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EDITORIAL

Ajit Kumar Thakur
Editor & Business Director

WHY INDIA MUST REWRITE ITS PLAYBOOK

An undercurrent of tension and discomfort is palpable across the global landscape today—be it climate change, geopolitical strife, security challenges, or economic volatility. The dynamic power play has turned the world into a high-stakes arena, with the majority of nations finding themselves on the defensive—locked in a relentless struggle for stability and relevance. In such an unpredictable, unsafe, and turbulent world, it's time for a global Reset; otherwise, survival itself may become increasingly difficult. Delusionary escapism—whether through the Ostrich Syndrome or the Pigeon Approach—is no longer an option.

As India continues its journey toward realising the *Viksit Bharat* 2047 vision, it must adopt a more strategic, pragmatic, and an agile approach. The ongoing "Year of Reforms" demands calibrated steps to break free from the shackles of legacy burdens and bureaucratic inertia. Now is the time for India to craft a bold new roadmap—one that prioritises real-world performance, efficiency, rapid adaptation, technological integration, and innovation. Only by leveraging these imperatives can India convert looming threats into sustainable opportunities and secure its demographic dividend before it risks deteriorating into a demographic debt.

> "The ongoing "*Year of Reforms*" demands calibrated steps to break free from the shackles of legacy burdens and bureaucratic inertia. Now is the time for India to craft a bold new roadmap—one that prioritises real-world performance, efficiency, rapid adaptation, technological integration, and innovation"

At the heart of India's global power aspirations lies national security, underpinned by economic resilience and technological supremacy. However, a significant capability gap persists, and bridging it will require India to rediscover its innovative zeal and unleash a transformative industrial and technological revolution. The strategic imperative must shift from being a mere technology consumer and follower to becoming a pioneering technology leader. This demands early and sustained investment in nurturing homegrown talent, particularly in niche and disruptive technologies, to secure first-mover advantage.

The first quarter of 2025—dubbed the "Year of Reforms"—saw a renewed push for *Aatmanirbharta* (self-reliance), particularly in defence. The Ministry of Defence's FY 2024-25 contracts worth ₹209,050 crore, with 81 per cent awarded to domestic players, underscore this commitment. India's burgeoning defence exports further highlight the gradual maturation of its indigenous defence ecosystem. The second quarter has begun on an equally promising note, with a flurry of new contracts. The DRDO Chairman's optimistic projection—that India will achieve around 90 per cent self-reliance in defence production within 4–5 years—reflects this buoyant sentiment. He identified high-potential sectors for Indian defence startups: UAVs, anti-UAV technologies, sensors, and space, stressing the urgency of early market capture.

To sustain this momentum, India must double down on indigenising critical technologies—those that underpin both national security and economic sovereignty. Policy reforms, regulatory flexibility, and sustained government-industry collaboration will be instrumental in unlocking the domestic defence industry's full potential.

The world is undergoing a momentous churn, today. Increasingly assertive and reactionary nationalism is blurring the distinctions between democracy and autocracy, while liberal values face unprecedented scrutiny. The Russia-Ukraine war and the Hamas-Israel conflict continue to destabilise the global order, fuelling uncertainty and realigning alliances. As global markets turn inward, trade becomes a geopolitical weapon, and economic rules are rewritten under political duress, India's ascendant ambitions will face fiercer headwinds. The global challenges underscore the urgency of India's adaptation. Navigating this volatile landscape will require more strategic autonomy, diplomatic agility, proactive economic policies, and enhanced competitiveness. Preparedness will be the ultimate differentiator amidst the ongoing global turbulence.

As *Raksha Anirveda* reinforces its niche as a defence and security publication with a difference, our April-June 2025 edition delivers compelling, thought-provoking, and actionable insights. We hope this issue resonates deeply with our esteemed readers, industry, intelligentsia and policy-makers, and sparks meaningful discourse in areas of vital importance.

Join the ongoing yearlong celebrations at *Raksha Anirveda*, which completes seven eventful years. Become a catalyst and a vital part of *Raksha Anirveda's* journey ahead!

Happy Reading! Jai Hind!!

