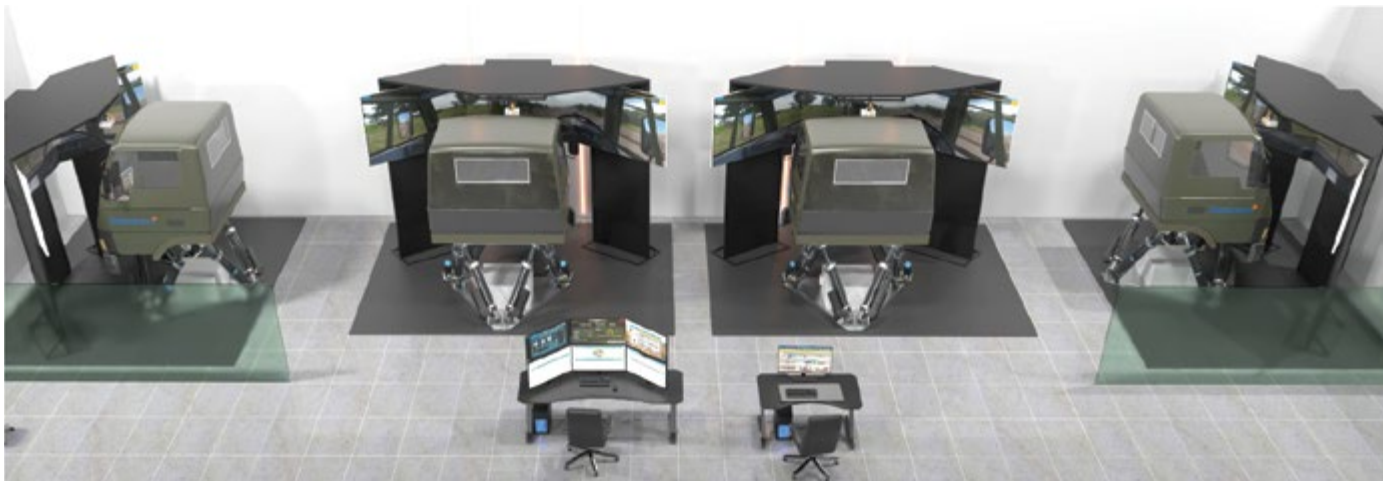
MULTIPLAYER TRAINING: FROM INDIVIDUAL SKILLS TO COLLECTIVE COMBAT EFFECTIVENESS

For decades, military simulators have been highly effective in developing individual skills and procedural proficiency. However, military operations are executed by teams, units and formations, where success depends as much on coordination, communication and collective decision-making as on individual expertise.

Defence forces worldwide are increasingly adopting multiplayer simulation environments that allow multiple participants to train simultaneously within a shared virtual battlespace. Tecknotrove's multiplayer training architecture enables trainees, crews and commanders to operate together within a common synthetic environment where the actions and decisions of one participant directly influence the experience of others in real time.

In effect, every participant becomes





part of the training environment for every other participant, creating a dynamic and realistic operational ecosystem. By transforming isolated training events into collaborative mission experiences, Tecknotrove is helping Armed Forces strengthen teamwork, communication and collective combat effectiveness.

ADAPTIVE TRAINING AND AI-POWERED LEARNING ECOSYSTEMS

One of the inherent limitations of conventional training is predictability. Repeated exposure to fixed scenarios often encourages scripted responses rather than developing the judgment and adaptability

required on modern battlefields.

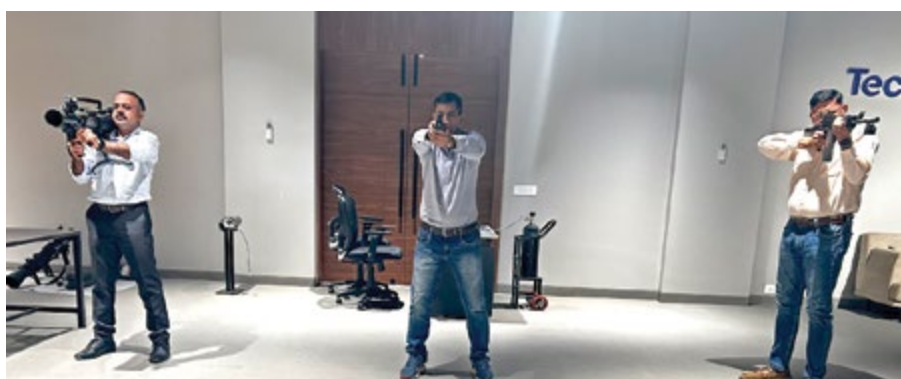
To address this challenge, defence forces worldwide are increasingly adopting adaptive training environments where scenarios evolve dynamically based on participant actions, operational developments and adversary behaviour. Unexpected threats, intelligence updates, equipment failures, weather changes and evolving enemy actions create uncertainty and force participants to continuously assess, adapt and respond.

Tecknotrove's advanced scenario-generation capabilities expose trainees to evolving operational situations that closely replicate the ambiguity and friction of real-world military operations. Complementing this approach, the company's AI-enabled Training Management Systems analyse performance, identify skill gaps and generate objective readiness assessments at both individual and group levels.

Together, these capabilities transform simulation from an event-based activity into a continuous learning ecosystem, helping commanders develop better decision-makers, more adaptive teams and more combat-ready forces.

LIVE-VIRTUAL-CONSTRUCTIVE INTEGRATION: CREATING A UNIFIED TRAINING ECOSYSTEM

One of the most significant developments in military simulation is the emergence of Live-Virtual-Constructive (LVC) training environments. By connecting live participants, simulator-based



trainees and computer-generated entities within a common synthetic battlespace, LVC enables military organisations to conduct complex exercises with greater realism, flexibility and scale.

Traditional training is often constrained by cost, logistics, asset availability and safety considerations. More importantly, training frequently occurs in functional silos, with individual platforms, units and formations exercising independently.

Tecknotrove is actively driving the transition towards integrated LVC ecosystems by connecting disparate training systems into a unified operational environment. This enables armed forces to conduct mission rehearsals, joint-force exercises and operational planning activities that closely replicate real-world operations.

By breaking traditional training silos and enabling seamless interaction between multiple participants, platforms and domains, Tecknotrove is helping create more holistic, scalable

and operationally relevant training experiences.

BUILDING INDIGENOUS DEFENCE TRAINING ECOSYSTEMS

As military training becomes increasingly software-driven, networked and data-centric, ownership of training architectures is emerging as a strategic imperative. Modern training ecosystems are no longer merely instructional tools; they increasingly influence operational doctrines, readiness assessment methodologies, threat modelling and future capability development. Recognising this reality, nations across the world are investing in indigenous simulation and training ecosystems to reduce external dependencies, safeguard critical data and retain control over the evolution of their military capabilities.

For India, the pursuit of defence self-reliance extends beyond indigenous platforms and equipment. It must also encompass sovereign ownership of the technologies used to train, evaluate and

prepare military personnel.

As one of India's leading simulations and defence training technology companies, Tecknotrove is at the forefront of this transformation. Through sustained investments in indigenous simulation technologies, AI-enabled training systems, digital twins, multiplayer architectures and LVC ecosystems, the company is helping build the foundations of a sovereign and future-ready military training infrastructure.

Beyond strengthening the training capabilities of the Indian Armed Forces, Tecknotrove's indigenous technologies also support national objectives of technological sovereignty, reduced external dependence, defence exports and the development of globally competitive Indian defence technologies.

The future of military training will not be defined by standalone simulators operating in isolation. It will be shaped by integrated training ecosystems that combine collective training, adaptive scenarios, artificial intelligence, Live-Virtual-Constructive integration and data-driven performance assessment.

For India, this transformation presents a unique opportunity to build a future-ready training architecture aligned with the demands of modern warfare while advancing the broader national objectives of technological self-reliance and capability development.

"As one of India's leading simulation and defence training technology companies, Tecknotrove is not merely developing simulators; it is helping build the foundations of a sovereign, intelligent and interconnected military training ecosystem. Through indigenous innovation and next-generation training technologies, the company is playing a leading role in enhancing combat readiness, strengthening technological sovereignty and positioning India as a global leader in advanced defence training solutions", says Shantanu Gupta, Managing Director, Tecknotrove. ■



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WEAPONS OF TRUST: EXPORTING SECURITY, EXPANDING INFLUENCE

Defence exports are unlike any other exports. Nations do not merely purchase military equipment; they purchase trust. Every defence deal is a contract of confidence. A nation purchasing a missile system is effectively entrusting a part of its security architecture to another country. With defence exports, India is exporting not just hardware but also strategic trust, tech competence and geopolitical influence

LT GEN RAJEEV CHAUDHRY

When Armenia emerged as one of the largest buyers of Indian defence equipment, it signalled something far more significant than a successful export transaction. A small nation located thousands of kilometres from India had chosen to place a part of its national security in Indian hands. It was a powerful vote of confidence in Indian technology, reliability and strategic credibility.

For decades, India was known as one of the world's largest importers of defence equipment. Successive generations of military leaders grappled with dependence on foreign suppliers for aircraft, artillery, missiles, radars and armoured platforms. Today, however, the narrative is changing. Military delegations from Southeast Asia, the Gulf, Africa and Europe are increasingly arriving in New Delhi not to sell weapons but to explore buying them. From BRAHMOS missiles and Akash air-defence systems to Pinaka rocket launchers, radars, drones and command-and-control networks, Indian defence products are attracting global attention.

Yet the real story is not about missiles, radars or rockets. Defence

exports are unlike any other exports. Nations do not merely purchase military equipment; they purchase trust.

What India is exporting today is not just hardware. It is strategic trust, technological competence and geopolitical influence.

DEFENCE EXPORTS BUILD TRUST

Every defence contract is fundamentally a contract of confidence. A nation purchasing a missile system is effectively entrusting a part of its security architecture to another country. It is making a long-term

judgement about the supplier's reliability, political stability, technological capability and strategic intentions.

This is why the rise of Indian defence exports deserves to be viewed through a broader lens. Armenia's decision to procure Indian systems was not solely based on technical specifications or pricing. It reflected confidence that India would remain a dependable partner. Similar calculations are shaping interest from countries such as Vietnam, Indonesia, the Philippines and several Gulf states.

In an increasingly fragmented world, trust has become a strategic





commodity. Nations seek suppliers who are technologically capable and politically predictable. India occupies a unique position in this regard. It is a democratic nation, enjoys credibility across competing geopolitical blocs and has consistently demonstrated strategic autonomy in its foreign policy. Unlike many major arms suppliers, India is not perceived as seeking political dominance over its customers. It offers partnership rather than dependence.

This trust dividend has become one of India's greatest strategic assets.

TECHNOLOGY IS THE NEW DIPLOMACY

The second pillar of India's defence export story is technological competence. For centuries, India exported ideas, philosophy, culture and spirituality. In the 21st century, it is increasingly exporting advanced technology.

The transformation did not occur overnight. It is the outcome of years of investment in research and development, institutional reforms and industrial capacity building. Initiatives such as Aatmanirbhar Bharat, SRIJAN (Strategic Research and Innovation through Janshakti for Aatmanirbhar Nationhood), defence industrial corridors, innovations under iDEX and growing participation by

Armenia has emerged as one of the largest buyers of Indian defence equipment. Armenia's decision to procure Indian systems was not solely based on technical specifications or pricing. It reflected confidence that India would remain a dependable partner. Similar calculations are shaping interest in Vietnam, Indonesia, the Philippines and Gulf states

the private sector have expanded India's defence manufacturing ecosystem. What was once a largely state-driven enterprise is evolving into a dynamic partnership between government laboratories, public sector enterprises, start-ups and private industry.

The significance of this transformation extends beyond economics. Technology has become a critical instrument of national influence. Countries today

evaluate technological competence as a measure of strategic capability. A nation capable of designing and manufacturing advanced missiles, sensors, air-defence networks and unmanned systems commands a different level of respect in the international system.

Indian defence exports, therefore, represent something larger than industrial success. They are evidence of India's growing technological maturity.

The emergence of systems such as BRAHMOS, Akash, Pinaka and integrated command-and-control networks demonstrates that India is no longer merely absorbing technology. It is increasingly creating it. The world is beginning to recognise this reality.

THE NEW GEOGRAPHY OF INFLUENCE

The third and perhaps most important dimension of defence exports is geopolitical influence. History offers numerous examples of how military exports shape international relationships. The United States built extensive security partnerships through defence cooperation. Russia sustained influence across continents through military sales and training networks. France has long leveraged defence exports as an important instrument of diplomacy. India is entering this arena.

A missile sale is never merely a missile sale. Defence contracts typically create relationships lasting decades. Training programmes, maintenance arrangements, spare-part support, software upgrades, technical exchanges and joint exercises often continue long after the original equipment has been delivered. As a result, defence exports create enduring strategic linkages.

When a nation deploys an Indian missile system, it is likely to engage regularly with Indian military trainers, technicians and defence institutions. When it acquires Indian radars or command-and-control systems, it becomes part of a broader ecosystem of cooperation. Over time, these interactions generate familiarity,



confidence and alignment of interests. This is where defence exports become instruments of diplomacy.

India's emerging defence footprint now stretches across multiple regions. Southeast Asia views Indian systems as a means of strengthening deterrence. Countries in the Indian Ocean region see India as a reliable maritime security partner. Nations in West Asia are exploring Indian technologies as part of efforts to diversify defence procurement. Even parts of Europe are paying increasing attention to India's growing capabilities.

The geographical spread is significant because it reflects the expansion of India's strategic influence beyond its immediate neighbourhood.

THE EVIDENCE

India's Emerging Defence Export Footprint

- Armenia – Pinaka rocket systems, radars, air-defence equipment and associated systems.
- The Philippines – BRAHMOS missile system.
- Vietnam – Advanced discussions and strong interest in BRAHMOS.
- Indonesia – Ongoing engagement regarding BRAHMOS.

The true significance of India's defence exports lies not in the number of missiles sold or contracts signed. Their deeper importance lies in emerging as a nation trusted to contribute to others' security

- The UAE and Gulf States – Interest in BRAHMOS and advanced air-defence architecture.
- Africa and Indian Ocean nations – Radars, patrol vessels, maritime security systems and defence cooperation.

These developments are important not because of their monetary value alone, but because they indicate growing international confidence in Indian capabilities.

CHALLENGES ON THE ROAD AHEAD

The road ahead, however, is not without challenges. Global defence markets are intensely competitive. India must continue to improve production capacity, delivery timelines, quality assurance and after-

sales support. Greater investment in research and development will be essential. Export financing mechanisms need strengthening, and private industry must play a larger role in scaling production.

The world does not simply buy technology; it buys reliability. Sustained success will depend on India's ability to deliver both.

FROM BUYER TO BUILDER TO PARTNER

Nevertheless, the broader trajectory is unmistakable. For decades, India measured military strength by the weapons it imported. Today, it is beginning to measure influence by the security it can help provide to others. This shift marks an important milestone in India's evolution as a major power.

The true significance of India's defence exports lies not in the number of missiles sold, contracts signed, or revenues generated. Their deeper importance lies in the emergence of India as a nation trusted to contribute to the security of others. Every radar deployed, every missile battery commissioned and every defence partnership concluded extends India's strategic reach beyond its borders.

India is no longer merely building military capability for itself. It is increasingly becoming a source of security, technology and confidence for partners across the world.

India's defence exports are no longer merely instruments of commerce. They are becoming instruments of trust, security and influence. In an uncertain world, the Weapons of Trust may prove to be one of India's most powerful expressions of National Power. ■



—The writer is an army veteran and writes on contemporary national and international issues, strategic implications of infrastructure development towards national power, geo-moral dimensions of international relations, and leadership nuances in a changing social construct. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda



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INDIA'S DEFENCE EXPORTS: POTENTIAL AND PROSPECTS

India's MoD deserves credit for the steps to encourage defence exports, which have reached ₹38,424 crore. However, India's market share is just 0.2%. Challenges include the nature of India's export portfolio, dependence on foreign sources and the product's reputation. What India needs is to focus on high-value weapon systems and platforms

Registering a year-on-year growth of 62.66%, India's defence exports reached the ₹ 38,424 crore mark in the Financial Year (FY) 2025-26. The state-owned Defence Public Sector Undertakings (DPSUs), often criticised for underperformance, witnessed their exports grow by a phenomenal 151%, while the private sector's exports increased by a modest 14%. This upsurge is truly impressive, as just a decade ago, in FY 2014-15, defence exports stood at a measly ₹884 crore.

The Ministry of Defence (MoD) deserves some credit for the steps it has taken in recent years to encourage defence exports, beginning with the notification of the Munitions List (Category 6 of the SCOMET list) in 2017. Since then, a standard operating procedure for exporting defence products has been laid down, and a fully end-to-end online portal has been set up to process export authorisations digitally. This has cut down time and paperwork for exporters. Open General Export Licences (OGEL) have also helped expedite routine exports.

From a local perspective, this upward trend is very promising, but viewed in a wider global context, defence exports have a long way to go before India becomes a major weapon exporter or a 'global defence manufacturing hub', which are the government's stated objectives. This note of caution is not to pooh-pooh the industry's achievements or capabilities, but to suggest that a reality check is required to avoid getting trapped in complacency.

India does not currently figure on the list of 25 leading exporters of arms compiled by Stockholm International Peace Research Institute every year; the last time it did was four years ago, when it ranked 23rd with a



AMIT COWSHISH

Former Financial Advisor (Acquisition),
Ministry of Defence

market share of 0.2%, alongside Czechia and Jordan. That India lost even this tenuous ranking despite rising exports indicates that making a mark in the global defence exports market is very challenging. Exactly how challenging it is can be gauged by the fact that, with all its technological advancement and geopolitical clout, China is currently only the fifth largest exporter with a market share of just 5.6%, as against the USA's 42%.

According to a November 2025 Press Information Bureau release, the top three destinations for India's defence exports in FY 2023-24 were the USA, France, and Armenia. Exports to the USA and France seemed to have picked up due to the MoD

putting pressure on companies like Boeing and Dassault to discharge their offset obligations in respect of the previously concluded contracts, which, according to a study by Delhi-based MP-Institute of Defence Studies and Analyses, are mostly discharged by the foreign companies by importing eligible defence products from the Indian companies.

While the status of the ongoing offset contracts is not known, hopefully, there will be no stagnation or decline in exports once the offset contracts are fully discharged because, by that time, the Indian companies would have integrated with

The minister of state for defence said in August 2021 that the major defence exports included Weapon Simulators, Tear Gas Launcher, Torpedo Loading Mechanism, Alarm Monitoring & Control, Night Vision Monocular & Binocular, Light Weight Torpedo & Fire Control Systems, Armoured Protection Vehicle, Weapons Locating Radar, HF Radio and Coastal Radar System

the global supply chains and found their own feet in the defence exports market. This, then, is not the real challenge.

The real challenge is on account of some other, less talked about, factors: the nature of India's export portfolio, dependence on foreign sources for critical components and sub-systems, reputational damage caused by malfunctioning of indigenously built systems, limited sphere of influence to develop a strong clientele, and last but not least, a disjointed defence export policy.

Replying to a question in Lok Sabha, the minister of state for defence stated in August 2021 that the major defence exports included Weapon Simulators, Tear Gas Launcher, Torpedo Loading Mechanism, Alarm Monitoring & Control, Night Vision Monocular & Binocular, Light Weight Torpedo & Fire Control Systems, Armoured Protection Vehicle, Weapons Locating Radar, HF Radio, and Coastal Radar System. The minister also added, for good measure, that most of the defence exports included parts and components, but what he did not say was that these parts and components are comparatively low-value items.

What India needs to focus on is exporting high-value equipment, weapon systems and platforms. True, some fully assembled weapon systems, such as the BRAHMOS supersonic cruise missile and Akash air defence missiles, artillery guns, Dornier-228 aircraft, Pinaka rockets, bullet proof jackets, patrol boats, and helicopters, have also been, or are being, exported, but the countries buying them are not major buyers of arms and, therefore, the demand for these products cannot be substantial. Low volume of exports, or low value of exported products, can impact the growth of India's exports.

Some of the potentially exportable platforms like the Advanced Light Helicopter, Light Combat Helicopter and K-9 Self-Propelled Howitzer, are dependent to varying degrees on imported components, sub-systems and technology. The Light Combat Aircraft, for example, is powered by General Electric GE-404IN after-burner engines. The delay of more than a year in the supply of these engines has disrupted Hindustan Aeronautics Limited's production plans and adversely impacted the operational efficiency of the Indian Air Force. This can be a matter of concern for potential customers.

The export potential of a platform is also highly sensitive to the reputational damage caused by the malfunctioning of the platform. A case in point is the Advanced Light Helicopter (ALH) Dhruv, a multi-role, multi-mission utility helicopter developed by HAL. Ecuador had imported seven of these helicopters but terminated its contract with HAL in October 2015 after four of them crashed.

What is important is to have a strategy to boost exports. The leading arms exporting countries acquired that status by selling combat aircraft and helicopters, major warships, missiles, tanks, fire support vehicles, other armoured vehicles and artillery. The Indian industry can realise its potential by manufacturing Brand India products to draw the international customers' attention

Ten years later, in January 2025, the entire fleet of 330 helicopters was again grounded by the armed forces after an ALH operated by the Coast Guard crashed in Gujarat. Shortly after the partial resumption of the operation of the Army and Air Force versions, a technical snag was reported in September 2025, prompting the Indian Army to order a 'one-time check'. Though HAL described it as a routine maintenance matter, not a systemic flaw, such incidents have affected India's reputation as a potential exporter of reliable state-of-the-art platforms.

Practically all the leading weapon exporters, except for the USA, have one thing in common: they all have one, or in some cases two or three, major buyers. According to SIPRI's latest report, India, Egypt and Greece accounted for 45% of exports from France, the second largest arms

exporter. Of this, India's share was 24%. Similarly, 74% of Russia's exports were to India, China and Belarus, with India accounting for 48%. Nearly 61% of China's exports were to just one country: Pakistan. India will need to develop a major client, or a major market such as Africa, in the coming years to become a major player in the export market.

Lastly, India's defence export policy constitutes a series of pronouncements of intent and disjointed steps taken from time to time, rather than a cogent roadmap based on an assessment of the Indian defence industry's current capabilities and its potential. What is equally important is to have a strategy to boost exports. The leading arms exporting countries have acquired that status by selling combat aircraft and helicopters, major warships, surface-to-air missiles, tanks, fire support vehicles, other armoured vehicles, and artillery. The Indian industry is strong in some of these areas and, with the government's backing, it could realise its potential by manufacturing Brand India products to draw the international customers' attention.

It is instructive that, as recently as March 2026, the Standing Committee on Defence has advised the MoD to "facilitate ease of doing business to promote exports, and the DPSUs should explore new global markets, invest in R&D and innovations along with designing newer and advanced competitive products." These are policy matters. MoD will do well to heed this advice and double down on its efforts to make India a leading arms exporter; giving a final touch to the Defence Production & Export Promotion Policy (DPEPP), which continues to be in the form of a draft almost six years after it was circulated in 2020 for comments, might be a good starting point. ■

FIREPOWER: INDIA'S RISE AS A DEFENCE EXPORTER

India's defence exports hit a record ₹23,622 crore in 2024-25 and reached ₹38,424 crore in FY 2025-26, with a ₹50,000 crore target by 2029. It marks a historic shift from being one of the world's largest military importers to an emerging exporter of advanced systems such as BRAHMOS, Aakash air defence and indigenous artillery. This transformation is enhancing India's strategic influence and positioning it to challenge established players in the global arms market

MRIGANK SHEKHAR

In the 6th century BCE, King Ajatashatru of Magadha unleashed a terrifying innovation on the ancient battlefields of India — the scythed chariot. Massive wheels fitted with razor-sharp blades mowed down enemy infantry like wheat crops before a combine harvester. Centuries later, Indian ingenuity gifted the world the stirrup, transforming horse cavalry into a devastating strike force that dominated warfare for a thousand years.

From ancient battlefields to modern skies, India has never lacked military creativity. After decades of Gandhian reticence, that same spirit is once again powering a dramatic transformation: the world's largest democracy is no longer just buying weapons — it is rapidly becoming a feared and respected defence exporter.

THE NUMBERS ARE ROARING

India's defence exports hit a record-breaking ₹23,622 crore in FY 2024-25, and reached a record ₹38,424 crore across more than 80 allied nations in FY 2025-26. The government has set a



bold target of ₹50,000 crore by 2029. If achieved, India will join an elite club of global arms suppliers and dramatically boost its strategic clout.

Prime Minister Narendra Modi has made Aatmanirbhar Bharat (Self-Reliant India) the battle cry. “India is moving ahead with the resolve of becoming self-reliant in defence manufacturing and becoming a major exporter,” he declared. The shift is real and accelerating.

The coming decade will determine whether India can join the top league occupied by the United States, Russia, France, China and a few European powers — or whether it will remain a promising but underachieving player. Success will depend on four critical pillars: innovation, technology, R&D, policy reforms and economic competitiveness.

Jointly developed with Russia, BRAHMOS flies at three times the speed of sound, hugging the terrain before delivering precision strikes that few systems can match. Its terrifying real-world reputation was cemented during Operation Sindoor in 2025, when it crippled Pakistani air bases, destroying fighter jets, reconnaissance aircraft, hangars and runways

THE GLOBAL DEFENCE CHESSBOARD

The international arms trade is more than just business — it is a strategic instrument of statecraft. The United States dominates global arms exports through technological superiority, extensive alliances and robust military-industrial ecosystems. Companies such as Lockheed Martin, Boeing, Raytheon and Northrop Grumman operate within a framework where innovation, government support and exports reinforce one another.

Russia, despite economic sanctions and geopolitical challenges, built its export success through affordability, battlefield-proven systems and long-standing defence partnerships. Its aircraft, tanks, and missile systems remain in service across Asia, Africa and the Middle East.

China offers perhaps the most relevant comparison for India. Over the last two decades, Beijing transformed itself from a major importer of military technology into a significant exporter. Chinese companies leveraged state-backed R&D, aggressive financing, rapid industrialisation and strategic diplomacy to market drones, missile

systems, naval vessels and air defence systems across the developing world.

India's challenge is unique. Unlike China's state-driven model or America's mature military-industrial complex, India has to balance democratic institutions, fiscal realities, private-sector participation and geopolitical sensitivities. Yet this challenge also presents an opportunity to create a sustainable and globally competitive defence ecosystem.

BRAHMOS: THE SUPERSONIC SPEAR

Nothing captures India's soaring ambitions better than the BRAHMOS supersonic cruise missile.

Jointly developed with Russia, this fire-breathing monster flies at nearly three times the speed of sound, hugging the terrain before delivering precision strikes that few systems can match. The missile's terrifying real-world reputation was cemented during Operation Sindoor in 2025, when BRAHMOS strikes crippled Pakistani air bases, destroying fighter jets, reconnaissance aircraft, hangars and runways in devastating fashion.

When your product performs like that on the battlefield, marketing becomes easy. The 2022 export to the Philippines was a watershed moment — India's first major sale of a strategic missile system. More deals are in the pipeline. Nations in Southeast Asia, the Middle East and Latin America are taking notice.

As former Army Chief General MM Naravane noted, these are not mere sales — they are strategic partnerships that deepen India's influence and security ties across the Indo-Pacific and beyond.

AAKASH: SHIELD OF THE SKIES

While BRAHMOS is the sword, Aakash is the shield. Designed to protect military formations and strategic assets from aerial threats, Aakash has undergone continuous improvements since its





induction. This indigenous surface-to-air missile system has evolved into a highly capable, layered air defence solution. The next-generation Akash-NG promises even greater range, mobility and lethality.

The global market for air defence systems is expanding rapidly. The conflicts in Ukraine and the Middle East have reinforced the importance of layered air defence networks - demonstrated brilliantly in Operation Sindoor, where hundreds of Pakistani drones launched against civilian and military targets were brought down with a 100 per cent hit rate. Countries are actively seeking reliable and affordable systems to defend against aircraft, drones, and missile attacks.

India's comparative advantage lies in offering systems that are substantially cheaper than Western alternatives while remaining technologically capable and more advanced than Chinese analogues. This combination is particularly attractive to developing nations seeking modern, effective

military capabilities without incurring unsustainable costs.

The export potential of Akash extends beyond the missile itself. Radar systems, command-and-control networks, launch vehicles and maintenance packages create long-term relationships and recurring revenue streams.

ARTILLERY: OLD SCHOOL, BUT STILL LETHAL

The success of artillery in recent conflicts has once again highlighted the enduring importance of long-range firepower. India's indigenous artillery programmes have matured significantly over the last decade. Systems such as the Advanced Towed Artillery Gun System (ATAGS), Dhanush and various rocket artillery platforms have demonstrated impressive capabilities.

ATAGS, in particular, has attracted international attention due to its range, automation and accuracy. Built through collaboration among DRDO, Bharat Forge and Tata Advanced Systems, it

represents the growing synergy between government research institutions and private manufacturers.

The experience of the United States with the M777 howitzer and Russia with various artillery systems illustrates how battlefield performance often drives export success. If Indian artillery systems continue to prove themselves operationally, they could emerge as major export products for Asia, Africa and Latin America.

Moreover, artillery exports have multiplier effects. They generate demand for ancillaries, creating a defence ecosystem rather than a one-time sale. Each gun sold opens the door to ammunition, training, maintenance and upgrades — creating decades-long revenue streams.

THE HIDDEN ENGINE: SUBSYSTEMS AND SMART TECH

While missiles and artillery grab headlines, India's real strength may lie in the invisible backbone — subsystems and components. Modern defence



manufacturing operates through complex global supply chains. Aircraft, warships, missiles and electronic systems incorporate thousands of specialised parts produced by multiple suppliers across countries.

Indian companies increasingly manufacture avionics, radars, sensors, electronic warfare systems, aerospace structures, precision-machined components and software solutions for global defence programs. This sector offers several advantages:

- Faces fewer political barriers than complete weapons systems.
- Enables Indian firms to integrate into the global supply chains of leading manufacturers.
- Provides opportunities for small and medium enterprises to participate in defence exports.

Former DRDO Chairman G Satheesh Reddy has emphasised that technology development and industry participation are central to India's long-term defence ambitions. The growth of defence startups, artificial intelligence

applications, autonomous systems and advanced electronics reflects this shift.

Reddy also stressed the criticality of Artificial Intelligence. According to him, the pace of change is such that "there will not be a system tomorrow onwards without AI." Any product, civilian or military, that does not embed artificial intelligence, he warned, will simply be obsolete. "If anyone comes out with any product in the years to come without AI, that is an outdated product."

The future of defence exports may therefore depend as much on microchips, sensors and software as on missiles and guns. Drones, autonomous systems, quantum technologies, hypersonics and space-based defence are where the future battles will be won.

INNOVATION, POLICY AND EXECUTION

No country has become a major defence exporter without investing heavily in innovation. The United States spends hundreds of billions of dollars annually on defence research,

creating technologies that often spill over into civilian sectors. GPS, stealth technologies, advanced computing and numerous aerospace innovations emerged from defence R&D. China's rapid progress similarly stems from sustained investment in research institutions, military modernisation and technology acquisition. India has made significant advances in missile technology, space systems, electronic warfare and unmanned platforms. However, challenges remain.

Defence R&D expenditure as a percentage of GDP remains lower than that of major defence powers. Bureaucratic delays, fragmented project management and technology gaps continue to affect outcomes.

To compete globally, India must prioritise:

- Artificial intelligence and autonomous systems
- Quantum technologies
- Hypersonic weapons
- Cyber warfare capabilities
- Advanced materials and propulsion systems
- Space-based defence technologies
- Unmanned aerial and underwater systems

The establishment of defence innovation initiatives and the growing participation of startups represent encouraging developments. Yet the scale of investment must increase substantially if India seeks leadership rather than participation.

POLICY REFORMS AND EFFECTIVE EXECUTION

Policy reforms have played a crucial role in India's defence export growth. The government has simplified export authorisation procedures, liberalised industrial licensing, expanded foreign direct investment limits and introduced positive indigenisation lists that encourage domestic production.

Defence Minister Rajnath Singh has consistently advocated self-reliance and export-led growth. "India is not only strengthening its security but is



also emerging as a trusted defence manufacturing partner for the world,” he has stated.

However, policy announcements alone are insufficient. Execution remains the key challenge. Export success requires timely deliveries, quality assurance, after-sales support, financing mechanisms, diplomatic coordination and competitive pricing.

The experience of the United States and France demonstrates the importance of aligning diplomacy, industry and military cooperation. Defence exports often succeed when supported by broader strategic partnerships. India must similarly integrate defence exports into its foreign policy framework, especially in Southeast Asia, Africa, the Middle East and the Indian Ocean region.

India’s political leadership must not forget that the battlefield is the best testing ground for any weapon. The Rafale was unable to find a single buyer until the French Air Force got the opportunity to showcase the fighter in the 2011 Libyan War. The following year, India placed an order for 126 Rafales. Similarly, the Patriot was an unknown missile defence system until its use in the 1991 Iraq War. Despite its complete lack of success against Iraqi Scuds, the publicity it received on CNN made it a top seller. India should not shy

away from testing its latest weapons against Pakistan at every available opportunity. As the old saying goes, what is visible sells.

ECONOMIC GROWTH AND STRATEGIC INFLUENCE

Defence exports are not merely about military hardware; they are engines of economic growth. A strong defence manufacturing sector generates high-skilled employment, promotes technological innovation, strengthens industrial capabilities and enhances national resilience. Each exported missile system, radar, or artillery gun supports thousands of engineers, technicians, software developers and manufacturing workers. The economic benefits extend beyond direct revenue. Defence production stimulates sectors such as metallurgy, electronics, aerospace, telecommunications, advanced manufacturing and logistics.

Plus, defence exports create strategic leverage. Countries purchasing military equipment often engage in long-term geopolitical relationships involving training, maintenance, upgrades, intelligence cooperation and joint exercises. This is why major powers treat defence exports as instruments of influence. Arms sales strengthen alliances, expand diplomatic reach and reinforce partnerships.

For India, growing defence exports can support its aspirations as a leading power in the Indo-Pacific and the developing world.

THE ROAD AHEAD

From Ajatashatru’s blade-wheeled chariots to BrahMos screaming across the sky at Mach 3, India’s military innovation journey has come full circle — and is now accelerating.

The demand for cost-effective weapons systems is rising. The opportunity is massive. If India executes with speed and excellence, its emergence as a defence manufacturing powerhouse could become one of the defining success stories of the 21st century — not just economically, but as a symbol of a confident, technologically sovereign nation shaping the future of global security.

The chariot wheels are turning once again. ■

—The writer is a defence journalist specialising in military affairs, security policy and defence technology. He reports extensively on operation strategies, defence manufacturing initiatives and geopolitical developments across the Indo-Pacific region. The views expressed are personal and do not necessarily carry the views of Raksha Anirveda

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INDIA'S DEFENCE EXPORTS: MAKING IT TO THE TOP LEAGUE

India's rise as a geopolitical player now runs through its rise as a defence exporter. The coming decade will decide whether it joins the top league or misses the opening

SUDIPTAA PAUL CHOUDHURY

India can convert momentum into a permanent seat at the top table.

India's defence exports reached a record ₹38,424 crore in FY2025-26, a rise of nearly 63% over the previous year. Indian-made equipment now reaches more than 80 countries, and the number of exporting firms has grown to 145. A decade ago, in 2013-14, that figure stood at ₹686 crore. This is no longer an aspiration. It is a trajectory.

It also tracks something larger. As India's geopolitical weight grows, its defence industry has become an instrument of that influence. The question is no longer whether India can export. It is whether

FROM THE WORLD'S LARGEST IMPORTER TO A RISING EXPORTER

The Decade in Numbers

Domestic defence production touched ₹1.78 lakh crore in FY2025-26, a 110% jump in five years. The defence budget rose from ₹2.53 lakh crore in 2013-14 to ₹7.85 lakh crore in 2026-27, and nearly 65% of equipment is now produced at home.

Why the Pivot is Strategic, Not Just Commercial

Here is the paradox to confront. India

As India's geopolitical weight grows, its defence industry has become an instrument of that influence. The question is no longer whether India can export. It is whether India can convert momentum into a permanent seat at the top table

Exports are not
a side business.
They are statecraft.

38,424 Cr

Defence exports FY 2025-26 (+63% YOY)

80+ Countries

now receive Indian defence equipment

1.78 Lakh Cr

Domestic production FY2025-26

remained the world's second-largest arms importer through 2020-24, a top-tier military power that still buys more than it sells. Every export deal now does double duty: it earns revenue and builds the interoperability and trust that turn buyers into long-term partners. Exports are not a side business. They are statecraft.

WHAT INDIA EXPORTS AND WHO IS BUYING

Missiles, Air Defence and Artillery

BRAHMOS is the flagship. The Philippines became its first foreign buyer in 2022, with deliveries from 2024, and Vietnam and Indonesia are close behind. Armenia

has emerged as one of India's largest customers for finished platforms, taking Akash air defence, Pinaka rocket systems, and ATAGS howitzers worth more than two billion dollars.

Drones, Loitering Munitions and Radars

Loitering munitions such as Nagastra and SkyStriker are drawing interest, including from Cyprus. Indian radars already serve Armenia, Myanmar, and Sri Lanka. The May 2025 conflict with Pakistan, which tested indigenous systems in combat, has sharpened global attention on Indian hardware.

Naval Platforms, Aircraft and Subsystems

India exports offshore patrol vessels, fast interceptor boats, Dhruv helicopters, and maritime patrol aircraft across the Indian Ocean. It also supplies roughly 2.8 billion dollars of components to firms like Boeing and Lockheed Martin, placing Indian suppliers inside the global value chain.

THE MARKETS THAT MATTER ***The Neighbourhood and the Indian Ocean Region***

Under Neighbourhood First, Bangladesh, Maldives, and Sri Lanka all operate Indian systems, and India has extended 37 lines of credit worth 14.27 billion dollars. Proximity, financed well, is a market.

Africa and Southeast Asia: Affordability as an Advantage

In Africa and Southeast Asia, buyers tend to prioritise affordability over the last increment of performance. South Africa, Egypt, Kenya, and Algeria have shown interest in Arjun tanks, Pinaka, BRAHMOS, and Akash. This is where India can win volume.

Europe and the West: From Recipient to Supplier

The more striking shift is upmarket. France has shown interest in Pinaka, and Greece and Armenia feature among India's growing customer base, while the United States



India's exports still skew toward friendly nations with limited budgets, often through non-competitive arrangements and the top exporter ranks remain dominated by the United States, France, Russia and the UK

now sources defence components from India. The traditional supplier-recipient relationship is reversing.

THE NEXT FRONTIER: AI, QUANTUM AND CYBER ***What the World Will Want to Buy from India Next***

The next decade of demand is for software-defined warfare: artificial intelligence, autonomous systems, electronic warfare, and quantum technology. India's defence-technology market is projected to reach roughly nineteen billion dollars by 2030, with close to half driven by AI, autonomy, and quantum. India's ADITI and iDEX schemes already fund exactly these priorities, from cyber to quantum to autonomous weapons.

Quantum-Safe Communications as a Sovereign Export

Securing all of it is its own export category. As adversaries pursue harvest-now, decrypt-later attacks, the systems India sells must protect data for their full-service life. India has already demonstrated an indigenous 1,000-kilometre quantum-secure communication network under the National Quantum Mission. Sovereign, standards-compliant security is becoming a product in its own right, not a feature bolted on later.

HOW INDIA CAN STRENGTHEN ITS POSITION AS A DEFENCE EXPORTER

Win on Trust: Quality, Delivery and Lifecycle Support

Buyers do not just purchase a platform. They buy decades of spares, repair, and upgrades. India must match its order wins with dependable lifecycle support and on-time delivery, the logistical and institutional areas where past efforts have faced barriers. Reliability is the real moat.

Defence Diplomacy, Lines of Credit and Government-to-Government Deals

Concessional financing has opened doors from Mauritius to a Dornier loan for Guyana. India should scale this



India has done the hard part: it has proven it can build and sell. The harder part is sustaining it, holding quality, depth and trust as volumes rise. Make the next decade about reliability and advanced capability and the top league stops being an aspiration. It becomes the address

deliberately, pairing credit lines with training and joint exercises so equipment sales mature into lasting relationships.

Co-Development and Technology Partnerships

The fastest route up the value chain is to build with others. Co-development partnerships already run inside the defence corridors, from Safran with HAL to Boeing with Mahindra and Israel Aerospace Industries with Bharat Electronics. Partnership is leverage.

THE POLICY REFORMS THAT WILL DECIDE THE DECADE

Faster Export Clearances and a Single Window

The Open General Export Licence now allows specified items to specified destinations under a single permit, and the SCOMET munitions list has been made public. The next step is a genuine single-window clearance, because in arms sales a slow yes is often a no.

Financing, Offsets and Long-Term Contracts

Foreign direct investment of up to 74% via the automatic route and a sharper

offset policy have pulled in global manufacturers. Long-term order visibility and export financing must now match, so suppliers can invest ahead of demand.

Securing What We Export: Protecting Data and IP

As exports turn digital, India must protect both the intellectual property in its platforms and the data they carry. Quantum-safe and cyber-resilient design belongs in export products from the start. Trust, once lost, does not return.

THE DECADE THAT DECIDES: TOP LEAGUE OR MISSED OPPORTUNITY

Be honest about the gap. India's exports still skew toward friendly nations with limited budgets, often through non-competitive arrangements, and the top exporter ranks remain dominated by the United States, France, Russia, and the UK. The target of ₹50,000 crore by 2029 is within reach. But the top league is not won on volume to neighbours. It is won by selling advanced systems, on merit, to demanding buyers. India

has the industrial base, the demand pull, and the strategic moment. The next ten years decide whether it uses them.

FINAL THOUGHTS

India has done the hard part: it has proven it can build and sell. The harder part is sustaining it, holding quality, depth, and trust as volumes rise. Make the next decade about reliability and advanced capability, and the top league stops being an aspiration. It becomes the address.

CALL TO ACTION

For policymakers and industry, the brief is simple. Treat the next ten years as the window they are. Build for the buyer, secure what you sell, and compete on merit, not just price.



—The writer is CMO, QnU Labs. An IIM-Calcutta alumna with 22+ years of global marketing leadership, she has led quantum security thought leadership initiatives positioning India's "Made in India, Made for the World" quantum capabilities across defence, government, and enterprise sectors globally. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda



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BRIDGING THE GAP

The small and medium enterprises in the United States and India struggle to collaborate despite strategic bilateral initiatives. The US-India opportunity is no longer limited by interest. It is limited by operational know-how, trust, partner vetting, compliance navigation, financing access and execution governance. This article examines the structural reasons behind this disconnect and proposes actionable solutions to improve cross-border SME engagement between India and the United States

RAVI NIRGUDKAR

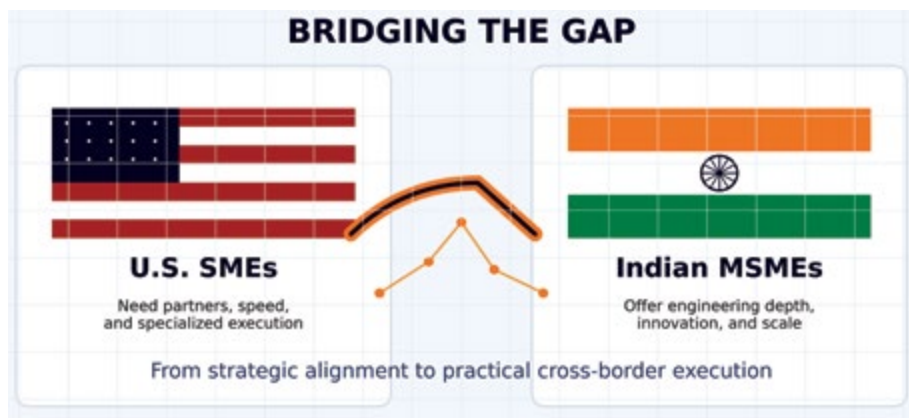
The United States and India have significantly strengthened their strategic and economic partnership over the last decade, particularly in defence innovation, advanced technology, manufacturing, and startups. Initiatives such as INDUS-X and India's iDEX have created frameworks to encourage collaboration between startups, innovators, and private-sector enterprises from both countries.

Despite this momentum, small and medium enterprises (SMEs), startups, and MSMEs in both countries continue to face substantial barriers in establishing meaningful business partnerships. Interest remains high, but practical collaboration is often limited by gaps in market knowledge, regulatory understanding, financing access, trust-building mechanisms, and operational support.

STRATEGIC ALIGNMENT IS STRONG, BUT SME EXECUTION REMAINS WEAK

India and the United States are increasingly aligned across defence, semiconductors, artificial intelligence, aerospace, cybersecurity, clean energy, and advanced manufacturing. Governments on both sides recognise that innovation ecosystems - especially startups and SMEs - are critical drivers of economic growth and technological competitiveness.

Large corporations often possess the



Custom visual: US and Indian SMEs need a trusted execution bridge to translate strategic alignment into practical collaboration.

legal, financial, and operational capabilities necessary to navigate international partnerships. SMEs, however, rarely have comparable resources, even though they are often more innovative and agile.

As a result, many promising US and Indian SMEs express interest in working together but fail to convert opportunities into sustained business relationships.

KEY BILATERAL INNOVATION INITIATIVES

INDUS-X: The India-US Defence Acceleration Ecosystem (INDUS -X), was launched to deepen cooperation between the defence innovation ecosystems of India and the United States. The initiative is designed to connect defence companies of all sizes, startups, incubators, accelerators, investors, universities, and government stakeholders.

- Connect startups and SMEs in both countries
- Accelerate defence technology collaboration
- Facilitate investor and industry participation
- Promote co-development and co-production
- Strengthen defence supply-chain resilience

Although INDUS-X has generated enthusiasm through summits, startup showcases, and networking events, many SMEs still struggle to move from discussions to executable partnerships.

iDEX: India's Innovations for Defence Excellence (iDEX) initiative was launched by the Ministry of Defence to encourage innovation among startups, MSMEs, individual innovators, industry, R&D

institutions, and academia for defence and aerospace applications.

- Support indigenous innovation
- Provide grants and incubation support
- Enable startup and MSME participation in defence innovation
- Build domestic technological capability for future defence and aerospace needs

iDEX has helped create a startup culture within India's defence ecosystem. However, international integration, especially with US-based SMEs, remains limited by regulatory, procedural, and market-access complexity. The problem is not lack of opportunity. The problem is the missing operating layer between strategic intent and commercial execution.

WHY SMEs WANT TO COLLABORATE

Complementary Strengths: Indian SMEs and MSMEs bring cost-effective engineering talent, rapid software development capabilities, manufacturing scalability, frugal innovation, and emerging deep-tech ecosystems. US SMEs bring advanced R&D, access to global defence and enterprise markets, venture capital networks, product design expertise, and mature commercialisation practices.

Together, these complementary strengths create strong incentives for collaboration. Yet complementary capabilities do not automatically translate into successful partnerships.

Supply Chain Diversification: Global geopolitical tensions and supply-chain disruptions have increased interest in diversified manufacturing and technology partnerships outside traditional hubs. India is increasingly viewed by US companies as a strategic manufacturing alternative, a democratic technology partner, and a growing innovation market. Indian SMEs, in turn, view the United States as a high-value technology market and a gateway to global defence and enterprise ecosystems.

CORE CHALLENGES PREVENTING EFFECTIVE COLLABORATION

Most SMEs lack practical understanding of cross-border contracting, US export-

U.S.-India Economic Momentum

\$212.3B

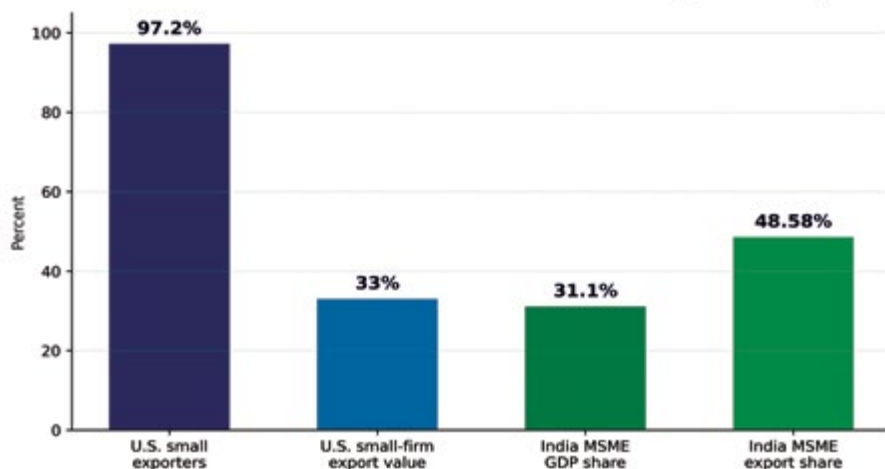
+8.3%

Estimated U.S. goods and services trade with India in 2024 | +8.3% from 2023

Source: Office of the U.S. Trade Representative, India country profile.

Macro-level US-India trade momentum is strong, but many SMEs still struggle to translate interest into executable projects

SMEs Are Central to the U.S.-India Opportunity

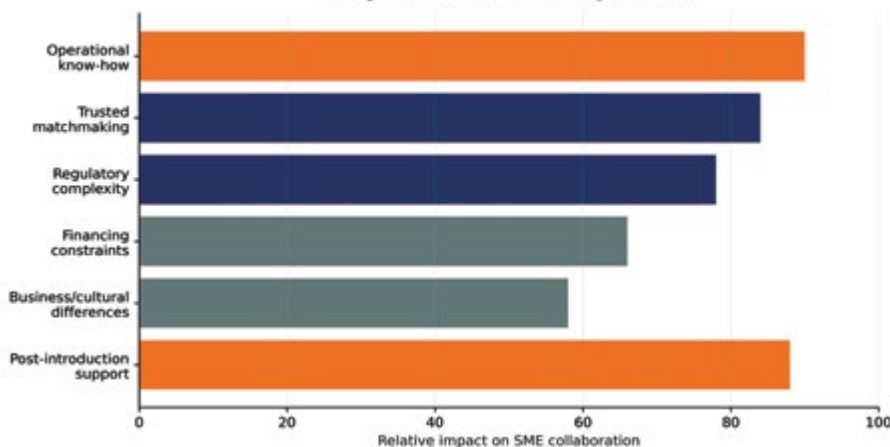


Sources: SBA Office of Advocacy 2025 U.S. Small Business Profile; PIB India/MSME sector release, May 2026.

SMEs and MSMEs are economically important in both countries and should be central to the next phase of bilateral collaboration

Illustrative prioritization based on barriers discussed in the article; not survey data.

Why SME Partnerships Stall



The largest barriers are practical and operational, not strategic

control regulations such as ITAR and EAR, Indian defence procurement systems, intellectual property protection, international taxation, and compliance requirements. Even when business interest exists, companies often do not know how to initiate or structure collaboration.

Absence of Trusted Matchmaking and Execution Support:

Current initiatives often focus on conferences, announcements, and strategic dialogues. What SMEs need, however, is longer-term matchmaking support, partnership facilitation, technical due diligence, legal onboarding assistance, and post-introduction execution support. Without this operating layer, companies often fail to identify reliable partners or sustain momentum after initial conversations.

Regulatory, Financing and Cultural Barriers:

US-side challenges include export controls, security requirements, defence compliance, and contracting complexity. India-side challenges include procurement bureaucracy, localisation requirements, certification delays, and public-sector purchasing processes. In addition, cross-border collaboration requires travel budgets, legal expenses, product adaptation, certifications, and pilot

High-Potential Collaboration Sectors



The strongest opportunities combine U.S. market access and product leadership with India's engineering, manufacturing, and startup capacity.

The strongest US-India SME opportunities sit at the intersection of technology, defence, aerospace, space, cyber, semiconductors and advanced manufacturing

funding. Most SMEs operate with limited capital and cannot absorb long international sales cycles.

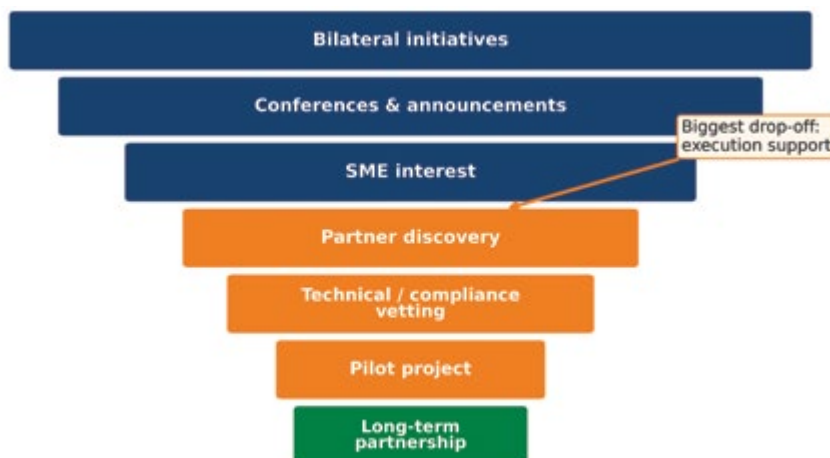
Differences in decision-making timelines, contract expectations, communication styles, risk tolerance, and procurement behaviour can further slow progress. Trust-building often takes longer than SMEs anticipate.

SECTOR-SPECIFIC OPPORTUNITIES

Defence technology offers potential collaboration in drone systems, AI-enabled surveillance, electronic warfare software, edge computing, and battlefield communications. INDUS-X can become a major catalyst if procurement pathways become more SME-friendly.

The highest value is created after the introduction. Without governance, escalation management, milestone tracking and technical review, cross-border partnerships can stall quickly. A trusted execution bridge keeps both sides aligned until the relationship produces measurable outcomes

Where Collaboration Breaks Down



Illustrative funnel showing where SMEs often stall between policy momentum and executable partnerships.

Many collaborations stall between initial interest and executable pilot projects

Semiconductors create opportunities for US design firms, testing and packaging partnerships, equipment suppliers, and talent collaboration. Cybersecurity offers a natural pairing between Indian engineering scale and US market frameworks. Commercial space ecosystems in both countries are rapidly growing and present opportunities in satellite systems, launch technologies, Earth observation analytics, and space software.

RECOMMENDATIONS

The next phase of US-India cooperation should focus not only on high-level strategic partnerships but also on operational tools that allow SMEs to participate meaningfully.

- Create bilateral SME facilitation cells that provide regulatory guidance, legal templates, export-control awareness, taxation guidance, and market-entry support.
- Develop trusted matchmaking networks with verified partner databases and sector-specific collaboration platforms.
- Launch joint pilot funding programmes to reduce early-stage risk and accelerate trust-building.
- Simplify procurement access through SME-friendly pathways, faster approval mechanisms, and sandbox testing environments.
- Build cross-border incubators and accelerators that help startups understand market expectations in both countries.
- Increase industry mentorship from experienced multinational executives, defence contractors, and technology leaders.

THE ROLE OF A CROSS-BORDER EXECUTION BRIDGE

A company with trusted connections in both countries can solve the gap by operating as a cross-border execution bridge rather than a simple broker. The bridge company can assess technical needs, identify suitable partners, vet capabilities, structure pilots, coordinate compliance review, and provide project governance.

For US SMEs, such a bridge reduces the risk of choosing the wrong partner and helps convert broad technical needs into executable scopes. For Indian SMEs and MSMEs, the bridge creates access to serious US opportunities and helps present their capabilities in a way that US buyers understand.

The highest value is created after the introduction. Without governance, escalation management, milestone tracking, and technical review, cross-

The Trusted Execution Bridge Model



Value is created by converting broad interest into scoped, vetted, governed, and measurable projects.

A trusted bridge company can move US and Indian SMEs from broad interest to scoped, vetted, governed execution

The United States and India can unlock a powerful new era of bilateral industrial and technological cooperation - one driven not only by large corporations and governments, but also by the thousands of SMEs and startups that form the backbone of innovation in both countries

innovation ecosystem.

However, enthusiasm alone is insufficient. SMEs require operational support, trusted networks, financing access, and simplified regulatory pathways to translate bilateral intent into commercial reality.

If these barriers are successfully addressed, the United States and India can unlock a powerful new era of bilateral industrial and technological cooperation - one driven not only by large corporations and governments, but also by the thousands of SMEs and startups that form the backbone of innovation in both countries. ■



—The writer is a globally recognised aerospace, defence, and national security executive with more than two decades of leadership experience driving enterprise transformation, mission-critical operations, and strategic growth across highly regulated defence, aerospace, and advanced technology sectors. He has held senior executive leadership roles with some of the world's most respected aerospace and defence organisations, including BAE Systems and Raytheon. He holds an MBA in Programme Management from George Washington University and a Master's degree in Electrical Engineering from Mississippi State University. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda.

border partnerships can stall quickly. A trusted execution bridge keeps both sides aligned until the relationship produces measurable outcomes.

SUMMING UP

The strategic alignment between India and the United States has created unprecedented opportunities for SME collaboration, especially in defence, technology, and advanced manufacturing. Initiatives such as INDUS-X and iDEX represent important first steps toward building a connected

BEFORE PEOPLE STEP IN: HOW UAVs ARE CHANGING HAZARDOUS OPERATIONS

The smartest way forward is to understand risk before action begins

PANKAJ AKULA

One lesson that comes with spending years in the UAV industry is that the biggest changes are rarely driven by technology alone. They begin when industries start looking at old problems differently. High-risk industries are now beginning to reflect that change.

Hazardous situations are the kind no one willingly chooses to face. Yet, across industries, there are teams who step into them every day because their work demands it.

In their day-to-day operations, these teams are exposed to risks that are often invisible until it's too late. Toxic gases, chemical exposure, confined spaces with low oxygen levels, weakened structures, and fire-damaged assets can all pose serious threats. While some dangers are immediate, others build silently over time, affecting respiratory health, vision, and overall well-being.

For a long time, this was simply the reality of industrial inspections. Across power, oil and gas, mining, infrastructure, and emergency response, inspections followed a familiar sequence.

When an incident occurred or maintenance became necessary, teams first entered the site to understand the situation before deciding what needed to happen next. It was a process shaped by necessity rather than choice because if an environment had to be understood, it first had to be physically reached.

Today, UAV technology is changing



Inspecting the interior of an industrial chimney to identify structural damage and potential hazards before personnel enter

“What began as a safer way to access difficult locations is steadily becoming a smarter way to understand them”

this sequence. The conversation is no longer limited to where a drone can fly. It is increasingly about how the information it captures can help protect the people who would otherwise have been the first to face the unknown.

Perhaps the most significant change is that we are no longer measuring success only by what a UAV can do, but by the risks it can help people avoid. We have always worked to build better UAVs. Today, it is equally rewarding to see them reducing the need for people to become the first

point of exposure in unsafe environments.

Although the applications are different, the purpose remains remarkably similar: remove uncertainty before work begins.

Every high-risk site presents different challenges. In some situations, UAVs inspect damaged structures. In others, they help detect gas leaks, monitor unstable terrain, or assess the impact of fires and industrial incidents. Whatever the mission, their role is the same: provide a clear picture before people step in.

Hazardous inspections also call for a different way of looking at UAV systems. For years, most discussions centred on endurance, payload capacity, and range. Those specifications still matter, but increasingly, organisations are evaluating UAVs by the confidence they provide in the information collected during every mission.

“The value of every UAV mission is measured by the confidence it gives to those making the next decision”

That shift continues to influence how we approach innovation as well. Every new UAV we develop is shaped by the same question: will it help organisations understand risk earlier, make better decisions, and reduce unnecessary exposure for the people on the ground?

Of course, even the most capable UAV is only one part of the equation. Successful inspections still depend on careful planning, disciplined execution, and the ability to collect reliable data under challenging conditions. Operators capture images from consistent viewing angles, maintain stable flight around complex structures, choose the right sensors, and plan missions around weather, communication coverage, and site conditions.

Technology alone doesn't determine the quality of an inspection. Operator capability plays an equally important role. Every mission requires careful planning, disciplined execution, and accurate data interpretation. Flying the aircraft is only one part of the operation. Delivering dependable inspection data is the real objective.

This understanding continues to shape our approach at AKSI Aerospace. Our experience across industrial deployments has reinforced one lesson: successful critical inspections depend on reliable systems, disciplined operating procedures, consistent data quality, and skilled operators working together.

Delivering that level of reliability also means continuing to build stronger UAV technologies here in India. The stronger our indigenous capabilities become, the better equipped we'll be to support critical industries with dependable solutions. For me, that has become one of the most important lessons this industry has taught me.

As hazardous operations become



Pankaj Akula introducing the Delta Wing UAV to Minister Uttam Kumar Reddy at AeroMart Hyderabad 2026, reflecting the company's continued focus on reliable inspection and industrial applications.



Pankaj Akula and the AKSI Aerospace team with Governor of Telangana, Shiv Pratap Shukla, highlighting the importance of 'Make in India' in drone manufacturing

“Reliable inspections begin long before take-off and continue long after landing”

more demanding, UAVs will play an even greater role in inspection and asset management. I believe the conversation will increasingly move beyond flight performance and towards the confidence organisations have in the decisions they make because of the information these systems provide.

For India's UAV ecosystem, this represents the next stage of growth. Our objective is no longer limited to reaching difficult assets. It is about delivering dependable insights that help industries plan maintenance, manage infrastructure, and make better

operational decisions before people are exposed to unnecessary risk.

Ultimately, I've come to believe that the true value of a UAV isn't measured by how far it flies or how much it carries. It's measured by whether the information it delivers helps someone make a better decision and allows another person to return home safely.

Because every successful hazardous inspection should leave behind more than images. It should leave behind safer decisions, healthier lives, and the reassurance that no one had to walk into danger simply to understand it. ■

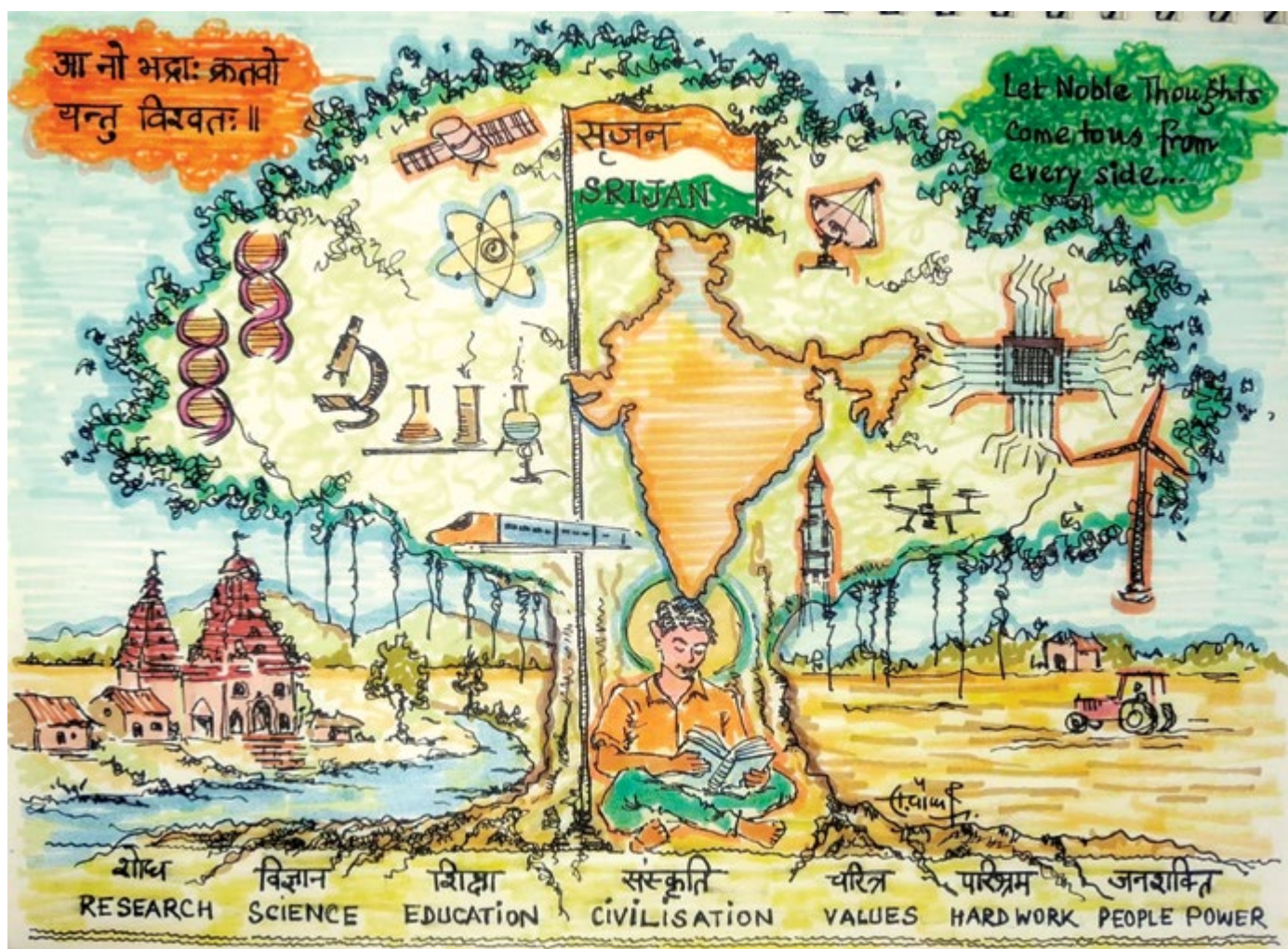


—The writer is Group Managing Director, AKSI Aerospace Group. The views expressed are personal and do not necessarily reflect the views of

Raksha Anirveda

SRIJAN: MAKING INDIA AN INNOVATION REPUBLIC BY 2047

The contest of the future will be fought over technological leadership. Therefore, the challenge for India is no longer adopting innovation but leadership in innovation. SRIJAN offers a blueprint for sovereignty in technology and Viksit Bharat 2047. However, India's expenditure on research and development remains below 1% of GDP, significantly lower than the leading innovation economies



LT GEN RAJEEV CHAUDHRY

India today stands at a paradoxical moment in its development journey. It is home to one of the world's largest startup ecosystems, possesses a vast pool of scientific and engineering talent, and has demonstrated remarkable capabilities in sectors ranging from digital public infrastructure to space exploration. Yet, despite these achievements, India's expenditure on research and development remains below 1% of GDP, significantly lower than many of the world's leading innovation economies.

This gap is more than a statistical observation. It reflects the defining challenge of the 21st century.