(Ajit Kumar Thakur)

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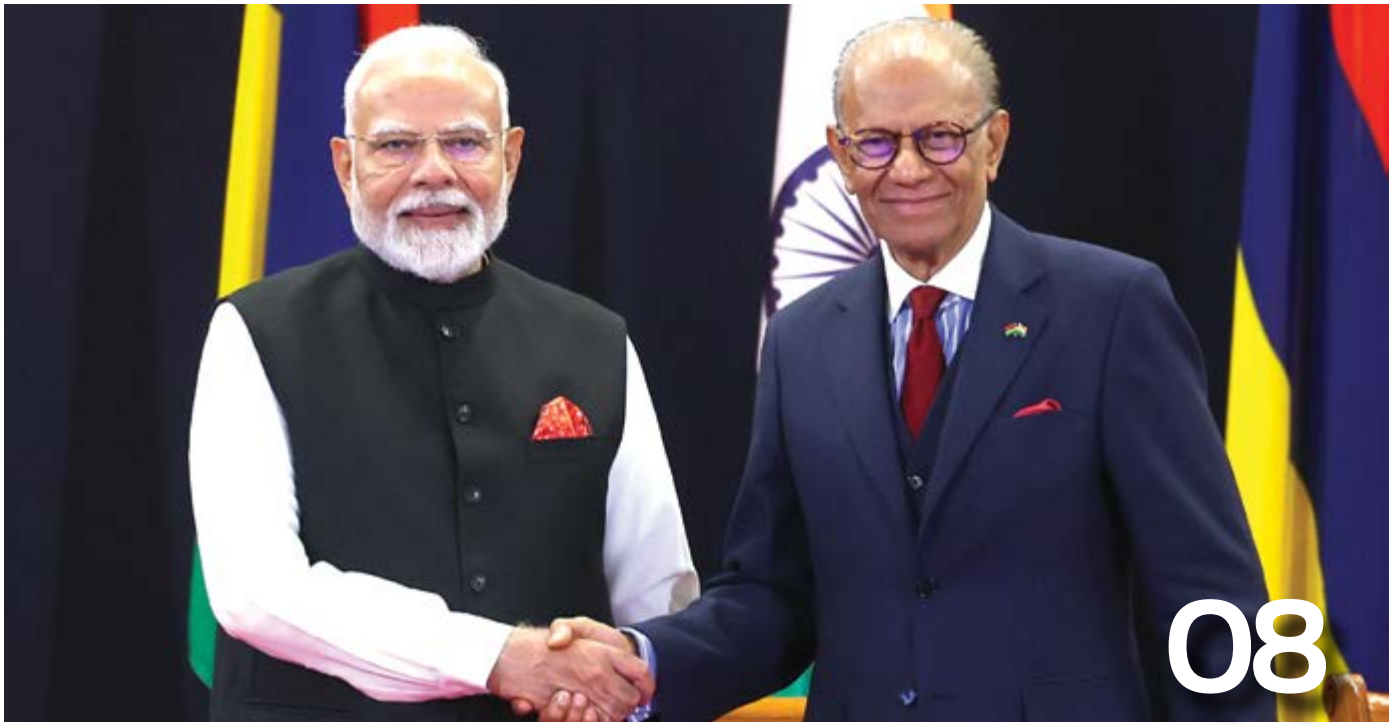

LEAD STORY

India's MAHASAGAR Vision with Mauritius

DEEP DIVE

Indian Military Must Adopt Emerging Disruptive Technologies

VIEWPOINT

A New Fighter Plane for the IAF

NTS

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Team *'Raksha Anirveda'* looks forward to receiving comments and feedback from the readers on the content of the magazine. Please share your thoughts at *info@raksha-anirveda.com*

IN PERSPECTIVE

METAMORPHOSIS OF THE TRANS-ATLANTIC ORDER

The Trans-Atlantic order, formulated after the end of World War II, remained a torchbearer of solidarity among the Western countries. However, the landscape has changed dramatically in recent times

PRANAY K. SHOME

The Trans-Atlantic Order, which was characterised by solid economic, military, political, and most importantly civilisational ties between the United States of America and its allies in Europe, has broken down almost irreparably. Today, the Trans-Atlantic Order is gasping for breath, trying its best to salvage the world's most powerful and economically prosperous relationship.

This regional order was a beacon of the USA-led capitalist bloc during the Cold War and was the de facto power centre of the world in the post-Cold War period despite the emergence of new state actors. However, this order has gone through its fair share of ups and downs, mainly due to the uncontested hegemonic presence of the United States.