The great powers of the future will not be distinguished merely by the size of their economies, the strength of their militaries, or the scale of their domestic markets. They will be distinguished by their ability to generate, absorb and deploy innovation at scale. Technology has ceased to be a sector of the economy; it has become the operating system of national power.

History offers compelling evidence. Nations that mastered steam power shaped the Industrial Revolution. Those who harnessed electricity transformed manufacturing. Countries that led in nuclear science acquired strategic influence in the 20th century. The digital revolution created new centres of global power. The next era, driven by artificial intelligence, quantum technologies, advanced materials, biotechnology, semiconductors, autonomous systems and space-based capabilities, will be even more consequential.

The contest of the future will not be fought primarily over territory. It will be fought

over technological leadership.

For India, therefore, the challenge is no longer innovation adoption. It is innovation leadership. The question is not whether India can use advanced technologies. The question is whether it can create them, scale them and sustain them across generations.

To achieve this, India must move beyond an innovation ecosystem and build an innovation state. It needs a permanent national architecture that aligns funding, institutions, geography and human capital towards a common strategic objective. This paper proposes such a framework through SRIJAN — Strategic Research and Innovation through Janshakti for Aatmanirbhar Nationhood.

INDIA'S MISSING INNOVATION ARCHITECTURE

India possesses many of the ingredients required for technological leadership.

It has globally respected educational institutions, a vibrant entrepreneurial culture, an expanding venture capital ecosystem, ambitious national missions, a rapidly digitising economy and one of the youngest populations in the world.

Yet innovation outcomes remain fragmented. Research institutions often operate independently of industry. Startups struggle to transition from prototypes to large-scale deployment. Talent frequently migrates towards

Countries that led in nuclear science acquired strategic influence in the 20th century. The digital revolution created new centres of global power. The next era, driven by artificial intelligence, quantum technologies, advanced materials, biotechnology, semiconductors, autonomous systems and space-based capabilities, will be even more consequential





strategic technologies by 2047.

Such funding should be protected from annual budget fluctuations and guided by clearly articulated national priorities. This investment would support:

- Frontier scientific research.
- Strategic technology development.
- University-industry collaboration.
- Advanced manufacturing capabilities.
- Deep-tech startups.
- National innovation challenges.

The significance of this proposal lies not merely in the quantum of funding but in the predictability of funding. Innovation cannot flourish in uncertainty.

Just as highways, ports and power networks created India's physical infrastructure, sustained research investment will create the intellectual infrastructure of the next century.

PILLAR TWO: NATIONAL STRATEGIC TECHNOLOGIES AGENCY

The technologies that will define future prosperity and security often

The world's leading innovation powers consistently devote a significant portion of their GDP towards research and scientific capability creation. China invests nearly four times the share of GDP in R&D that India does, while South Korea invests more than seven times as much

established commercial sectors rather than frontier technologies. Funding remains dispersed across multiple programmes and ministries. Innovation clusters continue to be concentrated in a handful of urban centres.

The problem is not a lack of initiatives. The problem is the absence of an integrated architecture. Funding, research, talent and geography function as separate pillars rather than components of a single national mission.

India has successfully built an innovation ecosystem. What it now requires is an innovative architecture capable of sustaining technological leadership over decades. The proposed SRIJAN framework seeks to address this structural gap.

The world's leading innovation powers consistently devote a significant portion of their GDP towards research and scientific capability creation. China invests nearly four times the share of GDP in R&D that India does, while South Korea invests more than seven times as much.

SRIJAN: A NATIONAL MISSION FOR TECHNOLOGY SOVEREIGNTY

SRIJAN is not conceived as another government scheme. It is envisioned

as a national mission designed to transform innovation into an instrument of economic growth, strategic autonomy and national development.

The framework rests upon four mutually reinforcing pillars:

1. The 1% Innovation Doctrine.
2. National Strategic Technologies Agency.
3. National Innovation Districts Network.
4. National Innovation Service.

Together, these pillars seek to create the financial, institutional, geographical and human foundations of India's innovation republic.

PILLAR ONE: THE 1% INNOVATION DOCTRINE

Every major technological power has made sustained investments in research and development over long periods.

Breakthrough technologies are rarely created through sporadic funding cycles. They emerge from patient capital, institutional continuity and long-term commitment. India should therefore adopt a phased pathway towards allocating 1% of GDP exclusively for research, innovation and

involve high risks, long gestation periods and uncertain commercial returns.

Consequently, private investors frequently avoid them, while conventional bureaucratic systems tend to prioritise procedural caution over experimentation. India requires a dedicated institution capable of bridging this gap.

A National Strategic Technologies Agency should be established with the mandate to identify, fund and accelerate breakthrough technologies critical to national competitiveness and security. Its priority domains could include:

- Artificial Intelligence.
- Quantum Computing.
- Semiconductors.
- Advanced Materials.
- Biotechnology.
- Cybersecurity.
- Space Technologies.
- Autonomous Systems.
- Next-generation Defence Technologies.

The agency must enjoy operational autonomy, attract world-class talent and embrace calculated risk-taking. Its purpose would not be to eliminate failure but to maximise the probability of transformative success.

History demonstrates that technological revolutions are rarely led by institutions that seek certainty. They are led by institutions willing to explore the unknown.

PILLAR THREE: THE NATIONAL INNOVATION DISTRICTS NETWORK

Innovation thrives where ideas, talent, institutions and capital converge.

India's innovation geography, however, remains heavily concentrated in a limited number of metropolitan centres. This concentration risks regional imbalance and leaves significant reservoirs of talent underutilised.

SRIJAN proposes creating 50 specialised Innovation Districts across

India possesses many of the ingredients required for technological leadership. It has globally respected educational institutions, a vibrant entrepreneurial culture, an expanding venture capital ecosystem, ambitious national missions, a rapidly digitising economy and one of the youngest populations in the world. Yet, innovation outcomes remain fragmented

the country. Each district would focus on a strategic technological domain aligned with local strengths and national priorities. Illustratively:

- Bengaluru may deepen its leadership in Artificial Intelligence.
- Hyderabad could specialise in Defence Electronics.
- Pune could focus on Autonomous Mobility Systems.
- Chennai may become a hub for Advanced Manufacturing.
- Ahmedabad could emerge as a Semiconductor Innovation Cluster.
- Guwahati may pioneer Mountain and Climate Technologies.
- Coastal districts could lead the Maritime Innovation.
- Frontier regions could become test beds for high-altitude technologies.

These districts would integrate universities, laboratories, startups, investors, manufacturers and government agencies into cohesive innovation ecosystems. Just as industrial corridors transformed India's manufacturing

geography, innovation districts must transform India's technological geography.

Innovation must become a national phenomenon, not a metropolitan privilege.

PILLAR FOUR: NATIONAL INNOVATION SERVICE

The most transformative pillar of SRIJAN is the National Innovation Service. India's greatest strategic asset is its Janshakti.

Every year, the country produces hundreds of thousands of engineers, scientists, technologists, medical researchers and innovators. Yet much of this talent enters narrow professional pathways disconnected from national priorities.

The National Innovation Service seeks to mobilise this immense human capital. Under this framework, young professionals would be encouraged to undertake a voluntary two-year period of national innovation service after graduation or early in their careers. Participants could contribute to:

- Strategic laboratories.
- Defence research projects.
- Space missions.
- Innovation districts.
- Semiconductor initiatives.
- Digital public infrastructure.
- Grand national technology challenges.

This is neither employment generation nor compulsory service. It is nation-building through innovation.

Just as earlier generations built the foundations of independent India through public service, infrastructure development and national institutions, the coming generation can contribute through scientific and technological advancement.

The National Innovation Service would cultivate mission-oriented leadership while simultaneously strengthening India's innovation capacity.



WHY SRIJAN MATTERS FOR VISION 2047

The strength of SRIJAN lies not in any individual pillar but in their interaction. Funding without institutions leads to inefficiency. Institutions without talent become stagnant. Talent without opportunity migrates elsewhere. Innovation clusters without strategic direction struggle to achieve national impact. SRIJAN integrates these elements into a coherent national architecture.

- The 1% Innovation Doctrine provides financial certainty.
- The National Strategic Technologies Agency provides strategic direction.
- Innovation Districts provide physical ecosystems.
- The National Innovation Service provides human capital.

Together, they create a self-reinforcing system capable of sustaining innovation over generations.

FROM STARTUP NATION TO INNOVATION REPUBLIC

As India approaches the centenary of its independence, the defining question is no longer whether it can grow. The defining question is whether it can lead.

The transition from a developing economy to a developed nation will depend not only on infrastructure, manufacturing, or consumption, but also on the ability to create, command, and continuously renew advanced technologies.

The question before India is not whether it can produce more startups, patents or unicorns. The larger question is whether it can build institutions capable of sustaining innovation across generations. Nations are remembered not for the technologies they import but for the technologies they create.

If the 20th century was India's quest for political sovereignty, and the

first decades of the 21st century its pursuit of economic transformation, the decades leading to 2047 must become its journey towards technology sovereignty.

SRIJAN offers a blueprint for that journey. It seeks to transform research into capability, innovation into national power, and Janshakti into a force for technological leadership.

For a Viksit Bharat, innovation cannot remain an ecosystem. It must become a national doctrine.



—The writer is an army veteran and writes on contemporary national and international issues, strategic implications of infrastructure development towards national power, geo-moral dimensions of international relations, and leadership nuances in a changing social construct. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda

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INDIA'S INNOVATION AMBITION NEEDS PRECISION, PATIENCE AND POLITICAL WILL

India has risen from 81st to 38th position on the Global Innovation Index in a decade, a genuine achievement. But to realise Viksit Bharat 2047 goals, that momentum must be transformed from promising trajectory into sustained, precision-engineered technological leadership

ASAD MIRZA

There is a version of India's innovation story that reads like an unbroken triumph. India climbed to 38th position among 139 economies in World Intellectual Property Organisation's (WIPO) Global Innovation Index 2025, up from 81st in 2015, ranking first among lower-middle-income economies and first across Central and Southern Asia. Four Indian cities - Mumbai, Delhi, Bengaluru, and Chennai - are now recognised among the world's top 100 science and technology clusters, and India ranks sixth globally

in patent applications. The country has over 149,000 Department for Promotion of Industry and Internal Trade (DPIIT)-recognised startups. Prime Minister Modi called the Global Innovation Index (GII) performance a "remarkable feat".

It is a remarkable feat. But rankings tell only part of the story - and often the most flattering part. The harder question is whether India's innovation ecosystem is building the deep, self-sustaining capability needed to achieve Viksit Bharat 2047 goals, - a developed, technology-leading nation by the centenary of independence. The evidence suggests that ambition and architecture are still running at different speeds.

THE JUGAAD TRAP

For decades, India celebrated jugaad - frugal, improvised, workaround innovation - as a competitive virtue. In conditions of resource scarcity, it was. But the demands of the fourth industrial revolution are different. Competing in semiconductors, quantum computing, artificial intelligence, hypersonic systems, and biotechnology requires not improvisation but precision: sustained investment, institutional depth, long-cycle research, and an ecosystem that converts scientific output into patented, scalable, globally competitive products.

India's GII 2025 profile tells its own story of this transition's incompleteness: while the country ranks 22nd in Knowledge and Technology Outputs and 38th in Market Sophistication, it lags at 64th in Business Sophistication, 61st in Infrastructure, and 58th in Institutions. The gap between outputs and inputs is the structural signature of an economy that still depends more on inherited scientific talent and entrepreneurial hustle than on a deliberately engineered innovation system.

THE R&D FUNDING GAP: THE NUMBER THAT DEFINES EVERYTHING

No single statistic captures India's innovation challenge more starkly than its R&D investment. India invests less than 0.65 per cent of its GDP in R&D. South Korea spends more than 4.5 per cent, Israel 5.4 per cent, the United States 2.8



Defence Minister Rajnath Singh releasing 'Defence Forces Vision 2047: A Roadmap for a Future-Ready Indian Military'



India's GII 2025 profile tells its own story of this transition's incompleteness: while the country ranks 22nd in Knowledge and Technology Outputs and 38th in Market Sophistication, it lags at 64th in Business Sophistication, 61st in Infrastructure, and 58th in Institutions

per cent, and China 2.4 per cent. India's gross R&D expenditure is lower than the global average of 1.79 per cent, and two-thirds of that expenditure comes from the government rather than the private sector - the reverse of the pattern seen in leading innovative economies.

This is not merely an economic abstraction. Underinvestment limits the scaling of research at IITs, IISc, and CSIR laboratories, discourages the creation of valuable industries like biotechnology, semiconductors, and artificial intelligence, and continues the dependency on foreign technologies.

India's renewable energy sector remains heavily reliant on imported solar modules; its high-tech manufacturing is still tethered to outsourced automation platforms. Experts have called for India to spend at least one per cent, and ideally three per cent, of GDP every year until 2047 on R&D for science to have meaningful developmental impact.

The Union Budget 2025-26 announced a new Research, Development and Innovation Fund worth ₹1 lakh crore over six years, with ₹20,000 crore allocated for FY26. This is encouraging - but the history

of India's science funding carries a sobering footnote: in 2022-23, the Department of Biotechnology used only 72 per cent of its allocated budget on centrally sponsored schemes, while the Department of Science and Technology used only 61 per cent. Announcing funds is not the same as deploying them with discipline. Patient capital - long-cycle, outcome-oriented R&D funding that does not demand quarterly returns - remains structurally rare in the Indian system.

THE SEMICONDUCTOR WARNING: WHAT HAPPENS WITHOUT STRATEGIC CLARITY

The semiconductor mission offers the clearest case study in the consequences of ambition without precision. India's Parliamentary Standing Committee on Communications and Information Security flagged significant bottlenecks in the implementation of semiconductor schemes, including delays in project approvals, coordination issues across ministries, and gaps in infrastructure readiness. ISM 1.0, approved in December 2021 with an incentive framework of

approximately ₹76,000 crore, succeeded in attracting investment announcements - but as of late 2025, projects had not yet translated into major output, and analysts said India's position would be determined less by headline investment and more by whether the programme could address the gaps that faffing alone cannot solve.

Semiconductor fabrication consumes tens of megawatts of electricity and millions of litres of ultra-pure water daily, it further requires sophisticated logistics and clean-room standards that few Indian cities currently offer, and demands a financing model that de-risks private capital through shared infrastructure, predictable policies, and coordinated implementation. India's semiconductor strategy has been described by analysts as scattered and diffused - no single nation can build a complete supply chain in the short term, and India's policy needs to focus on areas of greatest leverage rather than trying to compress decades of semiconductor ecosystem-building into a single policy cycle.

ISM 2.0, launched in 2026, has begun to course-correct - shifting focus from fab subsidies toward the full ecosystem of equipment, materials, Indian IP, supply

chains, and workforce training. But the lesson from ISM 1.0 is one that every subsequent mission must internalise: half-baked plans in capital-intensive, long-gestation technology sectors do not merely waste money - they waste the irreplaceable window of geopolitical opportunity that India currently occupies.

DEFENCE STARTUPS: THE MODEL WORTH SCALING

If the semiconductor experience shows what incomplete strategy looks like, the iDEX (Innovations for Defence Excellence) ecosystem shows what disciplined innovation support can achieve. Over 2,000 defence and 300 space startups are now driving deep-tech innovation in India. In emerging technologies like AI, quantum computing, and drones, Indian startups are producing globally competitive solutions - QNu Labs achieved record distances in Quantum Key Distribution, outperforming global competitors. PSUs, once viewed as mere assembly units, filed over 2,000 patents. Mazagon Docks engineers designed India's first midget submarine prototype.

The iDEX programme provides non-dilutive grants of up to ₹10 crore to defence technology startups for research, development, and prototype creation - the largest government startup grants available in India. The ADITI scheme, complementing iDEX, targets the development of thirty deep-tech critical and strategic technologies by 2026, with export potential built in from the design stage. Defence exports have grown from ₹14 billion in 2016-17 to ₹250 billion - a fifteen-fold increase - and for the first time India is not merely a defence importer but also a meaningful exporter.

The iDEX model works because it combines clear problem-statement framing, non-dilutive capital, fast procurement pathways, and a defined end-customer in the armed forces. That model - problem-led, outcome-linked, adequately funded - is precisely what India's broader innovation architecture needs to replicate across semiconductors, clean energy, biotech, and deep-tech manufacturing.



TOWARD PRECISION INNOVATION: WHAT VISION 2047 ACTUALLY REQUIRES

India's path from a promising innovation performer to a genuine technology leader by 2047 runs through four non-negotiable transformations. First, R&D investment must rise decisively - the ₹1 lakh crore RDI Fund is a start, but it must be deployed, not just announced, and private sector R&D contribution must be structurally incentivised to reach the 65-70 per cent share seen in leading economies. Second, patient capital must become a system feature rather than an exception - long-gestation deep-tech investments need financing structures that tolerate decade-long payback horizons, something India's predominantly short-cycle venture ecosystem is not currently built to provide.

Third, strategic clarity must precede investment in every capital-intensive technology domain - the semiconductor lesson must not be repeated in quantum computing, advanced materials, or space manufacturing. Fourth, the innovation-to-procurement pipeline for defence startups must be widened, with faster absorption of iDEX and ADITI solutions into actual military inventory and a deliberate push to

convert dual-use technologies into global export products.

India has built its innovation strengths on knowledge outputs and market sophistication. The weaknesses - in business sophistication, infrastructure, and institutions - are exactly the areas that separate a high-performing emerging economy from a technology leader. Closing those gaps is the work of the next two decades.

India has the talent, the diaspora, the demographic dividend, and now the political will. What it still needs is the strategic patience to build innovation institutions that outlast election cycles, fund science that will not show results for a decade, and resist the temptation to announce a mission without first assembling the conditions for its success. That discipline - more than any ranking - will determine whether Viksit Bharat 2047 is a vision realised or a vision deferred. ■



-The writer is New Delhi-based strategic, defence and international affairs commentator. He can be contacted on www.asadmirza.in. The views expressed are of the writer and do not necessarily reflect that of Raksha Anirveda



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INDIA'S DEFENCE INNOVATION MOMENT HAS ARRIVED

For India to realise its Vision 2047 goals, defence innovation cannot remain a sector-specific initiative. It must become a pillar of national technological and economic strategy. The transition from ingenuity to precision is already underway. The challenge now is to sustain it

DR R SHIVARAMAN

There is a story India has told about itself for decades. It is the story of jugaad: finding a way when resources are limited, solving problems creatively, and achieving results against the odds.

It is a story worth celebrating. But it is not the story that will define the next phase of India's growth.

As India moves towards its Vision 2047 ambitions, success will depend not only on ingenuity, but on the ability to build technologies that are reliable, scalable, precise, and globally competitive. Few sectors illustrate this transition more clearly than defence.

THE NUMBERS TELL A STORY

A decade ago, India's defence exports stood at a modest ₹686 crore. By 2025-26, that figure had reached a record ₹38,424 crore, with Indian-made defence products reaching buyers in over 80 countries. Indigenous defence production has risen to an all-time high of ₹1.78 lakh crore in 2025-26, a 15.6% increase from the previous year and more than double what it was five years ago.

These achievements did not happen by accident. They are the result of sustained policy support, growing private-sector participation, and a deliberate effort to place innovation at the centre of India's defence ecosystem.

The Positive Indigenisation Lists, Defence Acquisition Procedure reforms, and the Innovations for Defence Excellence (iDEX) framework have collectively created an environment where new ideas can move

closer to operational reality.

Driving deep-tech innovation across India, thousands of startups are now contributing to India's defence and space innovation ecosystem. In emerging areas such as artificial intelligence, quantum technologies, autonomous systems, and drones, Indian innovators are beginning to produce solutions that compete with global benchmarks. By March 2026, iDEX had engaged 676 startups, MSMEs, and innovators, with 551 design and development contracts signed.

The ecosystem is no longer theoretical. It is increasingly delivering real capability.

THE UNCLOSED GAP

While the progress is encouraging, there are still important challenges that deserve attention.

Driving deep-tech innovation across India, thousands of startups are now contributing to India's defence and space innovation ecosystem. In emerging areas such as artificial intelligence, quantum technologies, autonomous systems, and drones, Indian innovators are beginning to produce solutions that compete with global benchmarks

India's defence R&D expenditure, while growing, remains below what several leading defence powers invest as a proportion of their defence budgets. Defence R&D expenditure has increased significantly over the past decade, and since 2022-23, 25% of that allocation has been opened to industry, startups, and academic institutions.

This represents meaningful progress. However, technology leadership depends not only on funding innovation but on accelerating its transition into deployable capability.

The gap between prototype and procurement remains one of the most frequently cited challenges across the startup ecosystem. Certification timelines, testing bottlenecks, and working capital constraints can slow the journey from innovation to induction.

Building world-class defence technology requires more than innovation at the prototype stage. It requires a system that can consistently transform ideas into operational capability.

THE ADITI SIGNAL

One of the clearest indicators of where India is heading is the ADITI initiative.

Its objective is to accelerate the development of critical and strategic deep-tech technologies with defence applications and export potential, while fostering collaboration among startups, MSMEs, research institutions, and established industry players.

The significance of this initiative lies in the nature of the problems it seeks to address.

For many years, some of the most advanced technologies were assumed to



be beyond domestic reach and therefore sourced from overseas. ADITI reflects a growing confidence that Indian innovators can take on these challenges and deliver indigenous solutions.

That ambition, backed by grants of up to ₹25 crore, signals a meaningful shift in expectations and intent.

INNOVATION AS NATIONAL STRATEGY

For India to realise its Vision 2047 goals, defence innovation cannot remain a sector-specific initiative. It must become a pillar of national technological and economic strategy.

The impact of programmes such as iDEX is already extending beyond defence. Sectors including space, transportation, and critical infrastructure are increasingly adopting similar innovation-led approaches.

The broader opportunity extends well beyond defence.

Investments in defence deep-tech create capabilities, supply chains, and skilled talent that often find applications across multiple sectors. Technologies such as artificial intelligence, quantum communications, advanced propulsion,

autonomous systems, and electronic warfare frequently generate benefits that extend far beyond their original military use cases.

Perhaps the most encouraging development is the growing collaboration between the armed forces, industry, startups, academia, and policymakers. Innovation ecosystems succeed when users and developers work closely together, and India's defence ecosystem is increasingly moving in that direction.

The nations that view defence innovation as a driver of broader technological leadership, rather than simply a security requirement, are often the ones that shape the next generation of global competitiveness.

India has the policy intent. It has the entrepreneurial energy. Increasingly, it also has the results.

THE ROAD TO 2047

Vision 2047 is not a single destination. It is a sequence of choices made over the next two decades about where India chooses to lead and where it chooses to follow.

In defence technology, the direction is becoming increasingly clear. The infrastructure exists. The ecosystem is

growing. The export story is gaining momentum.

What remains is the discipline of execution: transforming prototype pipelines into production lines, converting promising innovation into proven capability, and building institutions that can sustain this momentum over decades rather than budget cycles.

India's innovation journey is no longer about proving what is possible. It is about consistently delivering technologies that are trusted, adopted, and deployed at scale.

The foundations are in place. The opportunity is real. The next two decades will determine how fully India converts that opportunity into technological leadership. The transition from ingenuity to precision is already underway. The challenge now is to sustain it. ■



—The writer is the Co-Founder and CTO of Big Bang Boom Solutions, India's first profitable deep-tech defence contractor and the first iDEX startup to export defence systems to a friendly foreign country. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda

INDIA'S STRIDE FROM JUGAAD TO PRECISION

By 2047, India aims to be more than a developed nation. It aims to be an innovation superpower. Defence may be the sector that determines whether it succeeds

AJIT K THAKUR

"Innovation distinguishes between a leader and a follower." — Steve Jobs

For decades, India's innovation story has been defined by jugaad — the uniquely Indian ability to devise ingenious solutions under constraints. It powered entrepreneurship in resource-scarce environments, helped industries stretch every rupee, and became synonymous with resilience. Yet as the global strategic landscape enters an era dominated by artificial intelligence, autonomous systems, quantum technologies, advanced materials, cyber warfare, and space-based capabilities, improvisation alone is no longer enough.

The future belongs to nations capable of converting ingenuity into industrial-scale precision, scientific excellence, and technological leadership. That challenge lies at the heart of India's Vision 2047 — the ambition to emerge as a developed, self-reliant, and globally influential nation by the centenary of Independence. While the vision spans every sector of the economy, nowhere is its success more consequential than in defence. The ability to build indigenous technologies, nurture globally competitive defence startups, fund frontier research and create innovation ecosystems capable of producing breakthrough capabilities will determine not only India's military preparedness but also its economic trajectory.

THE STRATEGIC REQUIREMENT

The global security environment is undergoing a profound transformation. The traditional markers of military power — troop strength, platforms and firepower — are increasingly being complemented by technological superiority. Conflicts in recent years have demonstrated the decisive role of drones, satellite intelligence, cyber capabilities, AI-enabled decision-making and autonomous systems. The battlefield is becoming digital, networked and data-driven. For India, situated in one of the world's most complex geopolitical neighbourhoods, technological dependence is no longer a viable option.

National security and economic competitiveness are converging. Countries that dominate emerging technologies are shaping global supply chains, setting standards, attracting investment, and exercising strategic influence. In this environment, innovation becomes not merely an economic objective but a national security imperative.

This is where India's aspiration for an Aatmanirbhar Bharat intersects with its ambition to become an 'Innovation Nation'. The goal is not simply to replace imports with domestic production. It is to create technologies that others seek



to buy. It is the difference between self-sufficiency and leadership.

BEYOND JUGAAD: THE RISE OF PRECISION INNOVATION

India's culture of innovation has long been celebrated for its adaptability. From rural entrepreneurs devising low-cost

solutions to engineers extending the life of legacy systems under difficult conditions, jugaad demonstrated remarkable creativity. However, modern defence systems require a fundamentally different approach. A hypersonic missile cannot be built through improvisation. Neither can an autonomous drone swarm, a quantum communication network, or a next-generation electronic warfare system.

These technologies demand precision engineering, rigorous testing, advanced manufacturing, quality assurance, certification, and sustained research investment. They require institutional capability rather than

globally competitive technologies. This shift is visible across various sectors, especially defence, where a new generation of startups is redefining what indigenous innovation can achieve.

DEFENCE STARTUPS: THE NEW STRATEGIC VANGUARD

A decade ago, the phrase 'defence startup' would have sounded almost contradictory in India as government laboratories, public-sector enterprises, and large industrial players dominated this sector. Entry criteria were high, procurement cycles were long, and venture capital largely stayed away.

Today, that picture has changed

defence and security, went public in 2023, becoming a bellwether for the sector and validating investor appetite.

- Tonbo Imaging develops cutting-edge sensors, seekers, and surveillance systems, supplying the Indian forces while exporting to over 30 countries. It has raised significant rounds, including \$20 million in Series D funding.
- NewSpace Research & Technologies excels in swarm drones, with contracts for systems capable of deep penetration.
- Others like Raphe mPhibr, Sanlayan Technologies (raising ₹186 crore in Series A), and Garuda Aerospace are pushing boundaries in propulsion, electronics, and aerospace.

These firms are moving beyond assembly to indigenous design, supported by 25% of the defence R&D budget earmarked for private industry, startups and academia. The ₹1 lakh crore corpus for innovation and deep-tech schemes further signals intent. The contribution of private sector companies to defence exports is rising, targeting over \$5 billion annually soon.

Collectively, these companies represent a significant shift in India's defence industrial base — from licensed production and assembly towards indigenous design, intellectual property creation, and deep-tech innovation. They are proving that Indian innovation can compete not only on cost but on capability.

THE IDEX REVOLUTION

No discussion of India's defence startup ecosystem is complete without examining the catalytic role played by Innovations for Defence Excellence (iDEX). Widely regarded as one of the most consequential reforms in India's defence innovation architecture, iDEX has fundamentally altered how the armed forces engage with innovators. By connecting startups, MSMEs, academia, incubators, and industry directly with defence problem statements,

individual ingenuity.

The transition currently underway represents a maturation of India's innovation ecosystem. Rather than abandoning the spirit of jugaad, India is evolving it. The same resourcefulness that once solved immediate problems is being redirected towards creating scalable,

dramatically. India's defence-tech ecosystem has exploded, with over 200 specialised startups raising more than \$700 million cumulatively, including nearly \$247 million in 2025 alone. Bengaluru, Mumbai and Hyderabad have emerged as vibrant hubs.

- ideaForge, a pioneer in UAVs for



the initiative has created a structured pathway from concept to deployment.

More importantly, it has introduced a cultural shift. For decades, innovators often struggled to understand military requirements, while defence establishments found it difficult to engage with non-traditional suppliers. iDEX has bridged that gap by creating a common platform where operational challenges become opportunities for innovation.

The programme has already engaged thousands of startups across defence and space technologies. Through Defence India Startup Challenges, SPARK grants, and advanced funding mechanisms, entrepreneurs are being encouraged to tackle some of the most complex technological challenges facing the nation.

The significance extends beyond individual products. iDEX is helping institutionalise innovation as a national capability. It signals a broader recognition that future military advantages will emerge not only from government laboratories but also from garages, university campuses, research centres, and startup ecosystems.

FUNDING THE FUTURE

Innovation cannot thrive on ambition alone. If India is serious about becoming a technology leader by 2047, it must confront one uncomfortable reality: India's Gross Expenditure on Research and Development (GERD) is approximately 0.65% of its GDP. That's abysmal compared with the United States (2.9%), South Korea (4.5%), China (2.6%) and Israel (a whopping 6.9%). Their technological leadership is not accidental; it is financed. India's innovation aspirations require a similar commitment.

The challenge is not merely increasing funding but ensuring that capital reaches the right stages of the innovation lifecycle. Many Indian startups successfully develop prototypes but encounter what investors often call the 'Valley of Death' — the critical early



phase of a startup or research project when the company has developed a prototype but has not yet generated revenue. Many startups fail at this stage as initial funding dries up before commercialisation is achieved. Defence technologies are particularly vulnerable because they require extensive testing, certification, infrastructure, and long development timelines.

The result is a funding gap precisely when companies need support the most. Bridging this gap demands a national innovation financing strategy that combines government support, venture capital, institutional investment, strategic procurement, and patient capital.

The creation of large innovation and deep-tech funds represents an important step. However, India must move further by establishing dedicated growth-stage financing mechanisms for strategic technologies. The objective should be clear: no promising defence technology should fail because of insufficient capital.

R&D AS A STRATEGIC ASSET

History offers a simple lesson: nations that dominate technology invest heavily in research long before commercial success becomes visible. The internet, GPS, stealth technology, advanced semiconductors, and many modern AI breakthroughs emerged from decades of sustained research investments. India's journey towards technological leadership will require a similar mindset. Research and development must be viewed not as expenditure but as strategic investment. This applies equally to government laboratories, universities, startups, and private industry.

The future battlefield will be shaped by technologies that are still emerging today — quantum computing, synthetic biology, advanced materials, directed-energy systems, human-machine teaming, and next-generation communication networks. If India wishes to lead in these domains, investments must begin now.

The most successful innovation ecosystems create virtuous cycles where



research institutions generate knowledge, startups commercialise discoveries, industry scales production, and the government acts as an enabling catalyst. India possesses many of the ingredients required for such a system: a large talent base, strong engineering capabilities, growing entrepreneurial energy, and expanding digital infrastructure. The task now is integration.

DEFENCE AS AN ECONOMIC MULTIPLIER

One of the biggest misconceptions surrounding defence investment is that it serves only security objectives. In reality, defence innovation is among the most powerful engines of economic transformation.

Advanced manufacturing facilities create high-skilled jobs. Aerospace programmes stimulate supply chains. Electronics and semiconductor ecosystems benefit from defence demand. Artificial intelligence, robotics, and cybersecurity innovations often find

many civilian applications.

The spillover effects can be enormous. Many of the technologies that transformed modern economies originated in defence programmes. The same pattern is increasingly visible in India. Drone technologies are finding applications in agriculture, logistics, disaster management, and infrastructure monitoring. Space technologies are creating new commercial opportunities. AI solutions developed for defence are being adapted across industries.

This convergence means that investments in defence innovation produce returns far beyond military capability. For a nation seeking sustained economic growth through 2047, defence technology can become a strategic growth engine.

Exports further amplify the impact. India's defence exports have risen dramatically in recent years, reflecting growing international confidence in indigenous capabilities. As domestic firms move up the value chain, opportunities will expand across Asia, Africa, the Middle East, and beyond. A thriving defence export ecosystem creates national wealth, enhances diplomatic influence, and creates economies of scale that further accelerate innovation.

BUILDING THE INNOVATION ARCHITECTURE OF 2047

The next two decades will determine whether India becomes a major technology power or remains a large technology consumer. Success will depend on creating an innovation architecture capable of sustaining leadership over generations. Several priorities stand out.

First, R&D spending must increase substantially and steadily. Sporadic or ad hoc investments cannot build enduring technological capabilities.

Second, procurement systems must become more agile and predictable. Startups need confidence that successful innovations will find pathways to adoption.

Third, academia-industry-defence

collaboration must deepen. Universities should become active contributors to national technology missions rather than isolated centres of learning.

Fourth, intellectual property creation must be encouraged and protected. Nations that own technologies capture disproportionate economic value.

Fifth, talent development must become a strategic priority. Engineers, scientists, data specialists, and advanced manufacturing professionals will form the backbone of the innovation economy.

Finally, India must embrace a culture that tolerates calculated risk. Innovation inherently involves experimentation, failure, iteration, and learning. Strategic sectors cannot advance if every setback is treated as a setback to ambition itself.