However, it is said in international politics that every order is in flux. In that context, US President Donald Trump's second term at the helm of the world's most powerful office has irreversibly changed the face of the trans-Atlantic order.

NO MORE 'WE'

With the commencement of Donald Trump's second tenure in office, there is a palpable sense of imbroglio among the various European capitals. In that context, the most visible impact is that there is no more 'we'. The idea of Western civilisation being the cornerstone of the trans-Atlantic order now seems like a nostalgic moment - a fleeting sense of satisfaction.

Donald Trump's first three months in office have made it clear to America's European allies that they must fend for themselves now. From practically excluding Europe in the peace process of the ongoing Russia-Ukraine conflict, followed by routine criticisms of European democracies and institutions shows that the United States is returning to its policy of 'isolationalism', which was the holy grail of its foreign policy from the 18th to 20th centuries.

The USA has practically singled out Europe as an entity that has repeatedly taken the United States for a swing and has benefitted from American military and economic largesse ever since the end of the Second World War.

America's threat to withdraw from NATO is clearly symptomatic of a mercurial political order in the Oval Office, which is insisting that it is no more 'we', but 'us' versus 'you'.

LIBERAL ORDER - REST IN PEACE

As Donald Trump has embarked on a no 'we' policy vis-à-vis the trans-Atlantic order, it is quite clear that the liberal world order, which was premised on the principles of democracy, security, human rights, fair and equitable trade and promotion of egalitarianism among the people of European descent (irrespective of their race, religion, creed, orientation etc), is now a dream.

The announcement of sweeping tariffs on countries around the world, particularly targeting the European Union and the UK, has shown that Trumpism could care less about shared values and ideas.

Trump's rationale behind the imposition of tariffs on the EU is that this supranational organisation enjoys a 200 billion euros trade surplus with the US and that by imposing tariffs, Trump was bringing manufacturing jobs back in the US has raised eyebrows in Europe with the latter planning to impose sweeping retaliatory tariffs on American goods and commodities in the coming times.

DEGLOBALISATION IS THE NEW NORM

With the announcement of sweeping tariffs on different countries on 'Liberation Day', the Trumpian presidency has clearly signalled that globalisation is no longer welcome in America. The USA under Trump is moving inwards. Apart from slashing research funds, the Trump administration is taking action against students in the form of detention and deportation simply because of their ideological dispositions. It indicates that Trump and his acolytes no longer believe in the sanctity of fundamental American rights, particularly the right to freedom of speech and expression, which is the sine qua non of American democracy.

The initiation of a global trade war signals to the rest of the world that America is no longer willing to embrace globalisation, an idea that has cemented the global financial, cultural, and economic relationship since the 1990s.

The retaliatory measures to be taken not just by Europe but the rest of the world are likely to spark an economic downturn in the world economy, contributing to the creation of a global recession, which may come to haunt America itself.

The threat of the United States to withdraw from NATO is symptomatic of a mercurial political order in the Oval Office, which insists that there is no more 'we', but 'us' versus 'you'

With the USA's inward-looking trade policies becoming the de-facto economic norm, it is very clear that globalisation will be a thing of the past.

In that case, Europe needs to be innovative, it needs to expand the basket of its allies and solidify relationships with its other allies. The expanding ambit of relationship with India is one such example.

Trump's America reflects a society that promotes nativism both in domestic and global policies. It is high time that Europe learns the relevant lessons and improvises accordingly.

– The writer is currently working as a Research Associate at Defence Research and Studies (dras.in) and is a columnist. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

LEAD STORY

INDIA'S MAHASAGAR VISION WITH MAURITIUS

The India-Mauritius strategic relationship is a testament to the power of shared values and mutual interests. By deepening cooperation in defence, maritime security, blue economy, and technological development, both nations can contribute to a secure, prosperous, and sustainable Indian Ocean region

DR MATHEW SINU SIMON

Prime Minister Narendra Modi visited Mauritius on March 11-12, 2025, at the invitation of Prime Minister of Mauritius Navin Ramgoolam. He was the Chief Guest for Mauritius National Day celebrations on March 12. Interestingly, the national day is celebrated as a homage to Mahatma Gandhi who visited Mauritius in 1901 and steered the destiny of Indian labourers with his three transformative messages – the importance of education, political empowerment and staying connected with India. March 12 in India is also the date when Mahatma Gandhi started his salt march.

The foundation of Vision SAGAR, which stands for "Security and Growth for All in the Region" was laid in Mauritius, ten years ago by PM Modi. He advanced this vision by prioritising the Global South through Vision MAHASAGAR - Mutual And Holistic Advancement for Security And Growth Across Regions. This vision is more comprehensive, connecting different regions with a focus on trade for development, maritime security and initiatives related to capacity building for sustainable growth.

The strategic relationship between India and Mauritius, anchored in historical ties and cultural affinities, has evolved into a crucial partnership, particularly in the Indian Ocean's dynamic geopolitical landscape. This research commentary delves into the key pillars of this relationship - defence, maritime security, blue economy, and technological cooperation.

PM Modi advanced the SAGAR vision to MAHASAGAR - Mutual And Holistic Advancement for Security And Growth Across Regions - by prioritising the Global South, making it more comprehensive with a focus on trade development, maritime security and capacity-building initiatives for sustainable growth

DEFENCE AND MARITIME SECURITY: A SHARED OCEAN SPACE

Strategic Significance: Mauritius, strategically located in the western Indian Ocean, is immensely significant for India's maritime security interests. India's commitment to supporting Mauritius's defence capabilities underscores the shared recognition of the need for a secure and stable Indian Ocean region.

The visit is significant in terms of the larger geopolitical undercurrents in the region. In October 2024, the UK agreed to transfer the sovereignty of the Chagos archipelago to Mauritius, on the condition of letting the US and the UK retain the military base on the atoll of Diego Garcia. India fully respects Mauritius's sovereignty over the Chagos and extends cooperation through strategic forums such as the Colombo Security Conclave, the Indian Ocean Rim Association, and the Indian Ocean Conference.

Defence Cooperation: India has been a reliable partner in bolstering Mauritius's defence infrastructure, providing patrol vessels, aircraft, and other defence equipment. Joint maritime exercises and capacity-building programmes strengthen interoperability and enhance maritime domain awareness. The development of infrastructure on Mauritian outer islands, with Indian assistance, is crucial for monitoring and safeguarding the vast Exclusive Economic Zone (EEZ).

In 2017, India transferred to Mauritius an Interceptor Boat C-139, along with onboard

Prime Minister Narendra Modi met Mauritius Prime Minister Dr Navinchandra Ramgoolam in Port Louis

equipment, which India leased to the Mauritius National Coast Guard since 1993. In 2022, Mauritius also joined the Colombo Security Conclave, established by India, Sri Lanka, and the Maldives in 2020 to enhance regional maritime security cooperation.

India as the first responder: In the wake of a massive oil spill following the grounding of the Japanese vessel Wakashio off the Mauritian coast on July 25, 2020, India was the first responder. An IAF aircraft brought 30 tonnes of technical equipment, and a 10-member Technical Response Team on August 16, 2020. INS Nireekshak joined the Mauritian National Coast Guard in salvaging the sunk Mauritian Tug 'Sir Gaetan Duval', following an accidental collision during the Wakashio salvage operations.

During the visit, the Indian Navy signed a technical cooperation agreement on information exchange related to white shipping. It includes real-time data sharing that would help enhance maritime security and ensure the safety of Mauritius' trading corridors. Further, an armed forces contingent from India participated in the National Day celebrations along with a warship of the Indian Navy and the Akash Ganga skydiving team of the Indian Air Force. This reflects the growing importance accorded to security partnerships

Combating Maritime Threats: Both nations are committed to combating transnational maritime threats, including piracy, illegal fishing, and drug trafficking. Enhanced information sharing and coordinated patrols are essential to maintaining the regional maritime security. The importance of securing sea lanes of communication vital to both nations, is a major driving force behind the cooperation.

BLUE ECONOMY: SUSTAINABLE DEVELOPMENT

Shared Resources: India and Mauritius share a deep interest in harnessing the blue economy's potential for sustainable development. Cooperation in fisheries, marine research, and coastal tourism can contribute to economic growth and job creation.

Sustainable Practices: Promoting sustainable fishing practices and protecting marine ecosystems are crucial for ensuring the long-term viability of the blue economy. Collaboration in marine scientific research and technology transfer can support sustainable resource management. Climate change poses a major threat to both nations and drives cooperation on mitigation and adaptation strategies.