THE PRECISION ERA

As India advances towards 2047, the nation's innovation journey is entering a new chapter. Defence provides perhaps the clearest lens through which to view this transformation. Across laboratories, startups, manufacturing facilities, universities, and military establishments, a new ecosystem is taking shape – one capable of designing, developing, producing and exporting sophisticated weapons systems and services.

The objective is larger than self-reliance – it is leadership. It is about ensuring that India is not merely a consumer of global technologies but a creator of them. It is about building an economy where innovation becomes a primary driver of growth. And it is about securing national interests in an era where technological superiority increasingly determines strategic influence.

By 2047, India's status as an innovation nation will be measured not only by patents filed, startups funded or exports achieved. It will be measured by whether the country successfully transformed creativity into capability, aspiration into execution and potential into power. The innovation revolution has already started. The next twenty years will determine how far – and how fast – it can take India.

FROM MAKE IN INDIA TO EXPORT FROM INDIA

Entering a decisive phase, India has a unique opportunity to become not only a major defence market, but also a trusted global defence exporter. Schiebel India's strategy is based on long-term capability building. Expanding in India, with India and for India, the company is also creating a pathway towards international markets

JAJATI MOHANTY

India's defence sector is entering a decisive phase. With its growing geopolitical role, expanding industrial base and clear focus on self-reliance, India has a unique opportunity to become not only a major defence market, but also a trusted global defence exporter. The coming decade will be crucial in determining how effectively the country can convert its industrial momentum, innovation potential and skilled workforce into globally competitive defence capability.

For Schiebel India, this vision is closely aligned with our own long-term strategy. Schiebel India is already established in the country, and we are now expanding its capabilities to support customers, strengthen local industry participation and contribute to India's wider Make in India, Aatmanirbhar Bharat and Vision 2047 ambitions.

Schiebel has more than two decades of experience in rotary-wing Vertical Takeoff and Landing Unmanned Air Systems (VTOL UAS). The CAMCOPTER® S-100 is a globally proven platform with extensive operational experience across maritime and land-based missions. In India, the Indian Navy is our customer, which reflects the relevance of this capability for demanding maritime

security, surveillance and operational requirements.

This operational foundation gives Schiebel India a strong basis for the next phase of local capability development working closely with domestic industry to further mature and adapt the technology. Our focus is on expanding an ecosystem in India that not only supports assembly, integration, maintenance, software development, selected manufacturing etc. but also builds advanced capabilities in world class software, additive manufacturing, electronic assembly, precision manufacturing and a strong MILCOTS

The CAMCOPTER® S-100 is a globally proven platform with extensive operational experience across maritime and land-based missions. In India, the Indian Navy is our customer, which reflects the relevance of this capability for demanding maritime security, surveillance and operational requirements

vendor network. This approach is fully aligned with Schiebel's global distributed manufacturing concept and is designed to meet customer requirements in the domestic area as well as future export opportunities.

A key priority is the creation of a stronger assembly and integration ecosystem. This goes beyond local representation. It is about building the ability to assemble, integrate, test and support systems in India with increasing participation from Indian industry. Such a model supports faster response times, deeper technical knowledge and long-term value creation within the country.

In parallel, we have created a Maintenance, Repair and Overhaul (MRO) set up in Hyderabad which provides necessary support to our Indian customers like Navy. We are presently expanding the MRO ecosystem by technologically evolving with the domestic industry in order to make this MRO into a maintenance hub for our global customers in this part of the globe. For advanced unmanned systems, operational availability is critical. Local MRO capability reduces turnaround times, strengthens customer support and builds confidence among operators. It also creates skilled technical employment and supports the development of specialised aerospace and unmanned systems expertise in India.

Another important step is



A key priority is the creation of a stronger assembly and integration ecosystem. This goes beyond local representation. It is about building the ability to assemble, integrate, test and support systems in India with increasing participation from Indian industry

the commencement of domestic manufacturing activities in areas such as composites, electronic assembly, precision manufacturing and cable set & harness manufacturing etc. These are important building blocks for a broader aerospace manufacturing base. As these capabilities mature, they can support Indian requirements while also becoming part of Schiebel's wider international supply chain.

We are also engaging extensively with domestic manufacturers to identify opportunities for deeper cooperation. India has a strong and growing network of public and private sector companies, Micro, Small and Medium Enterprises (MSMEs), start-ups and specialised engineering firms. By working with these partners, Schiebel India aims to contribute to the development of a manufacturing hub that can serve both domestic and international markets.

The ultimate aim is to support exports from India to global markets. Defence exports are not limited to complete platforms. They also include components, sub-systems, software, integration expertise, lifecycle support and certified

manufacturing capacity. India has the potential to contribute across this full spectrum, provided industry continues to focus on quality, reliability, repeatability and long-term support.

Innovation is equally important. India's defence innovation ecosystem has developed rapidly in recent years, supported by government initiatives, start-up participation and growing interaction between industry and the armed forces. The challenge now is to transform innovation into field-ready, scalable and reliable capability.

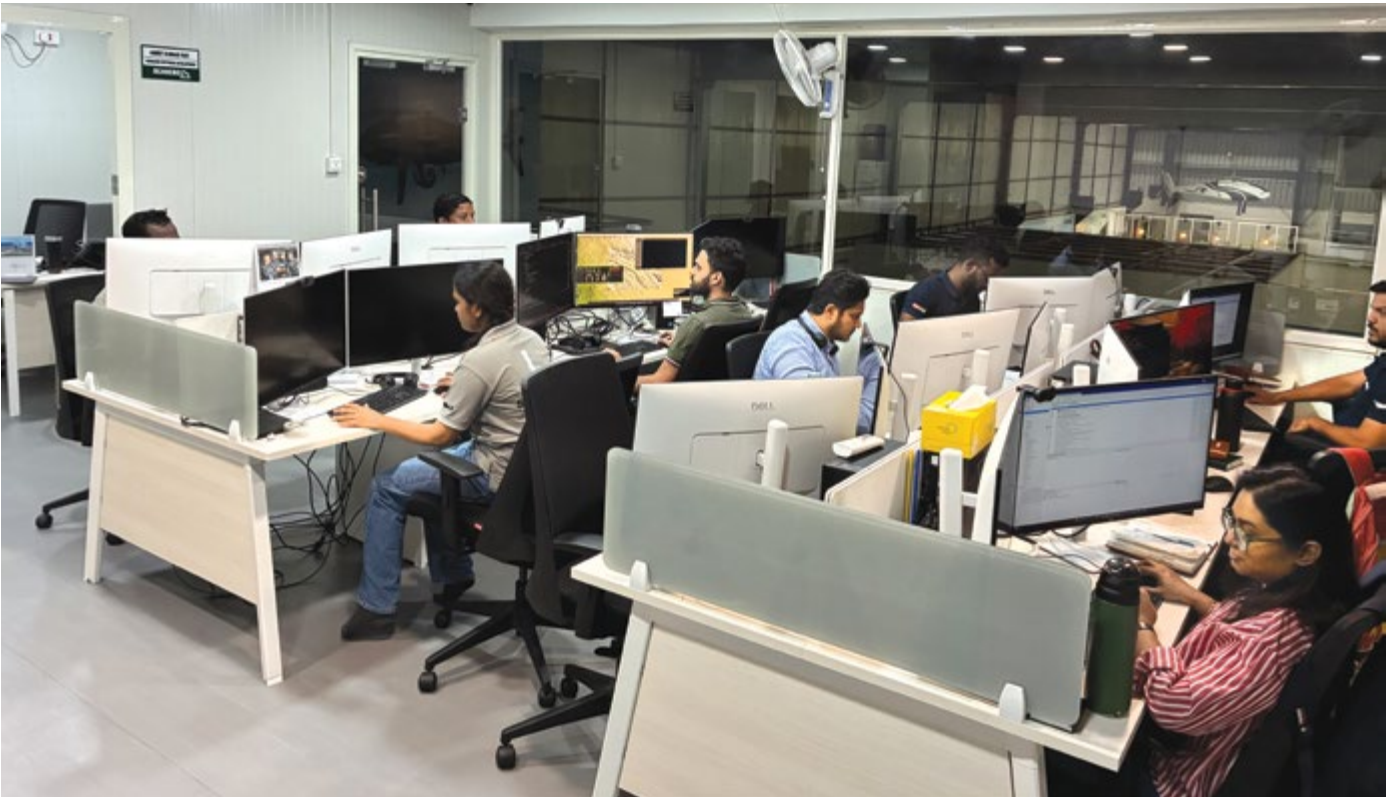
For Schiebel India, one major area of focus is the planned expansion of software capability. We have created a software division to develop future-ready mission planning and control software for both domestic and international markets. Software is becoming one of the defining elements of modern unmanned systems. It influences mission planning, control, data management, interoperability and operator effectiveness. The young programmers at Schiebel India are able to gain a deeper understanding of the underlying know why during

the software development process rather than simply learning the how know of how to execute a task. This is a significant step forward in the type and quality of software being developed in the domestic industry.

This is particularly relevant as unmanned systems become more integrated into wider command-and-control environments. Future operations will require platforms that are capable, connected, adaptable and able to support faster decision-making. India's strong software and systems engineering talent can become a major advantage in this area.

Mission adaptability is another important focus. Schiebel's CAMCOPTER® family is built around flexible payload integration and operational versatility. The S-100 has already proven the value of a compact and mature VTOL UAS for a wide range of missions. The CAMCOPTER® S-300 expands this concept with greater payload capacity, longer endurance and broader mission flexibility for demanding maritime and land-based operations.

Within Schiebel Defence, the



CAMCOPTER® S-101 and CAMCOPTER® S-301 represent dedicated defence platforms for customers requiring integrated ISTAR and mission-specific effectors. In India, we are working with domestic original equipment manufacturers in the field of weapon integration for these systems. This supports local expertise and creates opportunities for Indian companies to contribute to future

defence capability development.

We are also improving existing capability through new-generation ground support and handling equipment. This is a critical part of operational effectiveness. A UAS is not only the air vehicle. It is a complete system, including sensors, ground control, communications, maintenance, support equipment and trained personnel. Improvements in ground support and

handling can simplify deployment, reduce manpower requirements and increase flexibility in the field.

For India to reach the top league of defence exporters, the country must continue to build confidence in the quality, reliability and sustainability of its defence products. Global customers will look not only at performance, but also at lifecycle support, certification, compliance and supply chain resilience.

Schiebel India's strategy is therefore based on long-term capability building. We are expanding in India, with India and for India, while also creating a pathway towards international markets. The country has the talent, industrial ambition and innovation potential required to become a major defence technology and export hub. Schiebel India is committed to being part of that journey. ■



—The writer is CEO, Schiebel India. The views expressed are of the writer and do not necessarily reflect the views of Raksha Anirveda.



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TOWARDS A JOINT DRONE ECOSYSTEM

Drawing lessons from the wars in Ukraine and Iran, India has begun raising specialised Baaz drone battalions. However, the challenge lies in building an indigenous, integrated and technologically advanced drone warfare capability across land, sea and air domains

CMDE RANJIT B RAI

President Donald Trump launched the US-Israeli military campaign against Iran on February 28, 2026, under the codename “Epic Fury”, with the objective of crippling Iran and its nuclear programme. However, the campaign underestimated Iran’s war preparedness, missile inventory and extensive drone capabilities, despite the significant damage inflicted by US and Israeli forces on Iranian air and naval assets.

Iran surprised much of the world with its response, launching thousands of precision drone and missile attacks against US military bases in Bahrain, Kuwait, Saudi Arabia, Qatar and the UAE, while also carrying out long-range attacks against Israeli targets and US naval assets operating in the region.

The drone—a relatively inexpensive unmanned aerial platform capable of carrying sensors or weapons—has seen extensive use in the Russia-Ukraine war and has arguably come of age during the Iran conflict. Militaries across the world, including India’s armed forces, are closely studying the lessons emerging from these conflicts.

DRONE DOMINANCE: THE NEW RMA

Wars and preparations for war have historically generated new technologies and new methods of warfare, leading to what Soviet Marshal Nikolai Ogarkov described in the 1980s as a Military-



Soviet Marshal Nikolai Ogarkov, Andrew Marshall

Technical Revolution (MTR).

In the 1990s, American strategist Andrew Marshall, studying the Gulf Wars, argued that emerging technologies—including precision-guided munitions, space systems and microelectronics—fundamentally alter the conduct of warfare. He termed this phenomenon the Revolution in Military Affairs (RMA).

Recent conflicts suggest that drone warfare may represent the latest stage of this continuing revolution.

The wars in Ukraine and Iran have demonstrated that inexpensive unmanned systems, operating individually or in swarms, can challenge conventional military platforms, impose disproportionate costs on adversaries and fundamentally alter the offence-defence balance.

INTELLIGENCE: THE FOUNDATION OF MODERN WARFARE

In all wars, and in preparations for war and deterrence, intelligence plays a pivotal role. Iranian human and technical intelligence capabilities appear to have remained effective despite years of sanctions. Iran

reportedly refined approximately 600 kilograms of uranium and maintained hidden storage facilities underground.

It is also evident that Iran had compiled extensive geographical and photographic intelligence on US military bases, airfields, naval assets and even the deployment patterns of US ships and aircraft operating in the region.

China deployed the 30,000-ton Liaowang-1 intelligence and space-tracking vessel to the Gulf of Oman to monitor regional military developments and Western naval movements. China also reportedly provided Iran with intelligence support and other assistance.

As is well known, Iran exports oil to China in exchange for financial resources, technology and military equipment.

Russia supplied Iran with Geran-2 delta-wing drones, which were manufactured locally by Shahed Aviation Industries at the Alabuga Special Economic Zone in Tatarstan.

Iran subsequently upgraded these platforms into the Shahed-136 configuration, incorporating fibre-optic internal navigation systems and utilising China's BeiDou military satellite navigation system, thereby enabling precision strikes at varying ranges with considerable effectiveness.

OPERATION SINDOOR AND INDIA'S TECHNOLOGICAL EDGE

The world's militaries have closely studied India's successful Operation Sindoor.

On May 7, 2025, India launched a series of precision strikes using BrahMos and other guided missiles, employing Inertial Navigation Systems (INS), target imaging technologies and Global Positioning Systems (GPS) from land-based launchers and Indian Air Force aircraft.

Within a 25-minute operational window, beginning at approximately 1:25 am, Indian forces successfully struck terrorist infrastructure belonging to Lashkar-e-Taiba (LeT), Jaish-e-Mohammed (JeM) and Hizbul Mujahideen in Muzaffarabad, Kotli, Bhimber, Muridke, Bahawalpur and Sialkot.



Recent conflicts have established drone dominance as the latest Revolution in Military Affairs

In Parliament, Prime Minister Narendra Modi later revealed that US Vice President J D Vance had spoken to him on the night of 9 May, warning of a major impending Pakistani attack. The Prime Minister reportedly responded that any such action would impose a heavy cost on Pakistan, which subsequently proved to be the case until the ceasefire announced on 10 May, for which President Trump later claimed credit.

The international community

continues to remain concerned that any future India-Pakistan conflict could potentially escalate into a nuclear confrontation.

THE LESSONS OF OPERATION SINDOOR

Pakistan retaliated during Operation Sindoor using drones and aircraft equipped with Chinese-origin Beyond Visual Range (BVR) missiles, though with limited operational success.

In response, the Indian Air Force conducted strikes against eleven Pakistani airbases, including Nur Khan (Chaklala), Rafiqui and Sargodha, damaging runways and destroying critical operational infrastructure. Operation Sindoor has not ended; rather, it remains in a state of strategic suspension.



On May 30, 2026, former Chief of Army Staff General Upendra Dwivedi issued a stern warning to Pakistan, stating: "The Indian Army and all three services are preparing for Operation Sindoor 2.0, if required." Meanwhile, Pakistan's Army Chief, Field Marshal Asim Munir, appears to be preparing for the possibility of future military confrontation as well.

NETWORK-CENTRIC WARFARE AND JOINTNESS

The Air Defence Control and Reporting System (ADCRS) of the Indian Air Force, operating through the Integrated Air Command and Control System (IACCS), now interfaces with the Army's Akashteer air defence network and the Navy's Trigun command-and-control system.

Operation Sindoor demonstrated the effectiveness of such networked warfare architectures, allowing the seamless integration of sensors, decision-makers and weapons systems in real time.

The operation showed how indigenous defence technologies could perform under actual combat conditions without requiring troops to cross the Line of Control (LoC). India has demonstrated growing technological capabilities in modern warfare systems, particularly in precision missiles such as BrahMos and in advanced Unmanned Aerial Vehicles (UAVs) developed by private industry.

The Ministry of Defence has also increasingly emphasised the development

of long-term indigenous drone manufacturing capabilities.

PREPARING FOR SINDOOR 2.0

In any future conflict, including a possible Operation Sindoor 2.0, India's aerial security architecture will require integrated drone and counter-drone capabilities capable of responding to large-scale swarm attacks.

This will require cost-effective counter-drone technologies, robust air and missile defence systems and a standardised Beyond Visual Line of Sight (BVLOS) operational doctrine. A strong Ballistic Missile Defence (BMD) capability will also form an important component of Mission Sudarshan Chakra (MSC), announced by the Prime Minister during his Independence Day address in 2025.

THE DRONE REVOLUTION

Drones today range from remotely piloted systems to highly autonomous platforms capable of operating in hostile environments and conflict zones without risking human life.

Their high manoeuvrability, extended endurance and relatively low cost make them particularly attractive for modern warfare. They can be equipped with advanced sensors, communication systems and weapon payloads, enabling them to undertake a wide range of missions. The wars in Ukraine and Iran have demonstrated that even relatively

small weapon payloads, when deployed in large numbers or swarms, can inflict significant damage on critical infrastructure, including refineries, factories and strategic installations.

Increasingly, Artificial Intelligence (AI)-enabled drones are becoming capable of obstacle avoidance, autonomous navigation and mission planning, thereby reducing dependence on human operators.

LEHARI AND HAVAYI DRONES

Lehari (Sea) drones, launched from ships, can operate close to the sea surface and undertake surveillance, reconnaissance and strike missions over extended distances.

Similarly, Havayi (Aerial) drones, when launched from naval platforms, can significantly extend the surveillance and strike envelope of maritime task forces.

The deployment of shipborne drones equipped with advanced sensor payloads, including Electro-Optical/Infrared (EO/IR) systems and radar, substantially increases the detection range, situational awareness and attack capabilities of naval forces. The Indian Navy, therefore, must develop and integrate both Lehari and Havayi drone systems as part of a future networked maritime warfare architecture.

AIR POWER AND THE NEW OFFENCE-DEFENCE BALANCE

Recent conflicts have demonstrated that air power remains central to the conduct



of modern warfare.

The air strikes carried out by the United States and Israel against Iranian nuclear facilities during the so-called “12-Day War”, including Operation Midnight Hammer in June 2025, suggest that offensive air power remains highly relevant. At the same time, Unmanned Aerial Vehicles (UAVs) and drones have emerged as significant new actors in the domain of air power and are likely to influence the future balance between offensive and defensive capabilities.

The recent Revolution in Military Affairs has demonstrated that air power continues to provide the capability to secure the use of the air and project power from the air onto land and sea.

BAAZ BATTALIONS AND DRONE WARFARE

The Indian Army has decided to raise specialised units known as Baaz Battalions for dedicated drone warfare roles.

These formations will operate under the Army Aviation Corps and focus on long-range drone operations for surveillance, intelligence gathering and offensive missions.

The proposed battalions will also create a specialised cadre trained across the entire drone ecosystem, including deployment, maintenance, data exploitation and integration with ground forces. The Baaz Battalions are distinct from the existing Ashini drone

Future wars will increasingly be fought by integrated, AI-enabled and networked drone ecosystems

platoons and Divyastra batteries, which already form part of India’s evolving drone warfare capability.

According to media reports, the Indian Army’s drone inventory has increased from a few hundred systems two years ago to more than 50,000 platforms of varying sizes and capabilities.

These include the Rudrastra hybrid Vertical Take-Off and Landing (VTOL) unmanned system, developed by Solar Defence and Aerospace Limited, Nagpur.

Designed primarily for the Indian Army, the Rudrastra platform reportedly possesses an operational range of approximately 170 kilometres and a loiter endurance of around 90 minutes.

Although the precise number of Baaz Battalions has not yet been disclosed, defence manufacturers view the programme as possessing considerable growth potential.

TAKEAWAYS

The way forward lies in the seamless integration of land, sea and air drones into a unified, networked

and AI-enabled force structure. By investing in indigenous innovation, secure communications, autonomous technologies, swarm capabilities, cybersecurity and robust operational doctrines, India can build a highly responsive and resilient military ecosystem. Cross-domain and inter-service drone formations can function as powerful force multipliers while enhancing jointness among the armed forces.

The lessons emerging from Ukraine, Iran and Operation Sindoor suggest that drone warfare is no longer an adjunct to conventional military operations.

It is increasingly becoming a central pillar of contemporary warfare.

For India, the challenge is no longer whether to embrace drone dominance, but how rapidly it can build an indigenous, integrated and technologically advanced drone warfare capability across land, sea and air domains.



—The writer is a former DNI and DNO and curates a Maritime Museum at C-443, Defence Colony, New Delhi. He is the author of “India’s Elephant and China’s Dragon Navy”, ISBN 978-93-49934-73-3. The views expressed are of the writer and do not necessarily reflect that of Raksha Anirveda

SMPP: SUPPORTING INDIA'S NEXT PHASE OF DEFENCE MODERNISATION

Driven by Aatmanirbhar Bharat, India's defence industry is shifting from component assembly to developing cutting-edge, mission-critical tech. Led by innovators like SMPP, the nation is rapidly building a self-reliant, globally competitive ecosystem capable of redefining contemporary conflict through indigenous innovation and strategic partnerships

RA EDITORIAL DESK

India's defence preparedness is undergoing a fundamental transformation. Modern warfare is no longer defined solely by the size of the armed forces or conventional firepower but by the ability to rapidly integrate precision weapons, autonomous systems, advanced materials and indigenous manufacturing capabilities into a cohesive operational ecosystem.

As geopolitical uncertainties intensify and technology continues to redefine the character of conflict, India's defence industry has emerged as a critical pillar in enhancing national security while reducing dependence on imported military equipment.

The Government's emphasis on Aatmanirbhar Bharat, positive indigenisation lists, and a growing preference for domestic procurement has accelerated the evolution of Indian defence manufacturers from component suppliers to developers of sophisticated, mission-critical technologies. Companies are increasingly investing in research, advanced manufacturing and strategic collaborations that enable India to bridge capability gaps while strengthening its long-term defence industrial base.

SMPP represents this new generation of Indian defence companies that are expanding beyond their traditional strengths to develop integrated capabilities



SMPP entered into a strategic teaming agreement with France's KNDS

across soldier protection, ammunition, unmanned systems and precision-strike technologies.

Its recent initiatives illustrate how indigenous innovation, coupled with international technology partnerships, can contribute to building a resilient and globally competitive defence ecosystem.

One of the most significant developments has been the successful induction of the Peacekeeper (Agniveg) Jet-Based Kamikaze Drone by the Indian Army. With the completion of the delivery of 100 operational systems and six training platforms, the programme marks an important milestone in India's indigenous unmanned warfare capability.

Loitering munitions and autonomous

strike systems have become central to modern military operations, offering commanders the ability to engage high-value targets with precision while minimising collateral damage and reducing operational risk to personnel. The conflicts witnessed over the past few years have demonstrated the growing importance of such systems in both conventional and asymmetric warfare.

Designed with a turbojet propulsion system, the Peacekeeper (Agniveg) demonstrated high levels of operational performance during user trials, including a Circular Error of Probability (CEP) of less than five metres while operating in heavily jammed and GPS-spoofed environments.

With an operational range of up to 180

kilometres, the system provides the Indian Army with a internally developed precision strike capability suited to contested and technology-intensive battlefields.

Beyond the platform itself, the successful induction reflects the increasing maturity of India's indigenous defence innovation ecosystem. It highlights the ability of Indian industry to conceptualise, develop, test, manufacture and deliver advanced military systems capable of meeting stringent operational requirements.

Equally significant is the growing role of technology partnerships in accelerating capability development. During Eurosatory 2026, SMPP entered into a strategic teaming agreement with France's KNDS to manufacture advanced loitering munitions in India through SMPP Ammunition.

The collaboration will focus on the indigenous production of advanced precision-strike systems, including the VELOCE and RODEUR loitering munitions, as well as the ISTAR family of drones. More importantly, the partnership combines technology transfer with domestic manufacturing, reflecting India's broader strategy of acquiring advanced technologies while progressively building indigenous design and production capabilities.

Such collaborations are becoming increasingly important as defence technologies evolve rapidly across domains including autonomous systems, artificial intelligence, precision-guided munitions and network-centric warfare. Rather than relying exclusively on imports, Indian industry is now pursuing partnerships that create sustainable manufacturing ecosystems and strengthen the domestic knowledge base.

SMPP's participation in leading defence forums throughout the year also underscores another important dimension of capability development - the need for continuous engagement between industry, the armed forces, policymakers, academia and research institutions.

At platforms such as the North Tech Symposium 2026 and Kalam & Kavach 3.0, discussions extended beyond product showcases to address future battlefield requirements, indigenous technology



development, and the policy frameworks necessary to sustain India's defence industrial growth. Such interactions enable industry to better understand evolving operational needs while contributing to national conversations on defence innovation and capability planning.

International engagement remains equally important. At Eurosatory 2026, SMPP showcased its portfolio of advanced protection solutions, tactical systems, ammunition products and next-generation soldier protection technologies before military delegations and procurement agencies from around the world.

As India's defence exports continue to grow, global exhibitions provide Indian manufacturers with opportunities not only to explore export markets but also to establish technology collaborations and strengthen international industrial partnerships.

India's ambition to become a global defence manufacturing hub will depend not merely on expanding production capacity but on creating an innovation-led ecosystem capable of delivering advanced technologies across multiple operational domains.

Indigenous design, robust supply chains, sustained investment in research and development and strategic global partnerships will collectively determine the pace of this transformation.

The trajectory of companies such as SMPP reflects the broader evolution of India's defence industry - from manufacturing established systems to developing next-generation capabilities that address the operational realities of contemporary warfare.

By combining indigenous innovation with technology collaboration and manufacturing excellence, Indian industry is steadily strengthening the foundations of a self-reliant defence ecosystem.

As the armed forces prepare for future conflicts characterised by speed, precision, autonomy and information dominance, the role of domestic industry will become increasingly central. Building enduring capabilities will require sustained collaboration between government, the armed forces, research institutions and private industry.

The progress being made today demonstrates that India's defence sector is no longer merely supporting national security objectives - it is actively shaping the country's future military capability and its emergence as a significant force in the global defence landscape.



ADVANCING INDIA'S SEMICONDUCTOR SOVEREIGNTY

Tata Electronics and Advanced Semiconductor Materials Lithography have signed an MoU, which will eventually lead to chip production in India. This partnership will provide impetus to aviation sector. ASML's technology will enable India to establish a globally competitive fabrication facility. This strategic initiative also strengthens India-EU relations and complements the recently signed India-EU Free Trade Agreement

PROF D K PANDEY

The Memorandum of Understanding (MoU) signed between Tata Electronics and Advanced Semiconductor Materials Lithography (ASML), on May 16, 2026, in the Hague, represents a pivotal advancement towards India's semiconductor self-reliance, signifying a significant turning point for national technological and strategic interests. Witnessed by Prime Minister Narendra Modi, this agreement extends beyond commercial collaboration to reduce India's reliance on imported chips and enhance its position in the global supply chain.

Tata Electronics, a pioneering leader in India's electronics and semiconductor manufacturing sector, and ASML, a global

leader in semiconductor equipment manufacturing, are the two parties of the MoU to advance India's semiconductor manufacturing ecosystem.

Tata Electronics is developing India's first 300 mm commercial fabrication facility in Dholera, Gujarat. With a planned investment of \$11 billion, the facility will produce semiconductors for automotive, mobile devices, artificial intelligence (AI), and other key sectors, serving a global customer base. Tata Electronics has established strategic partnerships with global customers and ecosystem companies, beginning with Powerchip Semiconductor Manufacturing Corporation (PSMC) of Taiwan, thereby gaining access to a comprehensive technology portfolio that includes 28nm, 40nm, 55nm, 90nm, and 110nm process nodes.

ASML is a leading supplier to the semiconductor industry. The company provides chipmakers with hardware, software, and services to mass-produce integrated circuit (microchip) patterns. The agreement is critical as ASML's advanced lithography equipment is indispensable for nations seeking to manufacture state-of-the-art semiconductors. The lithography technology is fundamental to mass-producing semiconductor chips. With it, the world's top chipmakers are creating microchips that are more powerful, faster and energy efficient.

Without access to ASML's technology, India would be unable to establish a globally competitive fabrication facility. Tata Electronics' investment, therefore, serves as the foundation of the India Semiconductor Mission 2.0, directly advancing the Aatmanirbhar Bharat initiative by enabling domestic chip production for key sectors. This strategic initiative also strengthens India-EU relations and complements the recently signed India-EU Free Trade Agreement.

The partnership encompasses a broad scope. ASML will supply advanced lithography tools and solutions for Tata Electronics' new facility, which will manufacture a variety of chips in

collaboration with Taiwan's PSMC. Beyond equipment provision, the collaboration includes advanced machinery, technology support, training, and workforce development to establish a domestic talent pipeline for semiconductor manufacturing. The partnership also supports the development of research and development infrastructure, which is essential for sustained success. Critically, it aims to establish a resilient and trusted supply chain for global customers and

The MoU is critical as ASML's advanced lithography equipment is indispensable for nations seeking to manufacture state-of-the-art semiconductors. ASML is a leading supplier to the semiconductor industry. It provides chipmakers with hardware, software and services to mass-produce integrated circuit (microchip) patterns

India's key sectors.

The roadmap for this agreement spans 2026 to 2030 and outlines specific milestones. ASML's expertise ensures a timely setup, successful ramp to production, high yield, and manufacturing excellence. Construction of the Dholera facility is progressing rapidly, with the first chip anticipated by December 2026. The facility is expected to be completed by the second quarter of the 2027-28 financial year, with full commercial operations scheduled for 2028. According to Union Minister Ashwini Vaishnaw, four semiconductor plants will be operational by 2026, with two additional plants by 2027. The India Semiconductor Mission seeks to position India as a major global hub by 2030, targeting a \$63 billion market and a production capacity of 80,000 wafers per month. This ambitious timeline underscores India's commitment to achieving semiconductor sovereignty.

STRATEGIC SIGNIFICANCE

The agreement will provide a significant boost to the aviation sector, as aircraft safety and performance are increasingly reliant on advanced semiconductors. Precision chips are essential for safe take-offs and landings, real-time navigation, communication, flight management, and cockpit displays. These requirements are critical and cannot be easily substituted or postponed. Recent global shortages





have delayed aircraft deliveries for manufacturers such as Boeing and Airbus. Establishing domestic semiconductor production can mitigate India's supply chain vulnerabilities and enhance timely access to avionic components for both commercial and defence aviation.

The partnership between Tata Electronics and Bharat Electronics Limited (BEL), announced in June 2025, establishes a framework for integrating advanced semiconductor technology into avionics and defence applications. It represents a major step toward technological self-reliance, to make 'Aatmanirbhar Bharat' in semiconductors, with defence and strategic autonomy benefits, e.g., indigenous chips for systems like Tejas, BRAHMOS. This collaboration reduces technical risks and accelerates time-to-market for India's semiconductor ambitions under the India Semiconductor Mission.

Semiconductors serve as the fundamental building blocks of modern aviation, functioning as the 'brains' that enable the complex electronic systems required for safe and efficient flight. The importance of semiconductors in the aviation sector is demonstrated through their integration into various mission-critical systems. It aims to advance India's self-reliance in avionics, Flight Control Systems, Navigation and Positioning, radar systems, weapon systems, Safety and Emergency Systems,

The Dholera facility will reach full capacity in 2028, requiring the aviation sector to rely on imported chips for two more years. During this interim period, Indian aircraft and avionics firms must navigate global supply chain uncertainties while preparing for the transition to domestically produced components

and military communications by ensuring that the semiconductor fabrication facility produces certified aviation components that meet stringent certification standards for flight-critical systems.

IMPEDIMENTS

Nevertheless, several impediments and challenges must be considered. The aviation sector relies on highly specialised, rigorously certified components for safety and regulatory compliance, which cannot be substituted. The certification process is both slow and complex. In its initial phases, the fabrication facility

may prioritise automotive and consumer electronics, potentially delaying the availability of aviation-specific chips. Additionally, semiconductor production depends on raw materials such as neon gas and palladium, whose supply chains have been disrupted by geopolitical conflicts, particularly the Russia-Ukraine war. There is also a risk that commercial shortages could impact the military and aerospace sectors if production lines and supply chains are not adequately segmented, thereby increasing pressure on aviation suppliers.

The timeline for realising aviation sector benefits presents additional challenges. The Dholera fabrication facility will not reach full capacity until 2028, requiring the aviation sector to rely on imported chips for at least 2 more years. During this interim period, Indian aircraft and avionics firms must navigate global supply chain uncertainties while preparing for the transition to domestically produced components.

CONCLUSION

The Tata Electronics-ASML partnership constitutes a decisive advancement towards securing India's semiconductor sovereignty. It directly addresses a significant strategic vulnerability, establishes essential domestic manufacturing capabilities, and enhances India's standing in the global technology landscape. Although the full benefits for aviation and other sectors depend on timely completion and effective execution, the central premise remains clear: achieving semiconductor independence is fundamental to national security, economic sovereignty, and sustained global competitiveness. ■



—The writer is a Indian Air Force veteran. Currently, he is a Visiting Senior Fellow at CAPSS and Adjunct Faculty at Rashtriya Raksha University (RRU). The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda

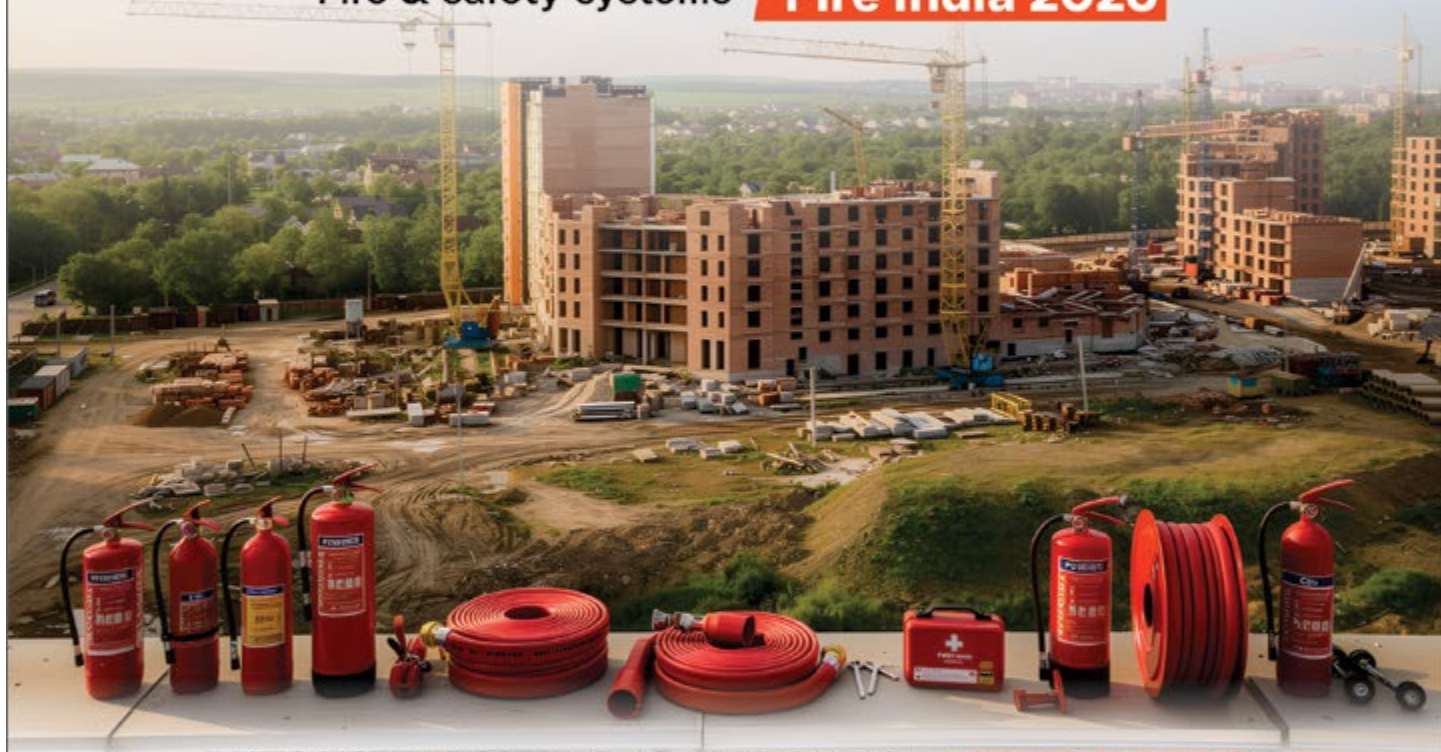


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MQ-9B: THE GAME-CHANGING UAS FOR INDO-PACIFIC SECURITY AND BEYOND

The rise of drone swarms as a tactic in modern warfare has highlighted the importance of long-endurance platforms capable of sustained operations. The MQ-9B, with its industry-leading endurance, is uniquely suited to counter this emerging threat

DR VIVEK LALL

Indo-Pacific nations are confronting the most complex set of security challenges since the Cold War. Competition between great powers, the proliferation of advanced battlefield technology, and historic levels of instability around the globe create a labyrinth for militaries and civil authorities who live and operate in the region.

Recent conflicts in the Middle East and in Europe have clearly demonstrated the threat posed by both low-cost, low-speed drones and the damage that can be unleashed by sophisticated long-range missiles. Indo-Pacific nations must prepare to confront the new security landscape with effective and versatile solutions.

MQ-9B SkyGuardian® and SeaGuardian® aircraft, designed and built by General Atomics Aeronautical Systems, Inc. (GA-ASI) are the latest additions to the MQ-9 family of systems. Its operational pedigree is unmatched: No large uncrewed aerial system (UAS) has demonstrated its effectiveness in more roles and in more theaters than the MQ-9. It is a proven asset in both permissive environments and highly contested wartime conditions.

MQ-9B goes beyond traditional data collection associated with intelligence, surveillance, and reconnaissance UAS – it delivers effects across all domains. And recent upgrades have made the aircraft even more relevant to the Indo-Pacific theater.

In 2026, GA-ASI is rolling out an Airborne Early Warning and Control (AEW&C) mission package, adding an Advanced Precision Kill Weapon System

(APKWS) to the MQ-9B's arsenal, and integrating long-range weapons to increase the aircraft's standoff strike capability.

ADVANCING AIRBORNE EARLY WARNING IN THE INDO-PACIFIC

GA-ASI's MQ-9B AEW&C mission package has been developed in partnership with Saab and is poised to transform how nations in the Indo-Pacific monitor and respond to aerial threats. It enables users to detect, classify, and counter threats before they reach their targets.

This innovative capability both complements and extends the reach of traditional crewed systems. For instance, the MQ-9B AEW&C might be used to penetrate airspace, deemed too dangerous to risk a large, exquisite system, not to mention the irreplaceable lives of the crew.

The mission package can also be used as an organic AEW capability if crewed platforms are not available, providing

persistent, lower-cost early warning coverage over vast maritime and land domains. When needed, MQ-9B will provide long-endurance surveillance of critical infrastructure, maritime chokepoints, and contested airspace.

This capability is particularly relevant in a region where the need for robust surveillance is paramount, given the increasing prevalence of stealthy cruise missiles, high-speed aircraft, and coordinated drone swarms.

A LONG-ENDURANCE SOLUTION TO THE DRONE SWARM THREAT

The rise of drone swarms as a tactic in modern warfare has highlighted the importance of long-endurance platforms capable of sustained operations. The MQ-9B, with its industry-leading endurance, is uniquely suited to counter this emerging threat.

Recent demonstrations of the APKWS



Deployed worldwide, GA-ASI's MQ-9B is the highest-performing UAS in its class.

on the MQ-9 underscore its ability to engage multiple targets with precision and efficiency.

MQ-9B's ability to remain airborne for extended periods ensures that it can provide persistent coverage, ready to take decisive action against a drone swarm attack whenever it strikes. This staying power, combined with the precision of the APKWS, offers a critical advantage in defending against saturation attacks.

By integrating this capability, the MQ-9B positions itself as a vital asset for Indo-Pacific nations seeking to bolster their defence against unconventional threats.

EXTENDING REACH WITH LONG-RANGE WEAPONS INTEGRATION

While having the means to shoot down threats in flight is necessary, an even better solution is to strike a target before it can fire salvos.

That's why in addition to its AEW&C and APKWS capabilities, GA-ASI has announced it is integrating MQ-9B with long-range weapons, such as Kongsberg's Joint Strike Missile and Lockheed Martin's Long Range Anti-Ship Missile. This upgrade enables the MQ-9B to deliver precision strikes over greater distances, providing a strategic advantage in the vast expanse of the Indo-Pacific region.

Whether addressing threats in contested maritime zones or supporting ground operations, the MQ-9B's ability to operate at extended ranges ensures that it remains a versatile and reliable asset.

The integration of long-range weapons also enhances the MQ-9B's deterrence capabilities, allowing Indo-Pacific nations to project power and protect their interests effectively.

A TRUSTED PARTNER FOR INDO-PACIFIC NATIONS

MQ-9B delivers long-range, persistent ISR that goes beyond collection alone, delivering effects wherever and whenever they are needed across all domains.

With its interoperability with US and allied forces, the MQ-9B is well-suited to



GA-ASI's MQ-9B equipped with the AEW&C system successfully completed its first flight on May 19, 2026. Artist rendering of MQ-9B configured for AEW missions.



An APKWS shown on a US Air Force MQ-9A Reaper® during testing in May 2026.

MQ-9B's adaptability to diverse mission sets, from intelligence, surveillance and reconnaissance to precision strike and maritime domain awareness, ensures that it can meet the unique needs of each nation

support joint operations and strengthen regional security partnerships. Nations as far spread as Japan and Canada, India and Germany, the United Kingdom and Qatar have all kicked off acquisition programs, highlighting its broad utility in a wide range of operational environments.

MQ-9B's adaptability to diverse mission sets, from intelligence, surveillance, and reconnaissance to precision strike and maritime domain awareness, ensures that it can meet the unique needs of each nation.

Moreover, the aircraft's cost-effectiveness and scalability make it an attractive option for nations looking to maximise their defence budgets without compromising on capability.

By investing in MQ-9B, Indo-Pacific nations can enhance their security posture while contributing to a more stable and secure region.



—The writer is Chief Executive at General Atomics Global Corporation. The views expressed are of the writer and do not necessarily reflect that of

Raksha Anirveda

THE FROZEN WAR AND THE FRACTURED WEST

After more than four years of conflict, the Russia-Ukraine war remains without an end in sight. For the contending powers, the choice is no longer between victory and defeat, but between an imperfect peace and the perils of strategic overreach

MAJ GEN DEEPAK MEHRA AND DR SUNANDINI

More than four years after the launch of the special military operation by Russia in Ukraine, both sides find themselves ensnared in a conflict that neither can decisively win, yet neither appears willing to end. As the frontlines continue to shift and military aid packages continue to flow, the human toll continues to rise. With the hindsight of over four years of conflict, a far more consequential question arises: is the conflict merely a war over Ukraine, or has it become a struggle for the future geopolitical architecture of Eurasia itself?

On June 4, 2026, President Volodymyr Zelensky proposed a face-to-face meeting with President Vladimir Putin in an open letter, stating that he was ready for a “full ceasefire”. However, Putin turned down the offer, saying that he saw no point in such a meeting at present.

The tone and tenor of the letter suggest that the Ukrainian President feels emboldened by the apparently successful military pushbacks against the Russian Army in recent weeks,

including the successful targeting of Russian infrastructure far into the Russian mainland. Putin agreeing to direct talks at this stage could be seen as a sign of weakness on the part of the Kremlin. Moreover, meeting Zelensky as an equal would undermine years of Kremlin propaganda aimed at delegitimising the Ukrainian President.

The latest exchange captures the fundamental paralysis of the current situation wherein both sides claim willingness to talk, but neither has made the concessions necessary for talks to begin, and the international mediating parties are themselves fractured.

Russian Foreign Minister Sergei Lavrov noted that the resumption of dialogue between Russia and Europe is impossible through ultimatums such as those presented to Moscow following the meeting of President Volodymyr Zelensky with the leaders of the European troika countries (France, the United Kingdom and Germany) in London on June 7, 2026. He warned of a serious threat of confrontation between Russia and NATO and characterised Ukraine as a “shock



fist” of a broader European military project that increasingly seeks strategic autonomy from the United States.

Whether viewed as rhetoric or a genuine warning, such statements highlight an uncomfortable reality: the war is no longer confined to questions of territorial control over eastern Ukraine. For significant elements of the Western strategic establishment, the objective is not merely to defend Ukraine but to weaken, destabilise and, in the most hawkish formulations, territorially fragment Russia.

THE RUSSIAN FEAR OF FRAGMENTATION

Russian President Vladimir Putin has repeatedly articulated this concern. In a



speech delivered in September 2022, he stated: “They are saying directly that they managed to break up the Soviet Union in 1991, and now it is time for Russia itself to be split into many regions that would be at each other’s throats.”

He warned that Russia would use any means at its disposal to defend its sovereignty.

Concerns regarding the fragmentation of Russia are not merely products of Kremlin imagination. They draw upon a body of strategic literature and policy discussions that have existed, in varying forms, within American and European policy circles for decades.

One of the most influential examples remains the work of Zbigniew Brzezinski. In his influential 1997 book, *The Grand*

The greatest strategic danger may not lie in deliberate escalation, but in the assumption that escalation can always be controlled

Chessboard: American Primacy and Its Geostrategic Imperatives, Brzezinski argues: “A loosely confederated Russia — composed of a European Russia, a Siberian Republic, and a Far Eastern Republic — would also find it easier to cultivate closer economic relations with its neighbours.” He goes on to add, “Without Ukraine, Russia ceases

to be a Eurasian empire... Russia without Ukraine can still strive for imperial status, but it would then become a predominantly Asian imperial state.”

In February 2023, the Hudson Institute and the Jamestown Foundation jointly hosted a conference in Washington titled *Preparing for the Dissolution of the Russian Federation*. Although not representative of official policy, the event attracted considerable attention and reflected the emergence of a small but vocal constituency advocating a post-Russian geopolitical order.

Similarly, in a provocatively titled report, *After the Fall: Must We Prepare for the Breakup of Russia?*, the Institut Montaigne in Paris published an analysis in 2023 exploring the strategic implications



of the potential fragmentation of the Russian state. These proposals go beyond supporting Ukraine's defence and point towards a broader objective of weakening Russia's long-term strategic capacity.

WHEN STRATEGIC LOGIC BECOMES STRATEGIC RISK

From a purely geopolitical perspective, the basic logic is not irrational. Russia is the world's largest country by territory; it commands the world's largest nuclear arsenal; holds vast hydrocarbon and mineral reserves; sits astride the Eurasian landmass; and is home to more than 50 per cent of the world's largely unexplored, mineral-rich Arctic coastline.

Also, a weakened and fragmented Russia would eliminate the most serious geopolitical challenge to Western primacy in Eurasia at a single stroke.

Yet strategic logic does not necessarily translate into strategic wisdom.

The fragmentation of a nuclear-armed state stretching across eleven time zones and marked by ethnic and territorial fault

lines would constitute one of the most destabilising developments in modern history. Even the Institut Montaigne acknowledges that any such scenario would likely be "chaotic, prolonged, sequential, conflictive and increasingly violent".

European history offers sobering lessons about the dangers of strategic overreach. Within one century, Europe's geopolitical rivalries, ambitions and miscalculations contributed to two world wars that devastated the continent and reshaped the international order.

Today, some of the strategic assumptions underpinning Western policy towards Russia carry risks that are no less profound.

At the heart of the issue lies a simple but uncomfortable question: what happens if the strategy of sustained pressure succeeds too well? Russia is not merely another regional power. It is a nuclear superpower possessing the world's largest nuclear arsenal and a military doctrine that explicitly reserves the right to employ nuclear weapons under

circumstances perceived as threatening the survival of the state.

THE COLLAPSE OF NUCLEAR GUARDRAILS

The danger, therefore, lies not in the current military balance but in the possibility of escalation resulting from strategic miscalculation. The global nuclear order today is arguably more fragile than at any point since the end of the Cold War. In February 2026, United Nations Secretary-General António Guterres warned: "For the first time in more than half a century, we face a world without any binding limits on the strategic nuclear arsenals" of the United States and Russia.

The expiration of the New START Treaty reflects the collapse of a decades-long arms-control architecture that had helped prevent catastrophic escalation between the world's two largest nuclear powers.

As the last surviving strategic arms-control agreement between Washington and Moscow, New START provided



transparency, verification mechanisms and limits on deployed strategic nuclear weapons. Its lapse removed the final institutional guardrail governing nuclear competition between the two countries.

Against this backdrop, several European governments continue to advocate policies designed to maximise pressure on Russia.

In June 2026, Sergei Lavrov issued one of Moscow's strongest warnings to date, stating: "A direct clash between NATO and Russia could quickly escalate into an exchange of nuclear strikes with catastrophic consequences."

It is sometimes tempting to dismiss such statements as instruments of coercive diplomacy. Yet history repeatedly demonstrates that the Russian Federation has often communicated its genuine concerns clearly and openly long before translating them into action. Ignoring such signals entirely may prove to be as dangerous as overreacting to them.

Whether one agrees with Russian policy or not, prudent statecraft requires acknowledging the possibility that nuclear

powers may act on the threats they repeatedly articulate. The greatest strategic danger may lie not in deliberate escalation, but in the assumption that escalation can always be controlled.

LESSONS FROM EUROPE'S PAST

Europe has encountered this problem before. More than one hundred years ago, the assassination of Archduke Franz Ferdinand in Sarajevo triggered, through a cascade of alliance obligations, miscalculated ultimatums and failures of diplomatic imagination, a conflict that consumed four empires and an entire generation of European men.

Russia, the Tsarist Empire, entered that war as a major power and emerged from it dissolved. Austria-Hungary, whose aggressive ultimatum to Serbia set the chain of events in motion, ceased to exist. Germany, which calculated that a short, sharp war would consolidate its continental dominance, instead created the conditions for its own disastrous defeat and, twenty years later, for the rise of National Socialism and the catastrophic Second World War.

THE PERILS OF STRATEGIC MAXIMALISM

More than a century later, some Europeans appear convinced that Russia's nuclear warnings are merely rhetoric, Putin's escalatory signals are a bluff and continued pressure on Russia will eventually produce either Russian military defeat or internal regime collapse. What Europe's maximalists refuse to examine, however, is the consequence of such an approach.

Let us assume, theoretically, that Russian military losses continue to mount; that the Kremlin begins to perceive the possibility of a conventional defeat threatening core national interests; that no new arms-control framework emerges to replace New START; and that strategic trust continues to erode.

What mechanism then prevents escalation towards the nuclear threshold? The only factor upon which the world would then be compelled to rely is Russian restraint.

Entrusting the future of humanity to the presumed restraint of a nuclear adversary, while simultaneously signalling that the long-term objective is its fragmentation, constitutes a profoundly fragile foundation upon which to build international security.

THE CASE FOR A FROZEN PEACE

Beyond strategic and military calculations lies a critical legal dimension that is often overshadowed by geopolitical narratives. Ultimately, the legitimacy and durability of any future settlement will depend not only upon military realities and political compromises, but also upon its compatibility with the foundational principles of international law.

A settlement perceived as violating core legal principles may succeed in ending active hostilities, but it is unlikely to secure lasting peace or broad international acceptance.

If total victory appears unattainable and escalation carries unacceptable risks, then efforts must inevitably shift towards halting hostilities and achieving peace, however imperfect it may ultimately be. The most realistic near-term outcome may resemble the armistice arrangement that ended active hostilities on the Korean Peninsula.

Under such a framework, the existing line of contact would be frozen without requiring an immediate comprehensive peace settlement. Ukraine would receive meaningful security guarantees while Russia would obtain assurances addressing some of its stated security concerns.

Such an arrangement would undoubtedly be imperfect. Territorial disputes would remain unresolved. Political tensions would persist. Europe would continue to live with an open strategic wound. Yet a frozen conflict would halt the killing, facilitate reconstruction, allow displaced populations to return and create diplomatic space for a more comprehensive settlement in the future.

TOWARDS A MULTIPOLAR PEACE PROCESS

A second avenue involves broadening the diplomatic framework beyond the



existing structure. At present, negotiations are heavily shaped by the United States-Russia relationship, with Ukraine often functioning as both participant and subject.

A genuinely multilateral framework including India, China, Brazil and Japan as active co-mediators would change the geometry of the negotiations in ways that could benefit all parties.

Significantly, President Putin, speaking at the Eastern Economic Forum in 2024, named India, Brazil and China as potential mediators. Russian officials have also repeatedly indicated that Moscow remains open to realistic peace initiatives that acknowledge Russian security concerns.

A complementary approach could involve the development of a peace framework with the participation of international organisations such as the United Nations (UN), European Union (EU) and BRICS.

Such organisations could collectively contribute to security guarantees, reconstruction efforts, monitoring mechanisms and confidence-building measures. A durable settlement will require endorsement from a broader coalition that reflects the increasingly multipolar character of the international system.

COMPETING VISIONS OF SECURITY

As of mid-2026, the Russia-Ukraine war has lasted longer than the First World War. Yet, despite the immense human, economic and geopolitical costs, the conflict remains trapped between competing visions of victory and differing definitions of security.

On one side stand those who believe that sustained military and economic pressure can permanently weaken Russia and reshape the geopolitical balance in Eurasia. On the other are those who argue that strategic realism demands an imperfect peace before escalation produces consequences beyond anyone's control.

The fundamental challenge for the West is to accept and recognise the fact that Russia is a permanent geographic and geopolitical reality in Eurasia that cannot simply be wished or militarily pressured out of existence. Its security concerns must be taken into account while devising any future security architecture for Europe.

Likewise, Russia must recognise that lasting stability cannot emerge from military coercion alone and that the principle of sovereignty remains a central component of any sustainable settlement.

THE SEARCH FOR AN IMPERFECT PEACE

The path out of the current impasse may

not satisfy all parties. It may leave territorial disputes unresolved, some grievances unaddressed and strategic ambitions unfulfilled. Nevertheless, durable peace is often built not on complete satisfaction, but on a mutual recognition of limits.

The choice before policymakers is therefore stark: construct an imperfect peace while the opportunity still exists, or continue down a path where miscalculation, pride and strategic maximalism could produce consequences from which no nation emerges victorious. ■



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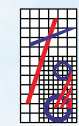
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DETECTION BEFORE COLLECTION: THE CASE FOR RF-FIRST SPACE ISR

The vast Indian Ocean Region is India's critical strategic frontier, but tracking hidden maritime threats remains an immense challenge. Relying solely on high-resolution imaging satellites is an expensive gamble. To secure its sovereignty, India must deploy space-based radio frequency sensing to listen to the ocean and pinpoint dark vessels

SIDDHESH RAVINDRA NAIK

The Indian Ocean Region is the theatre where India's strategic future will be contested, and it is also the hardest place on earth to watch. The area of interest runs from the Gulf of Aden to the Malacca Strait, across tens of millions of square kilometres of open water.

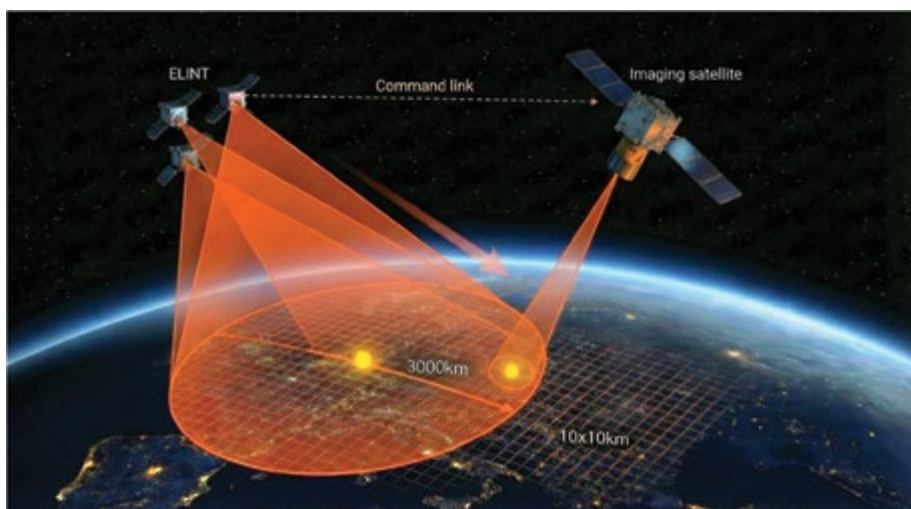
Somewhere inside it, at any given hour, are the vessels that matter: a research ship loitering over a cable route, a fishing fleet operating as a militia, a warship that has gone dark. Finding them is the defining intelligence problem of maritime India. It is, quite literally, a search for a needle in a haystack, and the haystack is the size of an ocean.

For two decades the instinctive answer has been more imaging. Optical and synthetic aperture radar satellites deliver extraordinary pictures, and India has built genuine strength here. But an imaging satellite is a microscope. It resolves a target beautifully once it is pointed at the right patch of sea, and it sees nothing at all when it is pointed at the wrong one.

The scarce resource in space-based surveillance is not resolution. It is knowing where to look. A constellation that spends its passes photographing empty water is not persistent surveillance. It is expensive luck.

This is where radio frequency sensing changes the architecture rather than merely adding to it. Almost everything of interest at sea emits electronic exhaust: navigation radars, communication links, identification transponders, the electronic exhaust of a functioning vessel.

When a vessel "goes dark," it is



silencing its identification transponder, not its ship. The navigation radar still sweeps, the communications links still reach for shore, the electronic signature of a working hull persists.

The act of concealment that defeats cooperative tracking is precisely the act that leaves a vessel radiating to a passive listener overhead. Going dark, in other words, is not going silent. A passive RF payload does not photograph the sea. It listens to it, across a

Finding “dark vessels” - ships that deliberately turn off cooperative transponders to mask their identities - across tens of millions of square kilometers is India’s defining maritime intelligence challenge

footprint far larger than any imaging swath, and it maps where electronic activity is concentrated and where signatures do not match declared identity.

RF sensing is the magnifying glass held over the whole scene. It will not tell you the hull number, but it will tell you, quickly and across a very wide area, where the hull worth photographing actually is.

Read together, the two sensing modes describe a hierarchy that the current Indian architecture has largely inverted. RF should be the first layer, the wide area detector that surveys continuously and cheaply.

Imaging should be the second layer, the confirming instrument that is cued precisely to a location RF has already flagged. Detection, in other words, should drive collection. When it does, the intelligence cycle compresses dramatically, because the imaging satellite is no longer searching. It is confirming.

This is not a hypothetical scenario. In late 2023, as attacks on shipping in the southern Red Sea intensified and vessel

after vessel switched off its transponder to avoid association with the traffic, commercial space-based RF sensing continued to detect and track those ships across a search area of some three hundred thousand square kilometres.

The transponders went dark. The vessels did not. A single wide-area RF collection over open water found the hulls that the cooperative picture had deliberately lost.

The compression is the point. The value of surveillance is not the image; it is the decision the image enables, delivered while the decision still matters. Today that loop typically runs through the ground.

A sensor collects, downlinks to a station, an analyst reviews, a tasking order is generated, a second satellite is scheduled, and the target, if it was moving, has moved. The observe-orient-decide-act cycle that doctrine treats is the measure of operational tempo as measured in hours and days, most of it spent waiting for the next ground contact.

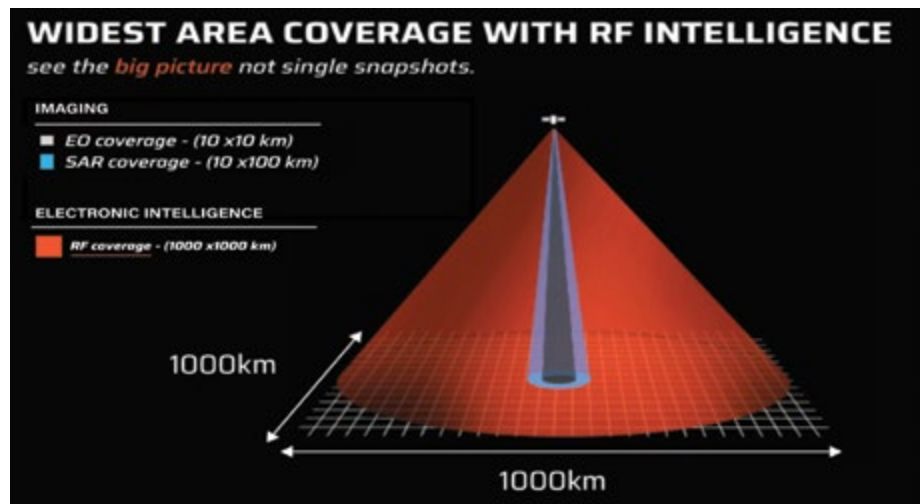
An architecture in which detection and cueing happen on orbit removes the longest legs of that wait. An RF satellite that detects an anomaly can pass a cue to an imaging asset over an in theatre link, with a human on the loop rather than a ground station in the critical path. The loop shrinks from days toward minutes.

This is not an argument for removing human judgment from consequential decisions, and it is not autonomy for its own sake. It is an argument about latency. In the grey zone, where advantage is measured in how quickly you can characterise an ambiguous contact, latency is the whole game.

None of this is theoretical for India, and this is where the capability question becomes a sovereignty question. Maritime domain awareness built on foreign feeds is awareness held at the sufferance of the provider.

The signals of interest, the geolocation, the pattern of life over India's own waters, these are national intelligence products, and they cannot sit inside architectures India does not control.

The case for building space-



Relying on foreign intelligence feeds risks national security. Driven by initiatives like IN-SPACE and iDEX, domestic deep-tech startups are shifting from jugaad (frugal improvisation) to precision physics to build an indigenous, uncompromised surveillance layer

based RF sensing indigenously is not primarily industrial. It is this category of intelligence, over this ocean, which must be sovereign by construction.

That requirement happens to arrive at a moment when the Indian ecosystem can meet it. The regulatory opening created by IN-SPACE, the pull from iDEX and the services, and the emergence of deep technology startups willing to build hard physics rather than software wrappers have together made it possible to develop payloads of this class in India, on Indian timelines, for Indian requirements.

This is what the transition from jugaad to precision actually looks like in practice. It is not frugal improvisation celebrated for its own sake. It is a small

number of teams choosing to solve a genuinely difficult sensing problem to a standard the mission demands, because the mission will not forgive anything less.

The strategic window is narrow. The countries that will dominate maritime intelligence in the coming decade are the ones deciding their sensing architecture now, and the default gravitational pull, in India as elsewhere, is toward more imaging because imaging is legible and its outputs are photogenic.

That pull should be resisted. Persistence is not achieved by adding satellites and hoping they happen to look at the right square of ocean. It is achieved by putting a detector in front of the camera.

The needle has not become easier to find. The haystack is still the size of the Indian Ocean, and it is filling with more electronic activity, more dark vessels and more deliberate ambiguity every year.

What has changed is that India no longer has to search the whole haystack. It can build the layer that points to where the needle is, and it can build it here.

The question is whether the architecture decisions being taken now reflect that, or whether the country will keep buying microscopes and hoping to get lucky. ■



—The writer is Co-founder and CEO, ULOOK Technologies. The views expressed are of the writer and do not necessarily reflect that of Raksha Anirveda

SEABED CONTEST: INDIA MUST CATER TO EMERGING MARITIME WARFARE CONCEPTS

India, with a 7,516 km coastline, relies heavily on secure maritime trade routes and undersea communication networks for national growth. Developing a comprehensive seabed warfare strategy is no longer optional but imperative for the country. Such a strategy must address current vulnerabilities while preparing for the requirements of future maritime warfare

CDR SUMIT GHOSH

The maritime domain is undergoing a profound transformation driven by technological advancements, geopolitical competition, and the growing strategic importance of undersea infrastructure. The seabed is fast emerging as a new arena of strategic contestation. Critical undersea communication cables, energy pipelines, sensors, autonomous systems, and mineral resources have elevated the significance of the ocean floor in national security calculations. For India, a nation with extensive maritime interests in the Indian Ocean Region (IOR), developing a comprehensive seabed warfare strategy is no longer optional but imperative. Such a strategy must address current vulnerabilities while preparing for the requirements of future maritime warfare.

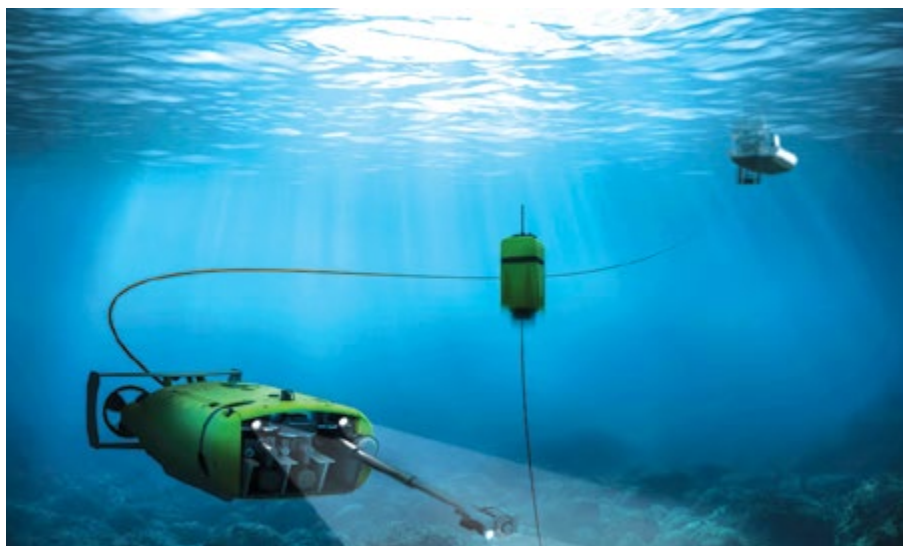
STRATEGIC IMPORTANCE OF SEABED

More than 95% of global internet traffic is carried through undersea fiber-optic cables. Energy pipelines and offshore installations further contribute to the strategic value of the seabed. Disruption of these assets can

severely impact national economies, military communications, and critical infrastructure. As maritime powers increasingly recognise the military utility of the seabed, it has become a contested operational domain. India's geographical position at the centre of the Indian Ocean provides significant strategic advantages but also creates responsibilities. The nation with a 7,516 km coastline relies heavily on secure maritime trade routes and undersea communication networks for national growth. Any hostile action against these systems could affect economic stability, military readiness, and our national resilience.