Port Development: India is also involved in port development projects in Mauritius, which improve maritime trade, and increase the country's ability to participate in the blue economy

TECHNOLOGICAL COOPERATION: BRIDGING THE DIGITAL DIVIDE

Digital Partnership: India's expertise in information technology and digital infrastructure can play a vital role in Mauritius's digital transformation. Cooperation in e-governance, digital education, and cybersecurity can enhance Mauritius's technological capabilities.

Space Cooperation: India's space programme has

Mauritius, strategically located in the western Indian Ocean, is immensely significant for India's maritime security interests. India's commitment to supporting Mauritius's defence capabilities underscores the shared recognition of the need for a secure and stable Indian Ocean region

LEAD STORY

(Above) Delegation level talks between India and Mauritius were led by PM Modi with Mauritius PM Ramgoolam in Port Louis

(Below) PM Modi addressed the Indian community at the Trianon Convention Centre in Mauritius

provided valuable assistance to Mauritius, including establishing ground stations for satellite tracking. This cooperation enhances Mauritius's capabilities in remote sensing and disaster management.

Capacity Building: India has offered many training programmes to Mauritian citizens, in many technological sectors, which has improved the technical skills of the Mauritian workforce.

CHALLENGES AND THE WAY FORWARD

Maintaining Momentum: Sustaining the momentum of bilateral cooperation requires continuous engagement and dialogue. Addressing potential challenges and ensuring the effective implementation of joint projects are crucial.

Diversifying Cooperation: Exploring new areas of cooperation, such as renewable energy and climate change mitigation, can further strengthen the partnership. Increasing trade between both nations.

Regional Collaboration: Promoting regional collaboration in the Indian Ocean region is essential for addressing shared challenges and fostering sustainable development. Both nations should also work together in multilateral forums.

CONCLUSION

The Mauritius government conferred upon Prime Minister Modi, the Grand Commander of the Order of the Star and Key of the Indian Ocean. The India-Mauritius strategic relationship is a testament to the power of shared values and mutual interests. By deepening cooperation in defence, maritime security, the blue economy, and technological development, both nations can contribute to a secure, prosperous, and sustainable Indian Ocean region. The future of this partnership hinges on continued commitment, effective implementation, and a shared vision for a stable and thriving maritime domain.

–The writer is Assistant Professor, ICFAI School of Liberal Arts, ICFAI University, Jaipur. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

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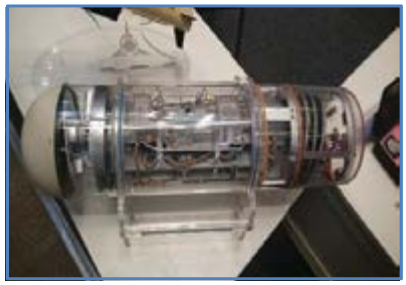

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REGIONAL SUMMIT

ECONOMIC COOPERATION TO DOMINATE BIMSTEC IN FUTURE

At the latest BIMSTEC Summit 2025, leaders of various member states seemed optimistic in promoting intra-region trade and economic activities, for which a BIMSTEC Chamber of Commerce has been proposed to be set-up. Prime Minister Narendra Modi announced more than 20 initiatives at the summit to promote intra-region cooperation, promoting growth and prosperity for the region

SRI KRISHNA

Underlining that BIMSTEC is a model for inclusive development and collective security and it is not merely a regional organisation, Prime Minister Narendra Modi Friday announced more than 20 initiatives — from the mechanism of Home Ministers on security to UPI connecting payment mechanisms, an energy centre to a chamber of commerce.

Speaking at the 6th BIMSTEC Summit in Bangkok, Modi said, "BIMSTEC serves as a vital bridge between South and Southeast Asia, and is emerging as a powerful platform for advancing regional connectivity, cooperation and shared prosperity."

"It is a matter of great satisfaction that the BIMSTEC Charter came into force last year. I am confident that the Bangkok Vision 2030, which we are adopting today, will further our collective commitment to building a prosperous, secure, and inclusive Bay of Bengal region," he said.

Stating that BIMSTEC embodies the spirit of 'Sabka Saath, Sabka Vikas, Sabka Prayas', he said "it stands as a testament to our shared commitments and the strength of our unity... I am confident that together, we will continue to strengthen the spirit of solidarity, cooperation, and mutual trust, and take BIMSTEC to even greater heights."