EMERGING NATURE OF SEABED WARFARE

Seabed warfare encompasses military operations conducted on, near or beneath the ocean floor. It includes surveillance, intelligence gathering, protection of underwater infrastructure, extensive use of remotely operated submersibles/vehicles, deployment of seabed sensors, mine warfare, anti-submarine operations, hybrid and gray zone operations, seabed mapping & hydrographic dominance, rapid repair and resilience integration with multi-domain operations, use of emerging technologies (AI, QM, DT) and offensive actions targeting adversary assets. States capable of dominating



the underwater battle-space will enjoy significant strategic advantages. A few notable incidents/sabotage of undersea infrastructure are given below.

PROGRESS BY MARITIME POWERS

United States invests heavily in undersea superiority, combining manned submarines, remotely operated and unmanned underwater vehicles (ROVs/AUVs/UUVs), towed arrays, and a robust industrial base for undersea sensors and communications. It operates many families of underwater unmanned vehicles (UUVs) across the Navy, Defense Advanced Research Projects Agency, Office of Naval Research, and other agencies.

China is rapidly building UW ISR capabilities to exploit the seabed mapping, lay dual-use infrastructure, and deploy undersea autonomous systems. It has over 130 independent

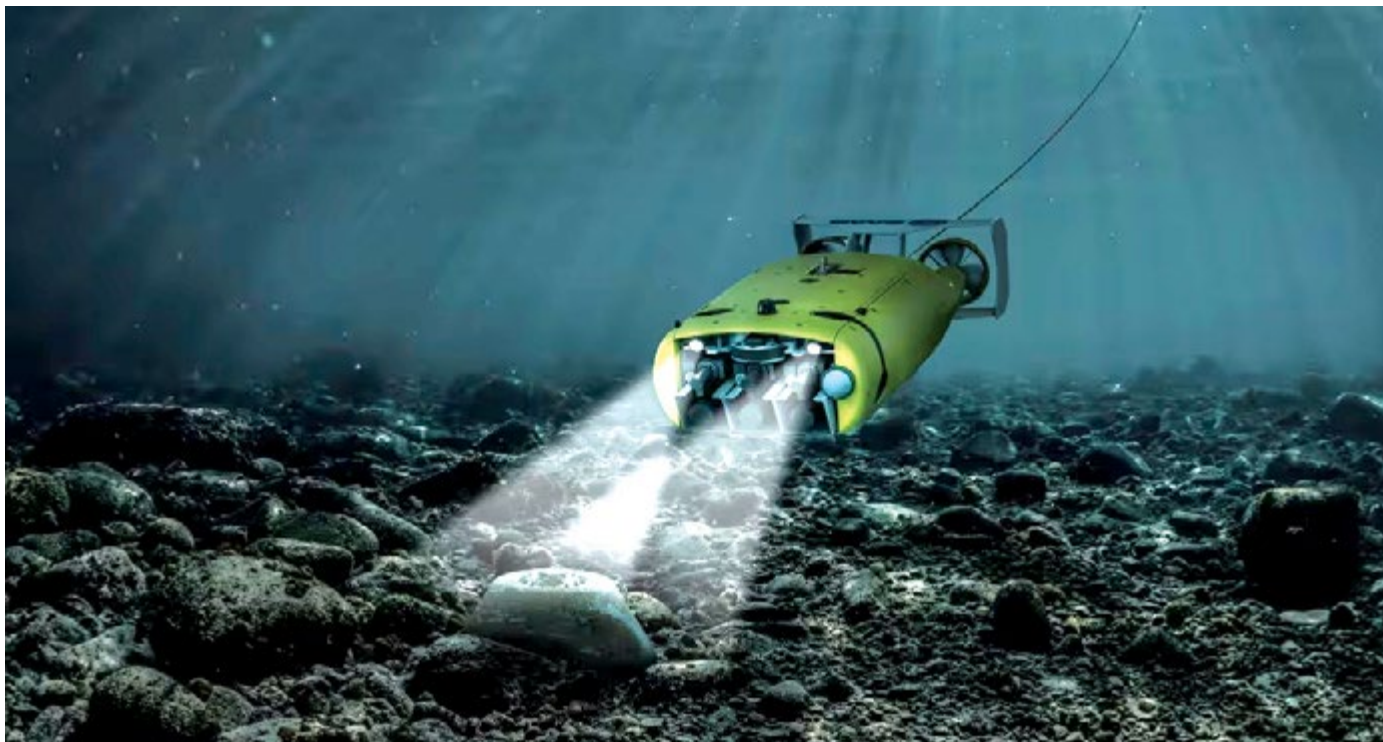


agencies researching UW technologies & equipment. Its investments in undersea mapping, mine warfare, and submarine-laid cables demonstrate how seabed control supports both grey-zone coercion

and wartime advantage. United Kingdom and NATO: Seabed-focused efforts emphasise resilience of undersea critical infrastructure (cables, pipelines) and collective defence of seabed assets. Their approach highlights multilateral cooperation, legal frameworks, and the development of norms to protect subsurface infrastructure. Australia and Japan are investing

INCIDENT	YEAR	TARGET	ESTIMATED LOSSES/IMPACT
Operation Ivy Bells	1970s–1980s	Soviet naval communication cable in the Sea of Okhotsk	The US secret tapping of Soviet seabed communication cables for valuable intelligence. Strategic intelligence has immense value.
Nord Stream pipeline sabotage	2022	Nord Stream 1 & 2 gas pipelines	Four explosions ruptured three pipeline strings. Huge physical & economic damage permanently removing a major gas export route, causing major energy market disruption. Attribution remains disputed.
Baltic connector pipeline incident	2023	Gas pipeline & telecom cable	Pipeline shut down for months, requiring extensive repairs costing tens of millions of euros and disrupting gas supply routes between Finland and Estonia.
Matsu Islands submarine cable cuts	2023	Fiber-optic cables	Multiple cable cuts disconnected Taiwan’s Matsu Islands from primary internet links, forcing reliance on microwave communications and reducing internet capacity for weeks.
Baltic Sea undersea cable incidents	2024–2025	Power and telecom cables	Several undersea power and telecom cables were damaged. Sabotage allegations and criminal charges, or accidental anchor drags, were more likely. Repair costs tens of millions of dollars alongside temporary communication and power disruptions.
Persian Gulf Cables	March 2026	Submarine cable projects	Fighting near the Strait of Hormuz disrupted work on subsea fiber-optic cable infrastructure, including the 2 Africa Pearls project. Construction halted and operators declared force majeure, delaying deployment of undersea communications infrastructure.

Seabed warfare encompasses military operations conducted on, near or beneath the ocean floor. It includes surveillance, intelligence gathering, protection of underwater infrastructure, seabed mapping, rapid repair and resilience integration with multi-domain operations, use of emerging technologies (AI, QM, DT) and offensive actions targeting adversary assets



in UUVs, joint ASW capabilities, and cooperative seabed monitoring with partners to secure maritime approaches against harassment and interference.

France has already promulgated its white paper on Seabed Warfare Strategy encompassing a plethora of domains.

Norway and the Netherlands are focused on North Sea infrastructure security, underwater surveillance, North Sea cable and pipeline protection. (Increased investment in seabed systems after Baltic incidents).

India has a formidable submarine force, air assets, and expertise in underwater operations, but only a few organisations, viz. DRDO, the National Institute of Ocean Technology (NIOT), the National Centre for Polar and Ocean Research (NCPOR), and the Indian National Centre for Ocean Information Services (INCOIS) contribute to oceanographic and technological research. India lacks an extensive network of underwater sensors, platforms for seabed operations, underwater infrastructure protection systems, and deep-sea intervention techniques for continuous monitoring of critical maritime zones. Cooperation

India must identify and prioritise the protection of critical underwater assets, communication cables, offshore energy facilities and strategic installations. Public-private partnerships involving telecom companies, energy operators and defence agencies can strengthen resilience against various threats

and synergy between various organisations are essential for enhanced seabed awareness.

BUILDING A FUTURE-ORIENTED SEABED WARFARE STRATEGY

Enhancing UDA: Establish a layered network of seabed sensors, underwater acoustic arrays, unmanned vehicles,

and satellite-supported monitoring systems for real-time information on submarine movements, underwater infrastructure status, and unusual seabed activities. Artificial intelligence and big-data analytics should be integrated into surveillance systems.

Developing Autonomous Underwater Systems: Accelerate development and deployment of AUVs and UUVs for ISR, mine countermeasures, and infrastructure inspection as they offer reduced risk to personnel, extended operational endurance, and the ability to operate in contested environments.

Protecting Critical Undersea Infrastructure: Identify and prioritise protection of critical underwater assets, communication cables, offshore energy facilities, and strategic installations. Establish regular monitoring, redundancy planning, and rapid repair capabilities. Specialised underwater units to conduct inspections, respond to threats, and support repair operations. Public-private partnerships involving telecommunications companies, energy operators, and defence agencies can strengthen resilience against various threats.

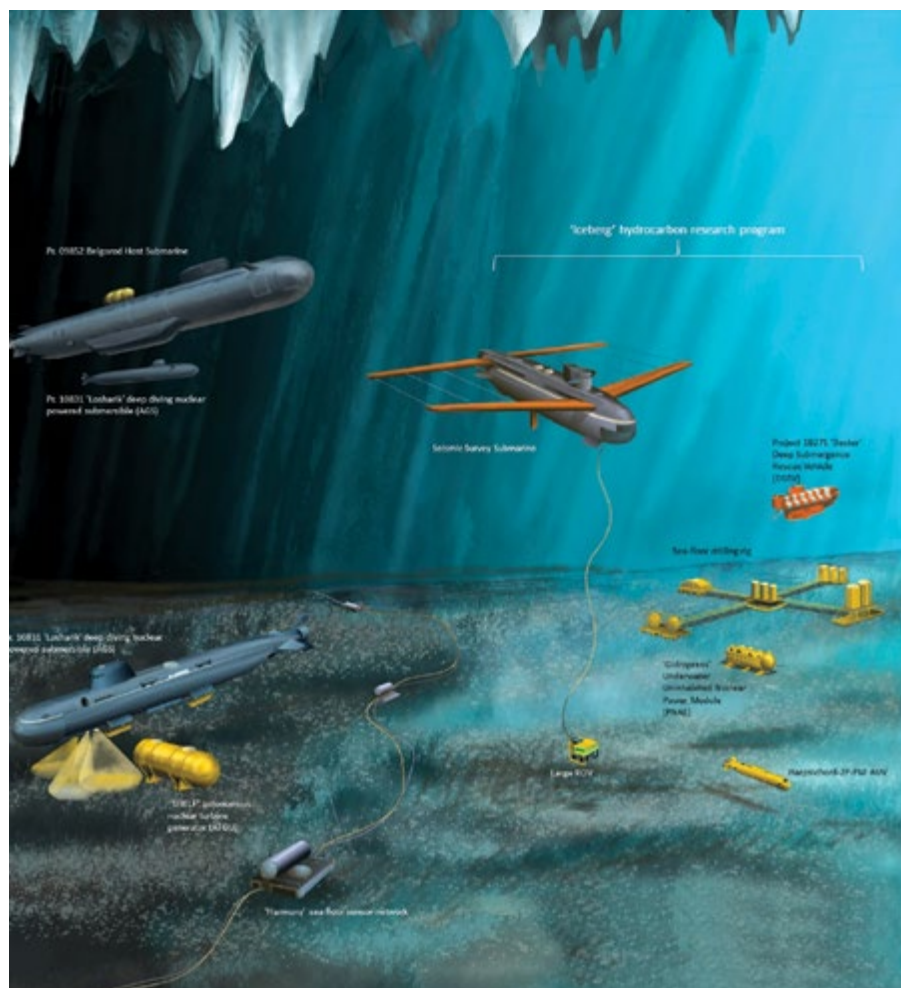
Emerging seabed warfare strategy is shifting from a narrow focus on detecting submarines to comprehensive control of the underwater environment. India must adopt a forward-looking seabed warfare strategy that combines technological innovation, operational readiness and international cooperation

Strengthening Anti-Submarine Warfare: Further modernise ASW assets and underwater sensor networks. Operate integrated manned-unmanned systems and combine data from multiple sensors and platforms to create a comprehensive operational picture in complex underwater environments.

Leveraging Deep-Sea Technologies: Use the Deep Ocean Mission to advance technologies with both civilian and strategic applications. Deep-sea exploration vehicles, seabed mapping systems, robotic platforms, and underwater communication technologies can support military objectives along with research. Invest in deep-sea innovation and blue technologies.

Regional and International Cooperation: Expand regional cooperation for information sharing, joint exercises, and collaborative research initiatives; access to advanced technologies; strengthen regional mechanisms on maritime security, underwater infrastructure protection, and ocean governance.

Policy and Institutional Reforms: Establish specialised commands, enhance inter-agency coordination, and develop operational doctrines to improve preparedness. Expand training programmes on oceanography, underwater robotics, cyber-physical systems, and seabed operations



POLICY RECOMMENDATIONS

- Create a National Seabed Security Task Force
- Accelerate high-resolution seabed mapping of the EEZ and strategic chokepoints
- Indigenise and fund a modular UUV and AUV acquisition programme.
- Establish permanent seabed-monitoring nodes around critical cables and offshore platforms
- Lead a regional initiative for the protection of undersea infrastructure
- Build rapid-repair ships and specialized MCM units.
- Promote legal reforms clarifying civil-military roles for seabed incidents.
- Invest in R&D for attribution technologies,

CONCLUSION

Emerging seabed warfare strategy is shifting from a narrow focus on submarine detection to comprehensive control of the underwater environment. India must adopt a forward-looking seabed warfare strategy that combines technological innovation, operational readiness, infrastructure protection, and international cooperation.



—The writer is a former Indian Navy Submarine Officer. He is a specialist in missiles, underwater weapons, sensors, anti-submarine warfare, and is a deep sea diver. He writes regularly on strategy, tactics, warfare and modern military technologies. He is an active member of national strategic think tanks, such as the USI, the Chakra Foundation, and STRIVE. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda



BITING THE SILVER BULLET

THE MODERN BULLET: TEN INNOVATIONS THAT LED THE WAY

Since the invention of firearms, ammunition has been an essential component of warfare, hunting and self-defence. Over the years, ammunition has evolved significantly due to technological advancements, innovations in materials and manufacturing processes. In this article, the writer explores the history of ammunition and how it has changed over time

SANJAY SONI

There's no shortage of history on firearms themselves, but what about the projectiles they fire at such breakneck speeds?

When people talk about guns, they often focus on the weapon itself - its magazines, buttstocks, scopes, trigger guards, compensators and suppressors. They also tend to discuss variables related to a gun's operation, like trigger pull, muzzle flash and recoil.

Any gun, though, is a means to an end, and that end is hurling a projectile, at high velocity, toward a target. Today, almost everyone refers to such a projectile as a bullet, a word derived from the French "boulette", meaning "small ball." And that's what early bullets were - lead balls fired from smoothbore weapons - although



Early Bullets

they evolved into cylindrical, pointed objects launched from rifled barrels. As soon as those developments took place, things got interesting. Gunmen became better shots, their bullets travelled farther and with greater accuracy, and their targets suffered devastating wounds.

Since the invention of firearms, ammunition has been an essential component of warfare, hunting, and self-defence. Its history dates back to

the 14th century when the earliest firearms were developed in Europe, and their ammunition was made from simple lead balls.

Over the years, ammunition has evolved significantly due to technological advancements, innovations in materials, and manufacturing processes. In this article, we'll explore the history of ammunition and how it has changed over time.

Although much has been written about the evolution of firearms, less attention has been paid to the development of the modern bullet, such as the 5.56 mm rifle round and the 9x19 mm handgun round, both standards for US military weapons. Indeed, that's the very point of this list - to move, step by step, through the most important innovations giving rise to the ammunition used today in weapons ranging from assault rifles to semi-automatic pistols.

EARLY DAYS OF AMMUNITION



Muzzle-loading Gun

The earliest type of ammunition was a simple round ball, which was used in firearms like the musket. The ball was loaded manually into the firearm, and its flight trajectory could be unpredictable, making it challenging to achieve accuracy. These types of firearms were vulnerable to weather conditions, affecting the gunpowder's moisture content and therefore spelling disaster on the battlefield.

In the 19th century, the invention of the metallic cartridge revolutionised ammunition technology. It was composed of a metallic casing filled with gunpowder and a lead bullet. This made the ammunition loading process quicker and more efficient and improved the accuracy of firing.

INNOVATIONS IN AMMUNITION TECHNOLOGY

The shift from gunpowder to smokeless powder marked a significant change in the industry, from a hand-crafted style of ammunition to more automated approaches. Smokeless powder allowed firearms to be more accurate and efficient by creating higher chamber pressure.

Modern-day ammunition has adopted new materials, such as copper and lead-coated steel, to create lighter and more effective bullets. The use of advanced composites; including Kevlar or ceramic armour, has led to the creation of armour-piercing bullets.

THE IMPACT OF TECHNOLOGICAL ADVANCEMENTS

Advancements in technology have impacted ballistics, creating new

In the 19th century, the invention of the metallic cartridge revolutionised ammunition technology. It was composed of a metallic casing filled with gunpowder and a lead bullet. This made the ammunition loading process quicker and more efficient and improved the accuracy of firing

targeting and ammunition systems like the Smart Gun System. This system ensures accuracy by preventing discharges unless the firearm has authenticated the shooter.

Advancements in manufacturing technology have allowed for a higher rate of production, consistency, and higher quality standards.

1. Black Powder

In the ancient world, the metaphor for a brilliant idea just might have been a firecracker exploding over someone's head. That's because firecrackers contained black powder, the invention of 10th-century Chinese pyromaniacs. It didn't take long before some bellicose warrior or jealous husband discovered he could launch a projectile using the same mixture of saltpetre (potassium nitrate), sulphur and charcoal.

The earliest black-powder weapons belonged to the Arabs - bamboo tubes



Fireworks, the colourful inspiration for powerful weapons

reinforced with metal that used a charge of black powder to shoot arrows. These were replaced by bronze hand cannons, which required two men to fire. One held the weapon while a second inserted a glowing coal or wire into a hole drilled in the solid end, or breech. This ignited the black powder, which sent a round ball - the first bullet - roaring from the open end of the cannon.

Over time, weapons became far more sophisticated, but they still relied on the same ancient chemical process, what scientists describe today as deflagration. In this type of reaction, a spark ignites a small mass of black powder, which doesn't explode but combusts rapidly to create a large amount of expanding gases held back by a non-fixed plug. That plug, of course, is the bullet, which fits tightly enough in the barrel that gases can't escape around it. As the gases expand and encounter resistance, they propel the bullet out of the muzzle.

It would be another nine centuries before something better came along.

EARLY DAYS OF AMMUNITION

Most people think of the arms race as a competition occurring between the US and the former Soviet Union during the Cold War. However, the struggle of nations to exert superiority over their enemies by amassing more and better weapons has been an ongoing reality for centuries. The lowly bullet is no exception. The earliest ammunition consisted of small round stones, but these had little effect on armour-covered warriors. This led arms manufacturers to explore metal bullets, made by pouring molten metal into a mould and letting it harden.

2. Musket Balls

Iron balls were popular for a while, but they were difficult to make, required extreme temperatures to melt and often ruptured the musket barrels trying to fire them. Then, in the early 1600s, lead balls started flying over battlefields. Lead had a low melting point, so it could be cast



Old mould for casting lead bullets

in a ladle over a wood fire. Soldiers and hunters could resupply their ammunition while they cooked dinner. And because they were softer, lead balls posed little risk of damaging gun barrels. These bullets, also known as musket balls or “rounds,” would reign supreme until the 1800s and the development of an aerodynamic projectile.

3. Cylindro-conoidal Bullet

You’re looking at a major development in bullet history – Minie balls. According to some sources, more than 95 per cent of all wounds treated by Civil War doctors were caused by firearms, such as the Springfield Model 1855 rifle-musket, shooting the .58-caliber Minie bullet.

Early smoothbore muskets received lead balls through the muzzle. The balls were smaller than the diameter of the bore, so that, upon firing, they bounced along the barrel until they exited. That bouncing didn’t do much for accuracy. Then, in the 15th century, German gunmakers invented rifling – the process of cutting spiral grooves into the inside wall of the barrel. These grooves dug into the projectile as it moved down the barrel, causing it to spin and giving it a truer flight. Rifling worked better if the projectile fit snugly in the barrel, which



Old Minie ball Bullet

A major breakthrough arrived in the 1850s, courtesy of a French army officer named Claude-Étienne Minié. His eponymous bullet was still made of lead, but it was conical, not round. When hot gases from black powder combustion expanded into the hollow-based Minié ball, they caused the soft bullet to flare out and grip the rifled barrel

meant lead balls needed a cover, or patch, to increase their diameter.

A major breakthrough arrived in the 1850s, courtesy of a French army officer named Claude-Étienne Minié. His eponymous bullet was still made of lead, but it was conical, not round. When hot gases from black powder combustion expanded into the hollow-based Minié ball, they caused the soft bullet to flare out and grip the rifled barrel. This meant that the innovative bullets could be made smaller than the bore without diminishing the spin they acquired. And they didn’t require a patch, which made them easier to load.

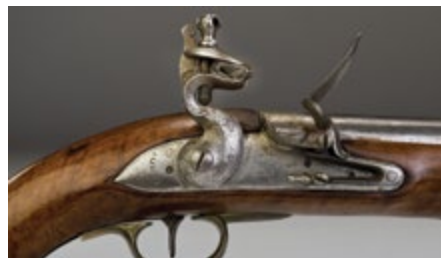
The Minié ball - the first cylindro-conoidal bullet - improved the accuracy of shooters tremendously. During the Civil War, which saw the first widespread use of these bullets, Union and Confederate infantrymen hit their targets more often and at far greater distances.

4. Fulminate of Mercury/ Percussion Cap

For a weapon to work, there must be a spark or ember to ignite the primer, which in turn ignites the black powder. Flintlock pistols and rifles accomplished this by striking a piece of flint against a serrated piece of steel. Sparks from the

flint striking the steel fell into the pan containing primer. The primer burned in a rapid flash, thereby lighting the powder charge.

Flintlock weapons worked well, but they had a disadvantage: the delay between the cock falling and the gun firing. A few inventors wondered if fulminating salts, which exploded on impact, might be a better alternative. Unfortunately, the salts were very sensitive to shock, friction, and sparks, making them too unstable to be practical. Then, in 1800, the English chemist Edward Howard managed to isolate



Flintlock Weapon

mercury fulminate, a relatively stable version of the compound. When the Rev. Alexander Forsyth mixed mercury fulminate with potassium chlorate, he produced a very reliable and safe priming agent. By the 1820s, this new primer was the key ingredient in the percussion cap, a small copper “top hat” that sat on an anvil or nipple. When the hammer struck the cap, it ignited the mercury fulminate, causing a flame to enter the barrel and initiate combustion of the powder charge.

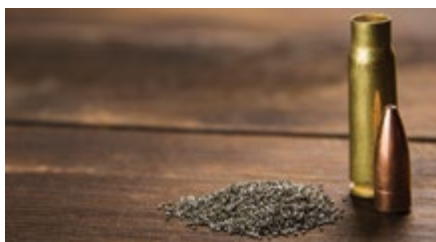
5. Nitrocellulose/Cordite

The invention of black powder may have been one of humankind’s most significant achievements, but it led to a messy battlefield. In a protracted fight, during which soldiers discharged their weapons many times, a thick veil of smoke filled the air, sometimes rendering the enemy invisible. By the 1800s, chemists and inventors were hunting for a better propellant.

The answer came from the plant kingdom, in the form of cellulose. This macromolecule, or long chain of repeating glucose units, is common in plant cells

and can be obtained from wood pulp or the short fibers of cotton. In 1846, the Swiss chemist Christian Friedrich Schönbein took cotton and dipped it in a mixture of nitric and sulfuric acids, causing the hydroxyl groups of the cellulose to be replaced by nitro groups. The result was an extremely flammable substance known as nitrocellulose or guncotton. Unfortunately, it tended to decompose spontaneously and explode without warning. Then, in the 1880s, French engineer Paul Vieille found that when nitrocellulose was mixed with certain stabilizers, it became much less volatile. This led directly to a new type of gunpowder, commonly known as smokeless powder, that revolutionised ammunition. Now a soldier could fire his weapon and not disappear behind a plume of white smoke.

The modern form of smokeless powder - cordite - contains nitrocellulose, nitro-glycerine and petroleum jelly. In its final form, it looks like small, graphite-coloured grains.



Smokeless Gunpowder

In the 19th century, the invention of the metallic cartridge revolutionized ammunition technology. It was composed of a metallic casing filled with gunpowder and a lead bullet. This made the ammunition loading process quicker and more efficient and improved the accuracy of firing.

6. Rim-fire Cartridge

Before the 19th century, primer, powder and bullet existed as independent components. To shoot a musket, for example, someone had to pour a little powder into the firing pan, pour some more powder down the barrel and then ram a ball against the charge. Touching



Rim-fire cartridge

an external spark to the primer initiated the firing sequence. Paper cartridges made this a bit easier by providing the shooter a premeasured packet of powder, although he still needed to tear open the paper and dispense powder into both pan and barrel.

All of this changed in the late 1800s with the introduction of the bullet cartridge - a self-contained unit that housed primer, propellant, and projectile in a brass casing. Parisian gunmaker Louis Flobert had already produced cartridges in 1840, but they were small and reserved primarily for indoor target practice. Daniel Wesson of Smith & Wesson fame saw Flobert's experiment and, in the 1850s, invented the first brass cartridge ready for the battlefield and the backwoods. Wesson's design packed a small bit of mercury fulminate in the rim of the brass case. Black powder filled the hollow tube of the case, and a bullet sat on top.

The entire unit could be placed into the breech of the gun, eliminating the need for patches, percussion caps or other separate components. The cartridge itself formed the seal at the breech. When the weapon's hammer struck the rim of the cartridge, it ignited the primer, which then spread the flame through the black powder, forcing the bullet down the barrel.

7. Centre-fire Cartridge

As revolutionary as rim-fire cartridges were, they had some disadvantages. The biggest was the cartridge itself, which needed a thinner shell to ensure that it would deform when the hammer struck it. But the thinner casing limited

the explosive force it could contain. As a result, rim-fire cartridges held less powder and generated less firepower.

To overcome these limitations, gun manufacturers quickly evolved the cartridge so it could incorporate a percussion cap, filled with shock-sensitive primer, within a unified, thicker-walled structure. The cap sat in the middle of the shell's base, which is how it came to be called a centre-fire cartridge. Gunmakers also had to modify their weapons to fire the new cartridge, including either a firing pin or a striker. In the former, a spring-loaded hammer transferred its energy to a blunt-nosed rod, which struck the percussion cap. In the latter, the hammer struck the percussion cap directly. In either case, applying a sharp blow to the cap ignited the primer, which then ignited the powder and fired the bullet.



Centre-fire Cartridges

Because centre-fire cartridges generate more power, they can fire larger bullets, which makes them the most common type of ammunition used in firearms today.

COPPER JACKET

The introduction of smokeless powder presented challenges to weapons manufacturers. Because nitrocellulose-based propellants produced higher temperatures and pressures than black powder, they moved bullets down the barrel with greater velocity. As they made the journey, softer lead bullets couldn't stand up to the increased friction. Their outer layers were stripped off and left in the barrel, causing fouling.



Full Metal Jacket (FMJ) Ammunition

The solution, of course, was to give bullets a thicker skin, or a jacket. Gunmakers chose copper or alloys of copper and zinc to cover their pistol bullets. They used a harder jacket of steel or cupronickel for rifle and machine-gun bullets. In both cases, the core of the bullet still contained lead, except in armour-piercing bullets, which used inner cores of hardened steel.

In military weapons, bullets possess a full-metal jacket (FMJ), meaning the jacket covers the entire projectile. These bullets are sometimes called non-expanding because they retain their shape as they pass through a target. For soldiers and military surgeons, this is a good thing, for FMJ bullets do less damage to internal tissues and organs.

Big-game hunters have far different requirements. They need a bullet that will cause massive internal trauma so their prey will go down quickly. They use expanding bullets, which mushroom out as soon as they encounter resistance. The jacket of such a bullet only extends over a portion of the lead projectile, leaving the tip exposed. When a soft-point bullet strikes a target, such as a deer or a bear, the tip expands and flares out, allowing it to inflict more damage on internal organs.

8. Tracer Ammunition

When a bullet exits a rifle barrel, it can be traveling between 800 and 1,000 metres per second (2,625 to 3,280 feet per second) - much too fast to be seen with the naked eye. In the days of black powder, a fired bullet sometimes left a trail of smoke, marking the path of the projectile through the air. But with the advent of smokeless powder, shooters



Tracer Bullets

When a tracer is fired, the powder in the cartridge propels both the bullet and lights the incendiary mixture. As the bullet travels through the air, it gives off an intense light and trails smoke, helping the shooter see the bullet go downrange

received no feedback about a bullet's trajectory until it arrived at the target.

Enter the tracer round, which includes an additional incendiary compound, usually a phosphorus or magnesium mixture, in the base of the bullet. When a tracer is fired, the powder in the cartridge both propels the bullet and lights the incendiary mixture. As the bullet travels through the air, it gives off an intense light and trails smoke, helping the shooter see the bullet go downrange. Military forces often use this type of ammunition in machine guns, in which every fifth round in the magazine or belt includes a tracer.

Today, tracers can produce a variety of colours for daytime and nighttime applications. White tracers can be seen during the day, while red and green ones can be seen at night.

9. Frangible Ammunition

Hunters and farmers often use frangible to shoot rats and other pest animals. These so-called varmint bullets can easily kill a small animal, yet if a shooter misses his target, there's little danger of

harming someone else in the vicinity.

Not much happened to bullets in the hundred years following the introduction of metal cartridges containing copper-clad projectiles. They worked amazingly well and, as a result, changed little over time. Then, in the late 20th century, law enforcement agencies began to form modern hostage rescue units tasked with apprehending criminals and terrorists in the midst of civilian personnel. Often, such interactions occurred in extremely close quarters, where bullets could pass through a target and then strike an innocent bystander. Meanwhile, law enforcement agencies were also seeing a number of situations in which officers were injured or killed by bullets, fired at close range, ricocheting off solid objects.

This led to a search for a new kind of bullet, one that would still possess stopping power but would break apart when it struck a wall or other solid surface. Eventually, ammunition makers devised a way to take small particles of composite material that they either pressed or glued together. Once formed into a bullet shape, the so-called frangible - or soft round - doesn't receive a copper jacket. That way, if the bullet strikes a hard object, the composite material simply breaks into small, grain-sized particles. If it strikes a bad guy, like a terrorist trying to hijack a plane, it enters the body and then breaks apart, causing a significant wound without the risk of over-penetration.

We just examined the development timeline of ammunition, from black powder to today's sophisticated bullets. Think of it as 10 rounds of ammo info. ■



-The writer is the Managing Director of Hughes Precision Manufacturing Pvt Ltd, India's first small-calibre manufacturer in the private sector. An MBA from the Indian Institute of Management (IIM), Bangalore, he has been involved with the ammunition industry in India and abroad for more than a decade

ENGINEERING THE FUTURE OF AUTONOMOUS DEFENCE SYSTEMS

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05 ELECTRONIC WARFARE
& RF JAMMING
SPECTRUM DOMINANCE



06 COUNTER-DRONE
SYSTEMS
DETECT - TRACK - NEUTRALIZE



07 AI TARGETING &
PRECISION STRIKE
COMPUTER VISION TARGETING



08 CYBER WARFARE
SECURE DIGITAL
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INDIA-ISRAEL: DEEPENING DEFENCE TIES, MATURING STRATEGIC PARTNERSHIP

India and Israel are strengthening their decades-old defence partnership, with a recent high-level visit by Israel's defence ministry chief to New Delhi underscoring growing cooperation in weapons co-development, technology transfer and industrial collaboration between the two strategic allies

ARIE EGOZI

The defence relationship between India and Israel continues to gather momentum. Maj Gen (Res) Amir Baram, Director General of Israel's Ministry of Defence, recently travelled to New Delhi for a series of high-level meetings with India's Defence Minister, Defence Secretary, Chief of Defence Staff and other senior officials. The talks focused on expanding bilateral defence and industrial ties.

According to the Israeli Ministry of Defence, the visit reflects a deliberate strategy to grow defence exports as a means of strengthening the IDF's force posture, advancing Israeli foreign policy goals, and supporting the country's defence industrial base. It fits into a wider push by Israel to build strategic partnerships across the East and deepen ties with important regional players.

Baram described India as a key strategic partner, noting that the visit was the product of extensive bilateral groundwork and reflected the significance both nations place on their expanding defence and industrial alliance. He characterised the relationship as one grounded not merely in shared interests but in mutual trust and cultural affinity, which he said gives the partnership its distinctive character.

ROOTS OF A LONG-STANDING ALLIANCE

While such high-profile visits capture attention, the foundations of India-Israel defence cooperation run much deeper,



Maj. General (Retd) Amir Baram, DG, Israel Ministry of Defence with Defence Minister Rajnath Singh

dating back to the establishment of diplomatic relations in 1992. Since then, defence ties have arguably become the most significant pillar of the bilateral relationship.

India has procured a broad array of Israeli military technology over the years, including Searcher and Heron unmanned aerial vehicles, airborne early warning systems, radars, missiles and air-defence platforms. Israel filled a practical need: India required specialised capabilities in areas like drones, sensors and electronic warfare, while Israel viewed India as both a vital market and a long-term strategic partner.

The relationship has evolved well beyond simple arms sales into genuine joint development. The Barak-8 air-defence missile family, created through Indo-Israeli collaboration, stands as a prime example, alongside subsequent projects spanning drones, sensors, cyber

capabilities and industrial manufacturing.

WHAT DRIVES THE PARTNERSHIP

Several factors explain the durability of this alliance. Operational necessity has been central - India has needed systems capable of rapidly addressing gaps in surveillance, air defence, counter-terrorism, and battlefield situational awareness, particularly where domestic industry couldn't keep pace with demand. Political trust is another key driver. Israel has shown a consistent willingness to share advanced technology and support technology transfer, while India has come to regard Israel less as a mere vendor and more as a genuine strategic ally.

A shared threat perception adds further weight to the relationship, as both countries confront ongoing terrorism



and irregular security challenges, making cooperation on intelligence and border security especially valuable.

For India, the partnership dovetails with the 'Make in India' initiative, as Israeli cooperation enables joint production and local industrial participation, helping build indigenous manufacturing capacity even as India modernises its forces. For Israel, India represents one of its largest defence customers, providing crucial support for its own production, innovation, and export capabilities - India was reportedly the top buyer of Israeli weapons between 2020 and 2024, according to SIPRI data cited by the Foundation for Defence of Democracies.

AN EXPANDING RELATIONSHIP

The partnership shows no signs of slowing. In November 2025, the two countries signed a new Memorandum of Understanding aimed at deepening cooperation across defence, industry and technology. Early in 2026, Reuters reported that Prime Minister Modi had signaled India's intent to pursue further joint development, production and technology transfer with Israel in the defence sector.

This is fundamentally a partnership

built on mutual capability rather than ideology alone: India gains access to advanced systems and industrial know-how, while Israel secures a large, reliable partner that values its technology and shares comparable security priorities.

As of 2026, Israel ranks among India's largest military suppliers, and India accounts for a substantial share of all Israeli defence exports - making it Israel's single biggest client globally. India's reliance on Israeli technology extends notably to anti-aircraft and missile systems, including naval Barak platforms, with talks reportedly underway to integrate additional layers of Israel's multi-tiered missile defence architecture into India's forces. Unmanned systems represent another area of deep collaboration, with the Hermes 900 and its India-manufactured counterpart, the Drishti 10 Starliner, playing an important role in border surveillance operations.

BEYOND BUYER AND SELLER

Perhaps most notably, the relationship has evolved from a conventional buyer-vendor dynamic into substantive co-development across artificial intelligence, cyber warfare and advanced weapons

systems, with both countries working to localise weapons production in support of India's manufacturing ambitions.

Frequent high-level exchanges - including Baram's recent delegation to New Delhi - help ensure the two nations stay aligned on evolving regional security dynamics. Shared geopolitical concerns, particularly cross-border terrorism and regional instability, continue to reinforce the partnership, which has proven resilient even amid broader turbulence in the Middle East.

Looking ahead, sources told *Raksha Anirveda* that India could become the second international customer for Israel's Arrow ballistic missile defence system - a system currently used abroad only by Germany. The Arrow reportedly intercepted a high proportion of Iranian ballistic missiles during the recent Israel-Iran conflict, and sources tracking the bilateral relationship suggest cooperation in this domain is likely to expand further in the near future. ■



-The writer is an Israel-based freelance journalist. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda

TASK-TO-TOOL OR DON'T USE A SLEDGEHAMMER TO CRACK A NUT

FSTD Capability Signature (FCS) is finally moving from theory to reality with the Task-to-Tool approach. The driving factor behind the changes is training, not equipment. SIM OPS has many targeted training programmes available to help operators navigate these changes



As EASA rolls out Implementing Rule EU 2026/781, we are finally seeing the FSTD Capability Signature (FCS) move from theory to reality. Underlying the changes is the Task-to-Tool concept. It is a bit of a mouthful, and while 'Task-to-Tool' might sound like just another industry buzzword, the philosophy behind it is actually a breath of fresh air. To understand why, you have to look at how we have been doing things — and where it occasionally went a bit sideways.

The change in the methodology of qualifying Flight Simulation Training Devices (FSTDs) is a consequence of the move to Task-to-Tool and Evidence-Based Training (EBT). The driving factor behind the changes is training, not equipment.

We often assume that the more a simulator looks like and simulates the real thing, the better it teaches. However, consider this: Several years ago, one of our partners at SIM OPS found himself unexpectedly responsible for running a military training centre. So, of course, he visited at the first opportunity. As fate would have it, earlier in his career, he had been part of the design team



responsible for the design of the Full Mission Simulators (FMS) at the centre, featuring full dome visuals and cueing seats, cutting-edge technology. He was therefore very proud of the FMS devices there. So, imagine his consternation when his guide for the visit, in civilian terms, the Head of Training, showed him what he considered to be the most useful training equipment in the centre; no, not the FMS but a simple PC attached to a simulated throttle top and a simulated stick top. It transpired that one of the most difficult parts of the training for pilots transferring to this aircraft type was mastering the Hands-On Throttle and Stick (HOTAS) philosophy.

For us, this perfectly illustrates the thinking behind the Task-to-Tool approach in the commercial world.

In that case;

The Task: Muscle memory and cognitive mapping of complex switchgear (HOTAS).

The Inefficient Tool: A Full Mission

Simulator. It's overkill; using an FMS to learn button locations is like using a Formula 1 car to learn how to adjust the wing mirrors.

The Efficient Tool: The desktop trainer. It isolates the specific cognitive load of the HOTAS task without the distractions (and hourly cost) of a Full Mission Simulator.

What is important to understand is that the PC trainer wasn't replacing the FMS, but optimising it. By the time the pilots got into the FMS, they already knew where the buttons were, making the expensive FMS time much more productive.

This military lesson mirrors challenges we've long seen in civil training. For the military, they always had flexibility in designing their training programmes, each new aircraft being subjected to an extensive training needs analysis and procuring devices to meet those specific needs. That said, the lessons carry across to the commercial aviation world as well.

We've witnessed training sessions in Level D FFSs where trainees were taught how to enter routes into an FMC or send an ACARS message, because that was the only 'tool' available.

For years, training has been 'Tool-to-Task' — we had a Level D Sim, so we built a syllabus around what that Sim could do. This was (and still is) based on the Operational Sustainability Data (OSD) provided by the type certification certificate holder, who lists the mandatory type-specific tasks required for a type rating.

With a Task-to-Tool approach, we ask:

- What does the pilot need to know to be able to do the task? (The Task)
- What is the most effective device to fix that? (The Tool) What features and fidelity does the tool need to accomplish the task?

Whereas our example from the military sphere wasn't about replacing the FMS, in the commercial world, it's not about phasing out Full Flight Simulators (FFS). Certain tasks will always need a level of fidelity up to what we've all been used to in Level D.

This is where the FCS comes in. For each task, an assessment is made as to what features and fidelity are required to accomplish that particular task. Consider the example of entering a route into the FMC, it's obvious there is no need for a motion system, control loading, a visual system or even a dimensionally correct flight deck.

We've looked at the FCS in previously, but in reaching the final Opinion (2025/01), EASA made a few changes from the system envisioned in ICAO 9625.

The result was that the FCS will comprise 14 FSTD features;

1. Flight deck layout and structure (FDK)
2. Flight control forces and hardware (CLH)
3. Flight control system operation (CLO)
4. Aircraft systems (SYS)
5. Performance and handling on ground (GND)
6. Performance and handling in ground effect (IGE)



7. Performance and handling out-of-ground effect (OGE)
8. Sound cueing (SND)
9. Vibration cueing (VIB)
10. Motion cueing (MTN)
11. Visual cueing (VIS)
12. Navigation (NAV)
13. Atmosphere and weather (ATM)
14. Operating sites and terrain (OST)

Each of these features is assigned a fidelity level, either

- S - Specific, the highest level of fidelity
- R - Representative, the intermediate level of fidelity
- G - Generic, the lowest level of fidelity
- N - None,

- (a) The feature is not installed, functional or available or
- (b) The feature is installed but not required and is not distracting.

The inherent benefit of this is that it provides an objective assessment of the training need independent of the assessment of any devices. Likewise, an independent assessment of the training device.

Now think about a type rating skill test, here the Type Rating Examiner (TRE) is

looking to ensure the trainee is safe to operate a particular aircraft type, or as it was put to me several years ago, "If I was flying as a passenger and Captain X did the welcome announcement would I want to deplane or be happy to fly with Captain X?"; the TRE has to assess the student interacting with all the systems and features of that specific aircraft. For this task, the bar is self-evidently higher; there is a need for complete immersion.

These changes are, in our opinion, a great step forward in allowing emerging technologies to fulfil their potential and facilitate better training on an appropriate tool at an appropriate cost.

HOW CAN SIM OPS HELP?

SIM OPS have closely followed the rule, carried out activities at EASA, and been active throughout the process. We have many targeted training programmes available to help operators navigate these changes. You may contact us on our dedicated training e-mail, training@sim-ops.com and/or take a look at our Regulatory training programme on our website.

THE LAST 300 SECONDS!

With evolving drone threat, the counter-drone technologies are also advancing and shaping the next generation of CUAS solutions. Yet, one reality is unlikely to change. The success of any counter-drone operation will depend on the ability to detect threats early, understand them quickly, and respond effectively

BALASUBRAMANIAN M

Atired sentry, after a night-long vigil, hears a faint buzzing sound. At first, he dismisses it as an insect. Seconds later, the sound grows louder. A small object appears over the tree line, flying low and steadily towards the perimeter. It is too small to identify with the naked eye. Is it a hobby drone? A surveillance platform? Or the beginning of an attack?

Modern battlefields rarely provide enough time to find the perfect answer. Decisions often must be made within minutes. Sometimes, within seconds. That brief window—between the first indication of a threat and the moment it reaches its target—is where modern Counter-Unmanned Aircraft Systems (CUAS) earn their place.

THE NEW FACE OF THE BATTLEFIELD

For decades, air threats were associated with fighter aircraft, helicopters, and missiles. These platforms were expensive, highly visible, and usually operated by state actors.

Modern day drones have changed that equation.

Today, a commercially available drone costing less than a smartphone can gather intelligence, track the ground movement, map sensitive installations, and it can even deliver a small payload. Most importantly, such drones are widely available and easy to operate.

This has transformed the nature of battlefield surveillance and security. A small quadcopter hovering over a

defence / restricted zone may appear harmless. Yet the same platform can be used to collect images, relay coordinates, or assist a larger attack.

The uncertainty surrounding these threats is what makes them difficult to counter.

FROM ALERT TO ASSESSMENT

Many people assume that once a drone is detected, the problem is solved. In reality, detection is often the easiest part of the process, but it is only the beginning. Determining its intent is often the harder task.

Modern CUAS use a combination of sensors to monitor the airspace. Radars search for airborne objects, radio-frequency sensors listen for communication links and signals, electro-optical cameras provide visual confirmation and thermal sensors assist during low-light conditions. Each sensor contributes another piece to the puzzle.

However, detecting a drone-sized object is not always straightforward. Birds, environmental clutter, buildings, moving vehicles, and weather conditions can all generate confusing signals. Operators must continuously assess incoming information and determine whether an alert represents a genuine threat. The battlefield rarely offers perfect data. Instead, decisions must be made using the available information and limited time.

THE OPERATOR IN LOOP

Technology often receives the spotlight, but every successful counter-drone engagement ultimately depends on people.

Behind every command-and-control

display, is an operator responsible for interpreting the data, assessing threats, and communicating with decision-makers. The operator's task is not simply to identify a drone.

They must determine whether the object poses a threat, understand its behaviour, evaluate possible responses, and coordinate with multiple stakeholders.

This responsibility becomes even more demanding during periods of high activity.

Imagine receiving several alerts within a short span of time. One may be a bird. Another may be a friendly drone. A third could be an unknown platform approaching



a sensitive area. The operator must make sense of these situations without the luxury of lengthy analysis. Training, experience, and judgement become just as important as technology. In many cases, the difference between success and failure lies not in the equipment but in the quality of human decision-making.

WHAT COMES NEXT?

Once a drone has been detected and identified, the next question is deceptively simple: "What should we do about it?" This is often the most critical stage of the engagement. Responding too slowly may allow the drone to complete its mission. Responding too aggressively may create unnecessary risks. A drone flying near an ammunition depot may require immediate action. A drone operating near a civilian area may demand a more measured response. Decision makers must balance operational necessity, safety considerations, and rules of engagement. There is no universal solution. Every

situation must be assessed based on its own circumstance.

SOFT KILL BEFORE HARD KILL

Modern counter-drone systems generally rely on a layered approach. Whenever possible, the preferred option is to disrupt the drone without physically destroying it. This is often achieved through different electronic warfare techniques. By interrupting the communication links or interfering with satellite navigation signals, operators may force a drone to land, return to its launch point, or lose its ability to continue the mission. Such measures can be effective while minimising collateral damage. However, electronic measures are not always sufficient on their own. Autonomous drones, pre-programmed flight paths, and evolving technologies are reducing the effectiveness of traditional countermeasures.

When soft-kill options fail, hard-kill solutions become mandatory. These may include kinetic interceptors, specialised

Modern Counter-Unmanned Aircraft Systems (CUAS) use a combination of sensors to monitor the airspace. Radars search for airborne objects, radio-frequency sensors listen for communication links and signals, electro-optical cameras provide visual confirmation and thermal sensors assist during low-light conditions. Each sensor contributes another piece to the puzzle

projectiles, directed-energy weapon, net catchers or other defeat mechanisms. The objective remains the same: neutralise the threat before it achieves its purpose.

WHEN EVERY SECOND COUNTS

Counter-drone operations are often measured in minutes. Sometimes even in seconds. A drone travelling at modest speeds can cover significant distances in a very short period. Every delay reduces the available response window. This creates what many operators describe as a race against time. Detection must occur early. Classification and Identification must be accurate. Communication must be clear. The entire process must work in tandem.

LESSONS FROM RECENT CONFLICTS

In many theatres, they have become one of the most visible examples of how innovation can rapidly alter the balance between attackers and defenders. They are a battlefield standard. What has changed is not just frequency of use but the nature of the threat. Small, low-cost drones are now being used in coordinated swarms, flying pre-programmed routes that defeat traditional jammers, strikes





with precision at the targets that once required far greater resources to reach. The cost asymmetry is significant, and the adversary can field dozens of systems for what it costs a defender to intercept one. This has forced a fundamental rethink of air defence doctrine. The question is no longer how to defeat a small number of high-value aerial threats. It is how to build a defence that is effective, scalable, and economically sustainable against a large and growing volume of low-cost airborne systems.

For India, this challenge carries additional significance. Securing a vast geographic area and a wide range of critical infrastructure requires solutions that are not only operationally effective but also scalable, sustainable, and most importantly indigenous. Counter-drone capability therefore sits at the intersection of national security and India's Aatmanirbhar Bharat initiative, which seeks to strengthen technological self-reliance in defence. Today, India roughly has around 10 credible CUAS integrators in the country who can supply a complete system (Detect, Track and Neutralise).

THE FUTURE OF COUNTER-DRONE INNOVATION

The counter-drone challenge is not merely an operational problem. It is increasingly an innovation challenge. The challenge is no longer developing individual technologies in isolation but integrating them into operationally effective systems that can respond at the speed of the threat. Modern Counter-Unmanned Aircraft Systems sit at the intersection of RF detection, radar, electro-optical sensors, interceptors, artificial intelligence, data fusion, embedded systems, and advanced software. Success in this domain requires expertise across multiple disciplines working together within a single operational framework.

Across industry, startups, and research institutions, efforts are underway to develop indigenous capabilities for electronic countermeasures. Counter-drone technology is not an abstract capability. It is a practical test whether India can innovate at the pace of a real and evolving threat combining software agility and hardware depth in a single deployable system.

LOOKING AHEAD

The drone threat will continue to evolve.

Artificial intelligence, autonomous navigation, swarm technologies, and improved communications will make future systems more capable and more difficult to counter. At the same time, counter-drone technologies will continue to advance. Better sensors, improved data fusion, faster decision-making tools, and enhanced electronic warfare capabilities are already shaping the next generation of CUAS solutions. Yet one reality is unlikely to change. The success of any counter-drone operation will depend on the ability to detect threats early, understand them quickly, and respond effectively.

Sometimes, the battle is won in the last 300 seconds! ■



—The writer is Vice President – Operations at Big Bang Boom Solutions Pvt Ltd. The views expressed are personal and do not necessarily reflect the views of Raksha Anirveda

Shielding Tomorrow: Inside the Tech Transforming Modern Policing

The International Police Expo 2026 served as a major launchpad for domestic defence innovation. HFCL Defence generated significant footfall at its stall by showcasing its advanced tactical communication systems, surveillance radars, and a state-of-the-art Coastal Surveillance System (CSS) engineered for maritime border protection.

Meanwhile, Bengaluru-based SSS Defence stole the show with its next-generation small arms. Public attention centred on its .338 Saber sniper rifle - the exact weapon used by the National Security Guard (NSG) to win the All-India Police Commando Competition.

Reflecting global conflict trends, drone and counter-drone technologies dominated the expo, accounting for over 35% of the exhibitors. SSS Defence debuted Varaha, a passive, acoustic-first counter-UAV system that tracks and neutralises drones without



emitting radio frequencies. Coimbatore's UMS Technologies showcased high-calibre engine systems designed to power high-performance unmanned aircraft.

Armed with over five-decade of experience in supplying engine systems for high-performance model aircraft or components for industrial applications, UMS Technologies boasts capabilities to give wings to any drone system through its high-calibre and powerful engine systems.

Indrajaal Drone Defence unveiled India's

first AI-integrated anti-drone patrol vehicle, built to counter aerial threats whilst on the move. Beyond aviation, the exhibition highlighted a sharp industry pivot towards AI-driven forensics, cyber intelligence platforms, and mobile forensic laboratories designed to modernise criminal investigations.

Next-generation security mobility also drew massive crowds. Armoured Vehicles Nigam Limited (AVNL) exhibited its latest Light Armoured Multi-Purpose Vehicle (LAMV), built for rugged terrains. Additionally, the DRDO and CRPF jointly presented the Rakshita motorbike ambulance, an innovative solution for rapid casualty evacuation in remote conflict zones. Ultimately, the event proved to be more than a trade show; it served as a critical forum for international collaboration, shaping the future of homeland security in an increasingly tech-driven world.

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INDIA ASSERTS DEFENCE MIGHT AT EUROSATORY 2026 TO ANCHOR EXPORT AMBITIONS

India's expansive showcase of advanced indigenous weapon systems at Eurosatory 2026 in Paris has highlighted the nation's unprecedented export surge, providing a robust template for hosting a premier global defence exhibition

ASAD MIRZA

The landscape of international military trade is undergoing a major structural realignment as emerging industrial powers transition from historical buyers into advanced system exporters.

At Eurosatory 2026 in Paris, the world's largest land warfare exposition, India capitalised on this strategic evolution by deploying an expansive national pavilion featuring 31 public and private defence entities.

Spearheaded by the Defence Research and Development Organisation (DRDO), alongside premier private innovators, the Indian delegation presented highly complex, combat-ready platforms to over 350 international delegations.

This aggressive marketing push aligns with India's domestic manufacturing breakthrough, which saw total national defence production climb to an impressive 1.78 lakh crore rupees, driving global weapon exports to an unprecedented record of 38,424 crore rupees in the fiscal year 2025-26. The technological sophistication on display in Paris systematically challenged the legacy monopoly of Western arms suppliers.

A major highlight at the exhibition was the formal unveiling of the MARG-39 next-generation mounted artillery gun system, developed by Kalyani Strategic



Hosting an institutionalised global exhibition of this scale would not only lock in billions of dollars in direct industrial offset investment but would permanently cement the nation's standing as an independent, sovereign anchor of international security architecture

Systems Limited. The 155-millimetre, thirty-nine-calibre weapon system, mounted on a high-mobility four-by-four wheeled chassis, features NATO-interoperable ammunition lines and responsive shoot-and-scoot operational software engineered to completely evade modern counter-battery tracking arrays.

This engineering success was powerfully reinforced by the debut of the Simha four-by-four light armoured multi-purpose vehicle, co-developed with South Africa's Paramount Group. Designed from the ground up around standardised aggregates, the modular vehicle is optimised for rapid local industrialisation across partner nations.



Simultaneously, the state-backed sector showcased high-tier strike technologies, including the long-range Pinaka guided rocket network, the RudraM anti-radiation missile family, and advanced light-weight anti-submarine torpedoes, proving India's ability to deliver tier-one capabilities at highly competitive lifecycle costs.

For India's rapidly maturing military-industrial base, continuous engagement with premier forums like Eurosatory is vital to sustain its current export trajectory. These large-scale conventions serve as critical strategic hubs where domestic manufacturers can directly interface with procurement authorities from the 80+ importing nations currently absorbing Indian hardware, while simultaneously forging deep co-production alliances with European original equipment manufacturers.

By securing validation on the global stage, Indian enterprises can seamlessly integrate their subsystems into multinational supply chains,

accelerating the shift from component fabrication to prime systems integration.

Crucially, the success of the Paris showcase demonstrates that India has achieved the industrial weight and administrative capability required to host a mirror edition of such a global showpiece on its own soil.

To transition from a prominent participant into a central global node, New Delhi should actively expand its domestic exhibition strategy by transforming existing regional events into a singular, highly integrated mega-expo on par with Eurosatory.

By establishing a permanent, world-class exhibition infrastructure near a major aviation hub, implementing simplified, single-window visa protocols for international military delegations, and leveraging its unique diplomatic position as a leader of the Global South, India can create the premier defence marketplace for Asia and Africa.

This ambition, however, demands first addressing a glaring inconsistency closer home: India's own flagship

biennial exhibition, DefExpo, has effectively missed two editions on its regular cycle, with the 12th edition held in October 2022 in Gandhinagar after a logistics-driven postponement, and no edition convened in 2024, leaving a multi-year gap before the 13th edition.

Hosting an institutionalised global exhibition of this scale would not only lock in billions of dollars in direct industrial offset investment but would permanently cement the nation's standing as an independent, sovereign anchor of international security architecture - a credibility that depends as much on DefExpo's renewed focus and disciplined, long-term scheduling at home as it does on showcases abroad like Eurosatory. ■



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The views expressed are of the writer and do not necessarily reflect that of Raksha Anirveda

Admiral Krishna Swaminathan Assumes Charge as the 27th Chief of Naval Staff, Indian Navy

Admiral Krishna Swaminathan, PVSM, AVSM, VSM assumed charge as the 27th Chief of the Naval Staff of the Indian Navy on May 31, 2026. He succeeds Admiral Dinesh Kumar Tripathi, who superannuated after 41 years of distinguished service.



guided missile destroyer INS Mysore and aircraft carrier INS Vikramaditya. Prior assuming charge as the Chief of the Naval Staff, Admiral Swaminathan was the Flag Officer Commanding-in-Chief of the prestigious Western Naval Command.

Admiral Krishna Swaminathan was commissioned into the Indian Navy on July 01, 1987. A Communication and Electronic Warfare specialist, he has held a wide range of operational, staff and training appointments during a distinguished career spanning nearly four decades.

Admiral Swaminathan's sea commands include the guided missile vessels INS Vidyut and INS Vinash, guided missile corvette INS Kulish,

He is an alumnus of the National Defence Academy, Khadakwasla; Joint Services Command and Staff College, Shrivenham, United Kingdom; College of Naval Warfare, Karanja; and the United States Naval War College, Newport, Rhode Island. Admiral Krishna Swaminathan is a recipient of the Param Vishisht Seva Medal, Ati Vishisht Seva Medal and Vishisht Seva Medal for distinguished service.

Vice Admiral Sanjay Vatsayan Takes Over as the Flag Officer Commanding-in-Chief, Western Naval Command

Vice Admiral Sanjay Vatsayan, PVSM, AVSM, NM, assumed charge as the Flag Officer Commanding-in-Chief, Western Naval Command on May 30, 2026.



Prior to this appointment, he served as Vice Chief of the Naval Staff at Naval Headquarters, New Delhi. An alumnus of National Defence Academy, Khadakwasla Pune, the Flag Officer was commissioned into the Indian Navy on January 01, 1988. A specialist in Gunnery and Missile Systems, he has held a wide range of command, operational, staff and training assignments, both afloat and ashore, during his distinguished naval career spanning more than three decades. The Flag Officer has served onboard various frontline warships,

including command of Coast Guard Ship C-05, Missile Vessels INS Vibhuti and Nashak, Missile Corvette INS Kuthar and Guided Missile Frigate INS Sahyadri. A graduate of the Defence Services Staff College, Wellington, Naval War College, Goa and the prestigious National Defence College,

New Delhi, the Flag Officer has excelled in key strategic and policy-oriented Staff roles.

He has also served as Deputy Chief of the Integrated Defence Staff (DCIDS) - Operations and DCIDS (Policy, Plans and Force Development) at HQIDS, playing a key role in coordination of operations, enhancing integration, jointness, force development and framing policies promoting indigenisation in the three Services.

Vice Admiral Ajay Kochhar Assumes Charge as the 48th Vice Chief of the Naval Staff

Vice Admiral Ajay Kochhar, PVSM, AVSM, NM, assumed charge as the 48th Vice Chief of the Naval Staff (VCNS) on May 29, 2026.



An alumnus of the prestigious National Defence

Academy, Pune, VAdm Ajay Kochhar was commissioned into the Indian Navy on July 01, 1988. A specialist in Gunnery and Missile Systems, he has held a wide range of command, operational, and staff assignments over his distinguished naval career spanning more than 37 years.

He has commanded Indian Naval Ships Nashak, Vibhuti, and Kirpan, and was the Commissioning Commanding Officer of the frigate Trikanth. The Flag Officer has also commanded the aircraft carrier INS Vikramaditya. During his tenure, the carrier successfully completed the integration and operationalisation of its air wing.

A graduate of the Defence Services Staff College, Wellington, the Naval War College, Goa, and the Royal College of Defence Studies, United Kingdom, the Flag Officer excelled in key strategic and policy-oriented staff roles at Naval Headquarters. These included Joint Director at Naval Plans, Director of Staff Requirements, and Principal Director DSCT.

For his exceptional leadership and meritorious service of a very high order, he was awarded the Ati Vishisht Seva Medal in 2022 and the Param Vishisht Seva Medal in 2026.

Prior to taking over as the Vice Chief of the Naval Staff, he served as Commander-in-Chief, Andaman and Nicobar Command, where he played a key role in operational coordination and in enhancing integration and jointness among the three Services.

Lt Gen Sandeep Jain Takes Charge as New Vice-Chief of Army Staff

Lieutenant General Sandeep Jain has assumed the prestigious role of Vice-Chief of the Army Staff, bringing extensive operational expertise and leadership experience to the Indian Army's second-highest position.

An alumnus of the renowned National Defence Academy, he was commissioned into the MAHAR Regiment in June 1988, marking the beginning of a distinguished career spanning nearly four decades.

His operational background is vast and diverse, featuring extensive service in some of the most challenging environments. He has actively participated in Operation Pawan and served as a Military Observer with the United Nations Mission in Ethiopia. Furthermore, he has completed multiple tenures in high-altitude regions and has extensive experience in counter-insurgency operations along the Line of Control and in the North East.

The General Officer also commanded



a Sector in the UN Mission in South Sudan. Upon his promotion to Lieutenant General, he commanded a Corps in the Northern Command. He later served as Chief of Staff at Headquarters Southern Command, where he contributed significantly to capability development, force restructuring,

and overall operational preparedness. Prior to this appointment, he served as the General Officer Commanding-in-Chief of the Southern Command. As the Vice-Chief of Army Staff, Lt Gen Jain will be responsible for overseeing several critical areas: Capability Development: Accelerating the induction of modern technology and equipment under the army's ongoing modernisation drive; Operational Readiness: Ensuring the force maintains a high state of alert across all sectors, particularly along the borders; Force Restructuring: Continuing the optimisation of the army's organisational structure for leaner, more agile deployment.

Airbus Appoints Eric Kirstetter as Executive Vice President Strategy

Airbus SE has appointed Eric Kirstetter as Executive Vice President Strategy, effective May 18. He will succeed Matthieu Louvot, who was recently nominated as CEO of Airbus Helicopters. Joining from global strategy consulting firm Roland Berger, Eric Kirstetter will report in his new role to Airbus CEO Guillaume Faury.

Holding a degree in Mechanical Engineering from ISAE-Supméca and a Master's Degree in International Industrial Management from HEC Paris,



Eric served for 17 years at international management consulting firm Arthur D. Little, prior to joining Roland Berger's Paris office in 2017.

Eric brings extensive experience in growth strategy and transformation, built on a wide range of successful projects in the automotive, aerospace and defence industries. He has supported top-tier clients in Asia, Europe and the United States in making strategic decisions, running transformations, closing M&A deals and scaling innovation.

Boaz Levy Appointed Chairman, Board of Directors of Israel Aerospace Industries

Israel's Defence Minister, Israel Katz and the Minister in charge of the Government Companies Authority, Dudi Amsalem, on May 13 signed the



official appointment letter appointing Boaz Levy as Chairman of the Board of Directors of Israel Aerospace Industries (IAI). The appointment follows Levy's election by the company's Board of Directors and the Senior Appointments Committee's approval.

The appointment marks a precedent in the history of Israeli government-owned companies, making Levy the first serving CEO to be appointed Chairman of the Board of Directors of the same company.

Boaz Levy has served as CEO of Israel Aerospace Industries since 2020. Throughout his tenure, he has led the company to unprecedented technological and business results, strengthening its position as one of the world's leading defence companies. Under his leadership, Israel Aerospace Industries has significantly expanded its global operations, achieved record order backlogs, and delivered exceptional financial performance.

Levy began his career at IAI in 1990 as an engineer on the Arrow programme and later held several key positions in the company, including head of the Arrow programme, head of the Barak programme, director of the Air-Defence Systems Plant, and EVP of the Systems, Missiles and Space Group. Levy holds a bachelor's degree in aeronautical engineering and a master's degree in systems engineering - both from Israel's Institute of Technology. He has thirty-five years of experience in financial, technological, business, management, and marketing fields, as well as leading a long line of huge transactions with clients around the world.

France Launches the Development of New Capabilities for the A400M

Airbus Defence and Space has signed a contract with OCCAR (Organisation for Joint Armament Cooperation), acting on behalf of the French Directorate General of Armaments (DGA), for the development of new capabilities for the A400M Atlas, a European four-engine turboprop military transport aircraft. These upgrades, known as the “Parallel Mission System” (PMS), aim to equip French A400M with multi-mission capabilities in the fields of intelligence, surveillance and reconnaissance (ISR).

The PMS development focusses on the integration of a new mission system on board, as well as tactical situational awareness consoles installed in the cargo hold to monitor various sensors and coordinate missions. They also aim to integrate an optronic sensor onto the aircraft. This new mission system is designed to integrate additional sensors and communication systems, as well as to manage drones and missiles launched from the aircraft’s cargo hold. Ultimately, the aircraft crew will be able to coordinate missions involving ground troops, helicopters – notably the Tiger and Caracal H225M – and fighter jets in a collaborative combat mode. Following a development phase, the new equipment will be installed on board the first French A400M in 2027 and tested in flight in 2028. A number of aircraft in the Air and Space Force fleet will then be retrofitted to accommodate a PMS kit. Furthermore, Airbus Defence and Space is already exploring the development of other capabilities for the A400M, such as long-range jamming, a mother-ship function for the in-flight release of drones and missiles, an increase in payload capacity to 40 tonnes, and finally firefighting capabilities. All these developments will further expand the capabilities and missions of the A400M, which are essential to meeting the current and future global needs of armed forces. ■

India Fortified: ₹52,000 Crore Defence Shield Cleared, Focus on Air Defence and Next-Gen Drone Warfare

The Defence Acquisition Council (DAC), India’s premier decision-making body for military procurement, chaired by Defence Minister Rajnath Singh, has accorded critical Acceptance of Necessity (AoN) approvals for capital acquisitions totalling ₹52,000 crore.

This wide-ranging clearance marks a significant milestone in India’s ongoing efforts to modernise its tri-services while aggressively advancing self-reliance through indigenous production. The massive capital injection targets critical operational gaps, with an unprecedented emphasis on bolstering counter-drone technologies, stratosphere surveillance, electronic warfare, and deep-layered air defence arrays.

For the Indian Army, the DAC has approved an expansive array of highly specialised protective and offensive hardware designed to upgrade infantry and armoured columns. Central to this defensive umbrella is the indigenous Akash Tarang anti-drone electronic warfare system, which will provide vital shielding against hostile aerial swarms.