Another major step forward was elevation of India's bilateral ties with Thailand to a strategic level and thereby giving a new impetus to the Bay of Bengal regional forum, namely, BIMSTEC.

With this boost to Indo-Thai relations, Prime Minister Narendra Modi has strengthened India's Act East policy and deepened India's initiatives to promote inter-regional cooperation.

Modi's brief sojourn in Bangkok, the first bilateral visit in more than a decade, has helped consolidate the efforts in the last few years in advancing bilateral ties.

India revived the BIMSTEC grouping in 2016 after the SAARC summit was cancelled. India boycotted the SAARC summit after the Pakistan-sponsored terror attack in Uri. Pakistan is not a member of the BIMSTEC grouping which has Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka, and Thailand — countries dependent on the Bay of Bengal.

On security cooperation, Modi said, "To further strengthen BIMSTEC, we must continue to expand its scope and enhance its institutional capacities. It is encouraging to note that the Home Ministers' mechanism is being institutionalised. This forum can play a major role in the fight against cyber crime, cyber security threats, terrorism, drug trafficking and human trafficking. In this regard, I propose that India host the first meeting of this mechanism later this year."

Stating that for "regional development, physical connectivity must go hand in hand with digital and energy connectivity", he said nations should accelerate efforts towards achieving electric grid interconnectivity across the region.

He also proposed establishing connectivity between India's Unified Payments Interface (UPI) and the payment systems of BIMSTEC member states. "Such integration would bring substantial benefits across trade, industry and tourism, enhancing economic activity at all levels." he said.

What is of significance is India's strengthening of bilateral ties with Thailand as it is a good sign of revitalising BIMSTEC forum in the wake of the SAARC being almost in limbo since Pakistan decided to stay away from the regional cooperation forum.

Pakistan's attitude gave a boost to the Modi government in rebooting BIMSTEC and paving the way towards greater institutionalisation of BIMSTEC in the form of a charter and more specific cooperation in a broad range of areas.

The Bangkok Summit of BIMSTEC saw the conclusion of a maritime transport cooperation agreement and adoption of a vision document at the forum.

On trade and business, Modi proposed the establishment of a BIMSTEC Chamber of Commerce. Additionally, an annual BIMSTEC Business Summit will be organised to foster greater economic engagement.

"I would also suggest conducting a feasibility study to explore the potential for trade in local currencies within the BIMSTEC region." he said.

Modi proposed the establishment of a BIMSTEC Centre of Excellence for Disaster Management in India. This centre will facilitate cooperation in disaster preparedness, relief, and rehabilitation efforts. Additionally, the fourth joint exercise among the BIMSTEC Disaster Management Authorities will be held in India later this year."

Modi also extended a warm welcome to Bangladesh as the incoming Chair of BIMSTEC.

The summit adopted the "Declaration of 6th BIMSTEC Summit, Bangkok Vision 2030", which is the first vision document to provide a comprehensive and practical roadmap for future cooperation amongst the BIMSTEC member states.

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REGIONAL SUMMIT

Pakistan's attitude gave a boost to the Modi government in rebooting BIMSTEC and paving the way towards greater institutionalisation of BIMSTEC in the form of a charter and more specific cooperation in a broad range of areas

It also adopted "Rules of Procedure for the BIMSTEC Mechanisms", which, together with the Charter, lay the foundation of the institutional framework for regional cooperation under BIMSTEC.

They also adopted the report of Eminent Persons' Group on the Future Direction of BIMSTEC. The document contains recommendations for enhancing trade through Free Trade Agreements (FTAs), trade facilitation measures, implementing Single Window systems, and developing multimodal connectivity strategies, all aimed at streamlining regional trade.

"If adopted, this will be very important to advance the cause of regional cooperation," said Prof Mustafizur Rahman, a distinguished fellow at the Centre for Policy Dialogue.

Bangladesh's Chief Adviser's Press Secretary Shafiqul Alam said the BIMSTEC chairmanship will officially be handed over to Bangladesh from Thailand.

"Chief Adviser Prof Muhammad Yunus is a great advocate for regional cooperation, economic development, and people-to-people contact. He will prioritise promoting trade and investment and improving relations with all regional countries," he told reporters in Bangkok as leaders from Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka, and Thailand arrived in the Thai capital.

However, according to foreign policy analysts and economists, BIMSTEC has not achieved much in its journey of 27 years.

The combined economic size of BIMSTEC members stands at around $4.7 trillion, highlighting the bloc's vast potential for boosting intra-regional trade, but its intra-regional trade accounts for just 7 percent of its total trade, which is 25 percent for the Association of Southeast Asian Nations (Asean).

Prof Mustafizur Rahman said the framework agreement of BIMSTEC was signed in 2004, but the Free Trade Agreement (FTA) could not be signed yet. The member countries failed to reach consensus on crucial trade issues, specifically regarding rules of origin and trade in goods and services.

Selim Raihan, professor of economics at Dhaka University, said one significant obstacle for BIMSTEC is the lack of political commitment from the leaders of member countries.

"Larger nations have not consistently demonstrated the political will required to push the agenda forward, while smaller nations have not prioritised BIMSTEC sufficiently," he said.

Prof Mustafizur Rahman, however, said trade and economic cooperation can go on despite the political or bilateral issues among the members.

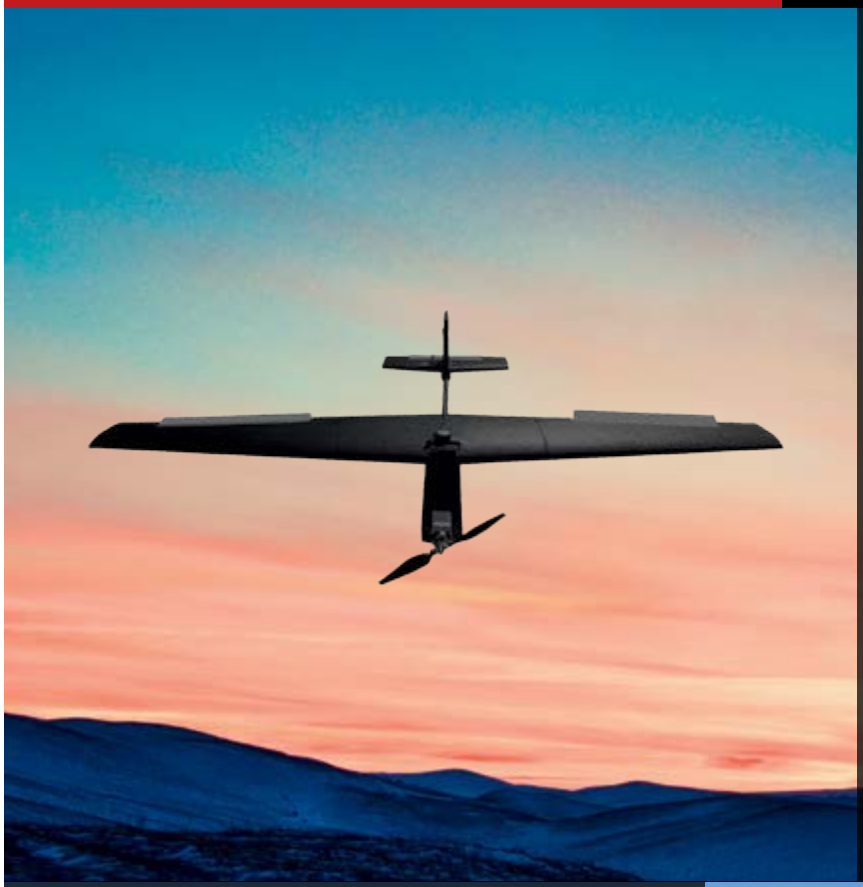
The 6th BIMSTEC Summit with the theme "Prosperous, Resilient, and Open BIMSTEC," sought to enhance regional cooperation on trade, security, connectivity, and endorse the Bangkok Vision 2030.

"The regional integration is more important than ever as a trade war is on the rise," Prof Rahman said in reference to the Trump administration imposing higher tariffs globally.

*– The writer is a senior journalist and media consultant. The views expressed are of the writer and do not necessarily reflect that of **Raksha Anirveda***

MAKING IMPOSSIBLE POSSIBLE.