The Army is also set to receive Medium-Range Surface-to-Air Missile (MRSAM) systems to counter high-velocity aircraft, helicopters, and drones at intermediate distances, alongside Very Short-Range Air Defence Systems (V-SHORADS) for localised tactical protection. To secure its frontline armour, the council approved Active Protection Systems (APS) for tanks, which act as automated shields to intercept incoming anti-tank projectiles before impact. The Indian Navy’s maritime domain awareness and defensive capabilities are also receiving a major boost. The DAC cleared the acquisition of advanced multi-influence ground mines alongside



sophisticated naval shipborne unmanned aerial systems to expand the surveillance footprint of vessels at sea.

Crucially, the approval outlines the establishment of a revolutionary Land-Based Testing Facility (LBTF) for the Navy. This specialised facility will replicate a ship’s intricate onboard power, combat and propulsion architectures, allowing local engineers to test and perfect cutting-edge electric propulsion technologies for future warship classes.

Meanwhile, the Indian Air Force is poised to enter a new era of persistent intelligence gathering with the approval of Fixed-Wing High Altitude Pseudo Satellite (FW-HAPS) platforms. Operating deep within the stratosphere at an altitude of approximately 20 kilometres, these advanced platforms bridge the gap between traditional aircraft and orbital satellites. Fitted with cutting-edge electro-optical/infrared sensors and high-resolution cameras, a pseudo satellite can remain stationary over a targeted region for weeks or even months at a time.

It provides the armed forces with uninterrupted reconnaissance, high-resolution live imagery, and highly secure communications networks. Because these systems can be deployed dynamically on demand and recovered safely like conventional aircraft, they offer a highly versatile, cost-effective alternative to launching dedicated military satellites. ■

Indian Army Plans Massive K9 Vajra Acquisition

The Indian Army is advancing plans to procure an additional 300 K9 Vajra self-propelled howitzers, marking its largest-ever artillery acquisition in decades to drastically boost mobile firepower along tense border frontiers.

In a massive step toward long-range artillery standardisation, the Indian Army has laid the groundwork for a mega-defence deal estimated at roughly ₹23,000 crore. The proposed acquisition of 300 additional units will scale up the Army's total fleet of K9 Vajra tracked self-propelled howitzers to 500 guns.

The force initially inducted 100 of these heavy artillery systems under a 2017 contract and subsequently pursued an additional 100 systems. This newest, largest-ever expansion aims to equip approximately 25 artillery regiments, significantly exceeding numbers originally planned under the military's Field Artillery Rationalisation Plan.

The K9 Vajra is a formidable 155 mm/52-calibre tracked self-propelled artillery gun system designed for devastating precision strikes. Built on a heavily armoured tracked platform, the system thrives in harsh terrains - ranging from barren deserts to high-altitude mountain regions - boasting a maximum operational speed of 67 km/h and an active combat range of 480 km.

Crucially, the system features a specialised "shoot-and-scoot" capability. It can halt, fire an array of rounds within 30 seconds, and completely relocate in under a minute, heavily



neutralising the threat of retaliatory enemy counter-battery fire.

The multi-billion-crore project stands as a major victory for India's Aatmanirbhar Bharat defence initiative. Originally developed by South Korea's Hanwha Aerospace, the K9 Vajra is licensed and assembled locally by Larsen & Toubro (L&T) at its specialised armoured systems complex in Hazira, Gujarat.

The production programme incorporates substantial domestic manufacturing, encompassing 14 major sub-systems developed entirely within India - including the main fire-control system, communications networks, the gunner's primary sight, and onboard Nuclear, Biological, and Chemical (NBC) crew protection systems.

By value, local components already comprise over 50% of the platform, and the upcoming massive order of 300 units is expected to push indigenous content even further while sustaining India's defence industrial base. ■

EDGE Group and Safran Seal Strategic Agreement in Aerospace & Defence

EDGE Group, the UAE-based advanced technology and defence group, and Safran, the French aerospace and defence leader, today signed a Strategic Cooperation Agreement at Eurosatory 2026, establishing a structured framework for a deeper cooperation and broadening the scope of joint work across the wider portfolios of both groups. EDGE Group and Safran cooperate on several programmes across defence electronics, smart weapons and other key areas, building on more than three decades of Safran's presence in the United Arab Emirates. The Strategic Cooperation Agreement further strengthens this partnership by extending its scope to a broader range of equipment, capabilities and know-how that the two groups can address together. It responds to the profound shift in modern warfare, including the growing role of unmanned systems, electronic warfare and the need for greater resilience and autonomy of defence capabilities. ■

DRDO Perfects Single Crystal Blade Tech for Advanced Jet Engines

India's Defence Research and Development Organisation has successfully perfected indigenous single crystal turbine blade technology, placing the nation into an elite global group capable of manufacturing critical, ultra-high-temperature aero-engine components. The Defence Research and Development Organisation (DRDO) has closed a critical technological gap with the world's leading military powers by mastering the design and casting of Single Crystal (SX) turbine blades. This manufacturing milestone provides India's aerospace sector with a vital component required to develop dependable, locally produced powerplants for military

aircraft and helicopters.

With the lab-scale phase successfully completed, DRDO is actively transitioning the technology to domestic private-sector defence firms. This deliberate transfer of technology (ToT) aims to establish a reliable, commercial-scale production infrastructure capable of securing stringent airworthiness certifications for mass production.

The development of single crystal blades carries major strategic benefits for India's defence ecosystem, directly supporting self-reliance initiatives like Aatmanirbhar Bharat. The technology will serve as a foundational building block for multiple ongoing and future

national aerospace programmes:

It will optimise the performance and reliability of domestic gas turbine spin-offs, ensure supply of core components for high-thrust engines designed for future multi-role fighters, and will also assist domestic programmes like the Indian Multi-Role Helicopter (IMRH) to operate safely in hot and high-altitude mountain environments.

By securing this specialised manufacturing capability locally, India effectively cuts its historical dependence on foreign suppliers for critical engine spares, ensuring its future frontline combat fleet remains self-sustaining. ■

QNu Labs Inks Landmark Security Research Pact at Bharat Innovates 2026

Bengaluru-based QNu Labs has signed a strategic research agreement with Eindhoven University of Technology to co-develop next-generation quantum cybersecurity solutions, anchoring India's position in the global deep-tech race.

The strategic agreement, formalised during the high-profile Bharat Innovates 2026 summit in France, marks a major milestone for India's burgeoning quantum technology ecosystem. By uniting with the Netherlands' prestigious Eindhoven University of Technology (TU/e), QNu Labs is building a powerful cross-continental bridge to accelerate the commercialisation of quantum-safe networking and cryptographic protocols.

As commercial quantum computers advance toward breaking classical encryption standards, the race to



implement Quantum Key Distribution (QKD) and Post-Quantum Cryptography (PQC) has become a matter of national and global security.

The QNu Labs and TU/e partnership will explicitly target co-developing high-rate, long-distance QKD systems capable of protecting critical infrastructure, banking networks, and defence communications, further enhance cutting-edge European foundational physics research into scalable,

ruggedised hardware manufactured right in India, and building cryptographic frameworks that seamlessly integrate into both European and Indian telecommunication architectures.

The announcement stood as a centrepiece of the Bharat Innovates 2026 pavilion, underscoring New Delhi's aggressive push under the National Quantum Mission to transform India from a software consumer into a deep-tech hardware exporter.

By leading with ready-to-deploy quantum security products on an international platform, domestic pioneers like QNu Labs are demonstrating that Indian deep-tech firms possess the maturity required to collaborate with, and protect, the world's most advanced digital economies.

National Military Drone Technology Hub at

The Ministry of Defence (MoD) has granted an in-principle approval for a ₹500-crore National Military Drone Technology Hub at IIT Kanpur, accelerating India's self-reliance in cutting-edge unmanned aerial systems and countermeasures.

The strategic clearance, driven by a proposal from the Uttar Pradesh Defence Industrial Corridor framework, aims to establish a full-stack domestic capability for advanced defence technology. The state-of-the-art facility will serve as India's premier integrated node for designing, testing, and certifying critical military payloads, specialised data links, ground control systems, and advanced counter-drone architectures.

Rather than focusing solely on basic airframe assembly, the upcoming national hub is engineered to solve complex, high-tier aerospace bottleneck challenges. IIT Kanpur will leverage its extensive existing infrastructure - including its

unique 60-year-old operational on-campus airstrip, flight laboratories, and national wind tunnel facilities - to develop end-to-end combat capabilities:

The new hub will focus on developing specialised electro-optical tracking systems, electronic warfare modules, and weaponised delivery packages, besides developing highly encrypted, jam-resistant communication arrays to secure drone operations in contested environments, and will build multi-layered interception systems, combining artificial intelligence detection with kinetic and electronic defeat mechanisms. The IIT Kanpur National Drone Hub operates across three core functional pillars. First, it drives Research & Development (R&D) and Prototyping by developing advanced AI systems, military-grade payloads, and secure data links. Second, the facility manages comprehensive Testing and Validation by utilising its dedicated on-campus airstrip



Navantia Tests the AIP Propulsion System on Submarine S83

Navantia, at its Cartagena shipyard, has begun testing of the Air Independent Propulsion system (AIP) already incorporated into the section of submarine S-83 'Cosme García', the third unit in the S80 series. These final tests are starting after all prior installation work on the various pieces of equipment required for their proper execution has been completed. The tests will make it possible to carry out the necessary adjustments to the system in its actual location before joining the 12-metre-long, approximately 400-tonne section to the rest of the submarine's pressure hull. The section of S83 carrying the AIP is located in a special test facility at the Cartagena shipyard, known as IPS3, where a multidisciplinary task force from the Submarine Business has carried out all the necessary checks to begin testing.

Testing of the AIP in its section has begun with the first loading of liquid



oxygen and bioethanol, from which the system produces hydrogen to fuel its hydrogen fuel cell and propel the submarine while submerged. It is therefore a third-generation AIP system - that is, it does not carry stored hydrogen, but generates it on demand from a liquid fuel - overcoming the limitations of previous generations currently in operation.

Air-independent propulsion will give

the S80 submarines the ability to operate submerged for weeks rather than days - the period for which current conventional submarines equipped with lead-acid batteries can remain underwater - thereby enhancing their stealth and deterrence capability. The testing process on board the S83 section represents a new milestone for the AIP, a system with a high level of national technological content that highlights the progress of the programme, with S82 undergoing harbour trials and S83 and S84, the next two units, under construction at the Cartagena shipyard.

With a high degree of stealth, advanced combat systems and state-of-the-art sensors, as well as a design optimised for long-duration operations, the S-80 submarines place Spain among the countries with the technological capability to develop this type of strategic platform. ■

IIT Kanpur

and specialised wind tunnel laboratories to evaluate flight readiness. Finally, the hub accelerates Industrial Scaling by incubating deep-tech defence startups to establish a robust domestic manufacturing pipeline for frontline military supply.

To bypass traditional bureaucratic delays and accelerate deployment timelines, the MoD has appointed the Army Design Bureau (ADB) as the single point of contact. The ADB will act as a direct intermediary, seamlessly linking the technical research emerging from IIT Kanpur with the real-world operational requirements of front-line armed forces.

The initiative directly ties into the Uttar Pradesh Defence Industrial Corridor (UPDIC) targets, creating a centralised ecosystem where academic researchers, deep-tech startups, and private defence manufacturers can collaborate under strict airworthiness and military standardisation protocols. ■

EDGE and 4iG S&D Partner for Advanced Security Technologies

EDGE, one of the world's leading advanced technology and defence groups, and 4iG Space and Defence Technologies (4iG S&D), a leading Hungarian defence and technology company, have signed a preliminary agreement at Eurosatory 2026 to establish a joint venture in Hungary focused on non-lethal defence technologies through EDGE entity CONDOR Non-Lethal Technologies (NLT). The initiative also includes plans for a regional expertise and testing centre dedicated to supporting European military, law enforcement, and public security organisations. Building on the Memorandum of Understanding signed in August 2025, the agreement advances cooperation in non-lethal technologies while supporting the development of localised industrial capabilities, specialised training, and operational expertise in Hungary and across the wider European market.

Under the framework of the agreement, the planned centre will provide comprehensive support for equipment

evaluation, testing, operational training, and capability development, enabling end users to assess and employ non-lethal technologies in increasingly complex security environments.

The planned joint venture will focus on the development, manufacture, and commercialisation of advanced non-lethal defence solutions, including specialised ammunition, pyrotechnics and smart defence technologies. The establishment of local production capabilities is expected to support growing demand for non-lethal systems designed to minimise collateral injury while enhancing operational effectiveness across military and law enforcement applications. The agreement reflects EDGE's broader strategy of expanding international industrial partnerships, supporting localised capability development, and advancing innovative technologies that address evolving security requirements while creating long-term value through industrial cooperation and knowledge transfer. ■

EDGE Seals Business France Partnership Agreement

EDGE entity CONDOR Non-Lethal Technologies, a leading global provider of less-lethal solutions, signed a Memorandum of Understanding (MoU) with Business France at Eurosatory 2026 in Paris. France's Ambassador to Brazil, His Excellency Emmanuel Lenain attended the ceremony, in addition to senior leadership from both companies. The agreement marks an important milestone in CONDOR's internationalisation strategy and reinforces EDGE Group's broader vision of strengthening its industrial, technological and commercial presence across Europe through strategic partnerships and localised capabilities.

The framework establishes cooperation designed to facilitate industrial, technological, and commercial collaboration between CONDOR and the French defence and security ecosystem. The initiative reflects the shared commitment of CONDOR and Business France to enhance cooperation between Brazil and France, promoting innovation, industrial collaboration and the exchange of expertise. France is one of CONDOR's most strategically important markets in Europe. For several years, the company has maintained ongoing contracts with French security forces, supplying tens of thousands of less-lethal munitions and other non-lethal solutions to French law enforcement agencies, including the French National Gendarmerie and the French National Police. These deliveries have supported public order and law enforcement operations, contributing to modern and proportionate security practices. ■



Indian Industrial Titans in Mega-Bid for £2.8 Billion Military Drone Project



Ten frontline public and private sector defence firms have launched competing bids to build 87 advanced, strike-capable unmanned aircraft for the Indian Air Force under a landmark sovereign manufacturing deal.

The massive procurement initiative, valued at over £2.8 billion (₹30,000 crore), closed its final submission window on Tuesday, June 16, 2026. The Ministry of Defence had previously extended the tender deadline twice to provide domestic aerospace companies adequate time to formulate complex technical proposals. This massive project aims to completely replace foreign multi-mission drone reliance with localised manufacturing infrastructure. The competitive lineup represents a comprehensive directory of the country's aerospace ambitions, combining veteran state enterprise with agile private engineering conglomerates.

The bidding lineup for the £2.8 billion surveillance and strike contract is divided into three distinct sectors of the Indian industrial ecosystem.

First, representing state-backed power is Hindustan Aeronautics Limited (HAL), the nation's veteran public-sector aerospace manufacturer. Second, the pool includes massive private-sector industrial conglomerates, specifically Tata Advanced

Systems, Larsen & Toubro (L&T), and Adani Defence Systems. Finally, the final segment features deep-tech specialists focused on advanced defence engineering, represented by Solar Defence & Aerospace and Raphe mPhibr Ltd.

The selected prime contractor will be tasked with manufacturing 87 Medium-Altitude Long-Endurance (MALE) Unmanned Aerial Vehicles (UAVs). These platforms are engineered to meet strict operational parameters finalised through an intensive, scientific military study. The overarching strategic goal is to establish persistent, round-the-clock intelligence, surveillance, and reconnaissance (ISR) coverage along heavily contested border regions bordering Pakistan and China.

The introduction of these long-endurance platforms provides a crucial capability boost for high-altitude missions. Operating across the rugged northern frontier requires continuous loitering thresholds at extreme altitudes - a task that is incredibly difficult to sustain using manned aircraft alone. With the bids officially under technical evaluation, this contract will solidify a domestic production pipeline while boosting local component suppliers and manufacturing jobs across the country's growing aerospace hubs. ■

Kalyani Strategic and AM General Ink Strategic Partnership to Offer Distinct Mounted Artillery Gun Systems

Kalyani Strategic Systems Limited (KSSL), the wholly owned defence subsidiary of Bharat Forge Limited, signed a strategic partnership with AM General, a leading military vehicle mobile defence capabilities provider at Eurosatory defence exposition.

This strategic partnership between AM General and KSSL addresses the requirement of modern armies of the world in an evolving combat scenario equipping them with compact, robust, light weight, ruggedised, mobile, all weather, all terrain Next-Gen Mounted Artillery gun platforms, with a distinct competitive edge.

There are numerous opportunities globally, and the partnership is intended to support broader allied distribution, positioning the platform as a scalable, exportable artillery solution for partner nations seeking modern, mobile, and survivable 155mm fires capability.

Leveraging this strategic partnership, AM General has also offered a proposal to participate in the US Army Mobile Tactical Cannon (MTC) programme. The proposal to the US Government includes the development and delivery of a 155mm MTC solution based on the mature, combat-



relevant architecture of KSSL's Mounted Artillery Gun platform, with delivery planned in 2027 upon its down-selection.

The MARG system delivers class-leading strategic transportability and tactical mobility through the combination of a purpose-built powerpack and suspension and a lighter gross vehicle weight rating. It's 52-calibre 155mm cannon is combined with the patented Soft Recoil Technology (SRT) and Recoil Mitigation system, an automated load-assist, and an advanced all-weather fire control suite providing indirect and direct fire capabilities.

The system can also fire a standard high-explosive projectile over 40 kilometres and carries over 20 projectiles and propellant charges on-board. The MARG's SRT system absorbs significantly more recoil force than traditional artillery systems and this allows for a lighter vehicle, lighter turret, and less shock on the entire weapons system over its life. KSSL takes pride in building, designed and made in India, globally benchmarked defence platforms, driven by the purpose of delivering technologically advanced, strategic defence capabilities for India, and the world. ■

SMPP Partners with KNDS to Manufacture Advanced LMs in India

SMPP, one of India's leading defence and aerospace companies, has entered into a teaming agreement with KNDS, through its subsidiary SMPP Ammunition, to manufacture state-of-the-art Loitering Munitions (LMs) in India. The partnership aligns with the Government of India's Aatmanirbhar Bharat vision by combining technology transfer with indigenous manufacturing. Validated in recent conflicts, these Loitering Munitions are designed to deliver high accuracy while addressing the critical operational requirements of modern warfare. The

agreement was signed on June 18, 2026, at the Eurosatory Exhibition in Paris.

These Loitering Munitions include the VELOCE and RODEUR systems, along with the ISTAR family of drones, enabling a highly effective "search-and-destroy" capability. These systems offer the capability to neutralise high-value threats with exceptional precision and leverage a hybrid guidance system that combines a multi-constellation Global Navigation Satellite System (GNSS) receiver with an Inertial Navigation System (INS) to ensure accuracy across diverse terrains

and combat environments. Its fire-and-forget capability further enhances their effectiveness in complex operational scenarios, including precision strikes against strategic enemy assets. Under the teaming agreement, SMPP and KNDS will focus on offering these Loitering Munitions to the Indian Army under the Make in India framework, strengthening India's capability to address key operational requirements of the Indian Armed Forces. This agreement comes at a time when the Indian Army has a significant and urgent requirement for advanced Loitering Munitions. ■

Rafael and SpearUAV to Develop and Market Iron Wasp

Israeli company Rafael, and SpearUAV, an Israeli company developing AI-based encapsulated weapon systems, announced a strategic collaboration to develop and market the Iron Wasp.

Iron Wasp is an advanced encapsulated UAS interceptor, a derivative of SpearUAV's Viper I (Interceptor) that brings an organic, on-the-move aerial interception capability directly to ground combat platforms. Deployed from a compact multi-canister launcher integrated directly onto a fighting vehicle, Iron Wasp provides an autonomous, ready-on-demand intercept option that complements the wider force protection suite without adding operational burden to the crew. Built on the core technologies of SpearUAV's proven Viper family of loitering weapon systems, Iron Wasp is designed for integration with Rafael's sensor and lethality solutions, including the detection and tracking systems already deployed across Rafael's force protection portfolio. Its open architecture supports compatibility across a wide range of armoured and tactical platforms, enabling flexible fielding across diverse customer requirements.

The collaboration joins SpearUAV's expertise in autonomous encapsulated UAS technology with Rafael's track record in system integration, combat-proven lethality, and the delivery of scalable, interoperable protection architectures to defence forces worldwide. Housed within a compact multi-canister launcher, Iron Wasp integrates directly onto a wide range of ground combat platforms and their C2 systems without significant modification. Designed for integration with Rafael's combat-proven sensors and warhead solutions, it supports versatile application across diverse operational scenarios, platform types, and force protection configurations. ■

Schiebel and Thales Unveil Armed Camcopter S-301 Drone

Austrian drone manufacturer Schiebel, in collaboration with defence leader Thales, has unveiled an armed variant of its next-generation Camcopter S-301 vertical take-off and landing drone, creating a lethal sensor-to-shooter platform. The rapid transformation of contemporary combat zones highlights a vital operational

requirement for versatile unmanned aircraft capable of executing persistent reconnaissance and direct strike actions simultaneously. Staged during the Eurosatory 2026, international defence exhibition in Paris, the public debut of the weaponised Camcopter S-301 system represents a major evolutionary leap for tactical rotary-wing drones.

Developed under the specialised stewardship of Schiebel Defence, the high-performance platform has been extensively modified to act as a unified airborne engagement hub. By seamlessly integrating guided rockets alongside newly engineered loitering munitions, the heavy-lift uncrewed helicopter completely compresses the traditional military kill chain, allowing front-line commanders to locate, track, and destroy high-value assets without deploying separate tracking assets or relying on external artillery networks. The baseline engineering of the platform is designed to sustain demanding multi-domain missions across both land and naval environments. Weighing 485 kilogrammes, the rugged airframe stands 1.8 metres tall and relies on a combat-proven heavy-fuel engine that is fully compatible with standard NATO aviation fuels, streamlining field logistics.

With a maximum gross payload capacity of 350 kilogrammes, the uncrewed helicopter delivers an exceptional flight endurance of up to 10 hours and an operational ceiling of 5500 metres. As it uses a vertical take-off and landing framework, the system operates independently from vulnerable runway infrastructure, launching directly from unfortified forward locations or the restricted helipads of single-spot naval vessels. Furthermore, advanced built-in flight control software allows for



complete operational autonomy, including automated launch and recovery parameters, pre-planned flight route management, and seamless emergency return-to-base protocols.

The defining characteristic of the platform's devastating capability includes multi-tiered strike loadout mounted on reinforced wing stubs. For direct kinetic engagements, the drone is outfitted with two Thales rocket pods containing laser-guided munitions, which deliver pinpoint precision against fixed positions and moving vehicles at stand-off ranges. This direct-fire capability is powerfully augmented by the integration of the brand-new Toutatis loitering munition system, a cutting-edge short-range strike asset developed through an industrial partnership between Thales and the Renault Group. Weighing less than five kilogrammes and sporting a modular wingspan under one metre, the Toutatis drone is ejected directly from the airborne helicopter, reaching attack speeds of over 150 kilometres per hour across a 30-kilometre range.

Equipped with an interchangeable one-kilogramme warhead, this sub-munition can linger stealthily over a target area for up to 30 minutes, giving operators an option to defeat light armoured targets and infantry fighting vehicles with surgical accuracy. To ensure survival in highly contested modern environments, the rotary platform relies on deep sensor fusion and robust electronic hardening. Alongside its heavy weapon load, the platform carries advanced day-and-night electro-optical and infrared targeting gimbals, maritime surveillance radars and active electronic warfare suites to maintain total situational dominance. ■

Flying Wedge Defence Unveils India's First AI-Piloted Fighter Jet Concept

In a historic leap for India's defence ecosystem, Flying Wedge Defence & Aerospace (FWDA), an Indian AI warfare company, on June 23 unveiled the nation's first AI-Piloted Fighter Jet Concept, FWD Supreme. Designed to advance the future of air combat through the Mobbing Doctrine, the company also announced that the first flight of its FWD Supreme Lite technology demonstrator is targeted for Q3, 2026.

With the programme, India enters the global AI fighter race with a new doctrine. It joins an exclusive group of top 3 nations, including the United States, Turkey, and Germany that are actively pursuing AI-piloted fighter aircraft programmes aimed at redefining the future of air combat.

Unlike conventional unmanned aircraft that are remotely operated by human pilots, FWD Supreme is an AI-piloted fighter jet which will use Artificial Intelligence (AI) to fly itself. The programme aims to integrate advanced situational awareness, sensor fusion, autonomous decision-making, cognitive mission execution, and advanced combat capabilities into a next-generation fighter jet architecture.

FWD Supreme is being designed to perceive, analyse, decide and act in highly contested environments with minimal human intervention. The platform is being built around the Mobbing Doctrine, a new warfare doctrine envisioned by Suhas Tejaskanda, Founder and CEO of FWDA.



The unveiling of FWD Supreme marks the beginning of a long-term development roadmap aimed at creating scalable AI-piloted combat aircraft capable of supporting future military operations across air, land and maritime domains.

Focused on the development of next-generation combat aviation technologies, Flying Wedge believes that AI-piloted fighter aircraft will become a defining element of future warfare, enabling nations to field intelligent, adaptable and collaborative combat systems capable of operating across increasingly complex operational environments.

With a growing portfolio of autonomous strike systems, AI-enabled combat platforms, and scalable unmanned aircraft programmes, Flying Wedge Defence & Aerospace aims to position India as a global hub for next-generation autonomous defence technologies.

Bharat Forge to Supply Gas Turbine Generators to the Indian Navy

Bharat Forge Limited (BFL) on June 19 signed a ₹425 crore contract with the Ministry of Defence (MoD), India, for the supply of Gas Turbine Generators (GTGs) to the Indian Navy (IN) for onboard power generation on Kolkata class ships. The contract will be executed over a period of five years. Rated at 1.25 MW, the new GTGs will replace the lower capacity units currently in service onboard. Awarded under the Buy (Indian) category of the Defence Acquisition Procedure 2020 (DAP-2020), the contract marks BFL's entry into the marine gas turbine (GT) business - and will deliver the first indigenous GT-based power plant to operate aboard Indian naval ships. A leader in India's defence industry, a proven manager of complex programmes and a trusted partner of the Indian armed forces, BFL will establish a dedicated Integration and Test facility for GTGs. BFL will also participate in design and development programmes for larger power plants and propulsion GTs.

Scaling New Heights: GRSE Accorded Navratna Status

Garden Reach Shipbuilders and Engineers (GRSE) Ltd was accorded Navratna status by the Department of Public Enterprises, Ministry of Finance, Government of India, on Friday, June 19, 2026, signifying a monumental milestone in the shipyard's journey. This was in recognition of the shipyard's consistent financial and physical performance over the years.

GRSE's financial performance over the last five years reflects its remarkable growth trajectory and operational excellence. The Company's Revenue from Operations has grown from ₹1,754 crore in FY 2021-22 to ₹7,002 crore in FY 2025-26, registering an increase of nearly 300%. During the same



period, Profit After Tax (PAT) has risen from ₹190 crore to ₹748 crore, reflecting a growth of nearly 294%. A firm proponent of the Government's Aatmanirbharta and "Make

in India" visions, the shipyard also delivered eight warships during the year, including three on the same day on March 30, 2026. These include P17A advanced guided-missile frigate Dunagiri, Sanshodhak - a Survey Vessel (Large) and Anti-Submarine Warfare Shallow Water Craft - Agray. Navratna status allows Public Sector Enterprises to make larger investments, enhancing their ability and expand operations. The elevation to a Navratna status for GRSE comes at a time when the shipyard is in an expansion mode. It has embarked on a mission to increase capacity through both brownfield and greenfield projects.



Agnikul and ICEYE to Explore Integrated Sovereign Launch Capabilities in India

Agnikul Cosmos, India's leading private full-stack space transportation company, and ICEYE, the world leader in sovereign intelligence from space, have signed a Memorandum of Understanding (MoU) to explore the potential to build, launch and operate Synthetic Aperture Radar (SAR) earth observation systems in India. Agnikul and ICEYE announced this at a globally significant event for India - Bharat Innovates - which was held in Nice, France. The event which saw participation from President Emmanuel Macron and Prime Minister Narendra Modi, specifically had Agnikul Cosmos as the only launch vehicle builder from India showcasing its fully reusable rocket technology to the world. The partnership aims to explore ICEYE's SAR satellite expertise and its establishment of satellite manufacturing capabilities in India and Agnikul's full-stack responsive launch capabilities. It brings together two technology forces from different continents, each world-class in its own domain. Agnikul contributes reusable launch infrastructure built around single-piece 3D-printed rocket engines that reduce manufacturing time from months to days, the kind of responsiveness that global satellite operators increasingly seek. ICEYE brings proven sovereign satellite technology that seven governments across Europe have already staked their national intelligence capabilities on, having delivered Poland's sovereign SAR constellation less than 12 months after contract signing, one of the fastest sovereign satellite deployments globally. ■

QNu Labs Partners with SAGA Consultants For Quantum Safe Cybersecurity Solutions

QNu Labs, a global leader in end-to-end hybrid quantum cybersecurity solutions, has announced a strategic partnership with SAGA Consultants, a US based technology consulting firm, to expand the reach of quantum safe cybersecurity solutions across global markets.

The collaboration brings together QNu Labs' expertise in quantum cryptography and secure communications with SAGA Consultants' deep consulting capabilities and industry relationships to help organisations strengthen cyber resilience in an increasingly complex threat landscape.

As quantum computing advances, enterprises, governments and critical infrastructure operators worldwide are reassessing their cybersecurity strategies to address emerging risks that could compromise traditional encryption methods. Through this partnership, QNu Labs and SAGA Consultants will drive the adoption and deployment of quantum safe security solutions, enabling organisations to access advanced technologies across quantum-secure communications, cryptographic security, network protection and secure digital infrastructure.

By combining QNu Labs' innovation in quantum cybersecurity with SAGA Consultants' market expertise, the collaboration aims to strengthen long-term cyber resilience, accelerate



quantum readiness and help organisations' safeguard sensitive data, critical communications and digital assets while navigating an increasingly complex security and regulatory landscape.

QNu Labs has emerged as a leading innovator in quantum cybersecurity, developing indigenous technologies that address the growing need for secure communications and data protection in a post-quantum world. Through continuous research and development, the company is advancing solutions that help organisations strengthen trust, privacy and resilience across their digital ecosystems. Together, QNu Labs and SAGA Consultants will work closely with enterprises, industry stakeholders and technology leaders to accelerate the adoption of future-ready cybersecurity frameworks and support the growing demand for quantum safe security solutions worldwide. ■

Merlinhawk Composites Inaugurates Advanced Composites Facility in Tamil Nadu

Merlinhawk Aerospace Pvt Ltd, in partnership with Italy-based Vega Composites, on June 30 inaugurated its advanced composites manufacturing facility - Merlinhawk Composites & Engineering Pvt Ltd at Shoolagiri at the Tamil Nadu Defence Industrial Corridor, marking a significant step in India's evolution as a globally competitive aerospace manufacturing hub. The facility was inaugurated by former Chief of Navy Staff (CNS), Admiral Dinesh K Tripathi, in the presence of senior industry leaders, global partners, and key stakeholders from India's defence and manufacturing ecosystem. This milestone formalises a strategic India-Italy collaboration, bringing together global expertise in advanced materials and manufacturing technologies with India's growing engineering and industrial capabilities. The Shoolagiri facility is designed to manufacture advanced composite aero structures and high-performance materials that are critical to next-

generation aerospace and defence platforms, including aircraft and unmanned systems, radar and electronic warfare structures and high-performance defence applications. With integrated capabilities spanning cleanroom layout, precision cutting, autoclave curing, and five-axis CNC machining, the facility enables end-to-end composite manufacturing from design to delivery within India. It also reflects a deeper shift in India's defence ecosystem - from build-to-print manufacturing to design-led, high-value engineering capabilities. The facility integrates globally aligned manufacturing technologies and processes, with key equipment and systems sourced from leading European partners, reinforcing its positioning as a globally compliant aerospace manufacturing centre. This collaboration enables technology transfer from Europe, strengthens capabilities in advanced materials and supports integration into global aerospace supply chains. ■



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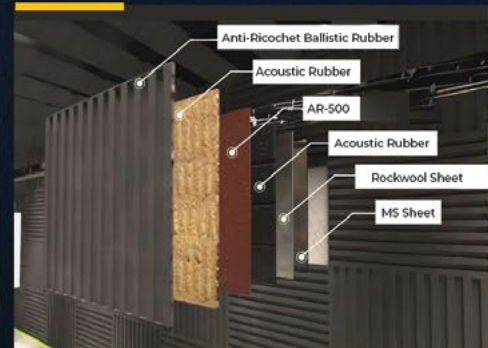
MOBILITY

The containerized shooting range can be easily transported and deployed to virtually any location, offering flexibility for both permanent and temporary training setups. Its mobility is highly beneficial for remote areas or missions that require quick setup and takedown.



MODULARITY

These ranges are modular and customizable to meet specific training requirements, such as different shooting distances, ballistic standards, and target systems. Multiple containers can be combined to create larger or more complex range systems, such as multi-room tactical training environments.



SAFETY

Equipped with advanced anti-ricochet materials, ballistic-rated walls, and soundproofing, Our ranges ensure the highest levels of safety for users. These materials are designed to absorb rounds, preventing hazards from ricochet and stray bullets, while also minimizing noise pollution.



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