JOHNNETTE



JOHNNETTE JF-2 TACTICAL UAV

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OPEARTIONAL RANGE: 12 Km
ENDURANCE: 75 Mins
CRUISE SPEED: 45 KMPH
MATERIAL: EPP + Composite
PAYLOADS: Gimbalised Day and Thermal

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JOHNNETTE JM-1 LOITERING MUNITION

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OPEARTIONAL RANGE: 05 Km
ENDURANCE: 20 Mins
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MATERIAL: EPP + Composite
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ECONOMIC AFFAIRS

TRUMP'S RECIPROCAL TARIFFS: RESHAPING GLOBAL TRADE AND INDIA'S STRATEGY

The spate of trade tariffs announced by the American President Donald Trump, during his second presidency, might translate into a shift in global trade dynamics, besides making every nation ponder how it is going to respond to these new trade barriers. For India too, navigating these new uncertainties by adapting its trade policies, enhancing domestic production, and diversifying its export markets looks daunting

CHIRAYU SHARMA AND DR PUNIT SAURABH

Donald Trump's recent announcement of reciprocal tariffs marks a significant shift in global trade dynamics, emphasising his administration's focus on addressing the so called 'trade imbalances' which according to him has till now put America in the losing position.

Under President Donald Trump's 'The Fair and Reciprocal Trade Plan', the United States will impose tariffs equivalent to those levied by other countries on American goods. This move, intended to protect American industries and reduce the US trade deficit while positioning US as a manufacturing powerhouse has sparked concerns of a global trade war, with widespread economic consequences for both developed and emerging economies.

POSSIBLE IMPACT ON EMERGING ECONOMIES AND INDIA

Emerging economies, particularly in South Asia, Latin America, and Africa, are expected to bear the brunt of these tariffs. Historically, these countries have relied on high import duties to shield nascent industries from foreign competition.

The abrupt shift in US policy could disrupt these protectionist measures, making it difficult for domestic businesses in these regions to compete effectively. Countries like India, which has traditionally imposed high tariffs on agricultural and industrial products, may face retaliatory measures that could impact key sectors such as manufacturing, pharmaceuticals, and technology.

As a major trading partner of the US, India's exports of textiles, information technology services, and automotive parts could suffer under the new tariff regime, thereby affecting employment and economic growth. Moreover, Indian companies that rely on cost-effective imports from countries with lower tariff structures may face increased input costs, reducing their global competitiveness.

Despite the negatives, India is also in a better position to ward of the tariff fears and convert the problems into opportunities. This is because India is now in position as a sweet spot like never before, with lesser tariff imposed on it then its primary export competitors like China, Vietnam and Cambodia reeling under the Trump's tariff hammer.

SECTOR-WISE RAMIFICATIONS

The impact of these tariffs extends beyond individual countries to entire sectors. The steel and aluminium based industries are directly affected, as the United States has increased duties on these commodities.

Countries like Canada, Mexico, and Brazil, which export large volumes of these materials to the US, will have to seek alternative markets or face economic slowdowns.

Similarly, the automobile sector is set to be significantly disrupted. The newly imposed 25% tariff on imported vehicles and motorbikes will hurt countries like Germany, Japan, and India, which export cars to the US.

In response, these nations may introduce countermeasures much like that of China's, leading to increased prices for automobiles and reduced global sales. India, which has been increasing its automobile exports to the US, may see a significant setback, especially in segments like electric vehicles and auto components.

Another critical sector that could have felt the effects of these tariffs is pharmaceuticals. The US has traditionally maintained minimal tariffs on medicines and pharmaceutical ingredients. But thankfully the US has desisted from putting any tariffs in the sector as it understands the critical nature of the sector and importance of low-cost medicine to its own citizens and its health sector, incidentally this sector is a major contributor (approximately $9 billion) to India's US exports.

AGRICULTURE AND TRADE BARRIERS

Agriculture is another sector that is likely to see significant repercussions. Many emerging economies impose high tariffs on agricultural imports to protect domestic farmers. In response to the US's reciprocal tariff policy, nations like India, China, and Japan may face higher levies on their agricultural exports.

This could reduce their competitiveness in the US market,

impacting farmers and food industries in these countries. Additionally, American agricultural exports, which traditionally benefited from low tariffs, may face new barriers in global markets, exacerbating financial pressures on US farmers.

In India, where agriculture is a crucial sector employing nearly half of the population, any decline in exports of commodities like rice, spices, and tea to the US could negatively impact rural economies. India needs to stay firm in its decision not to reduce agricultural subsidies come what may.

BROADER ECONOMIC IMPLICATIONS AND INDIA'S POSITION

Beyond specific sectors, the overall economic impact of Trump's tariff policies raises concerns about global economic stability. Economists argue that increased tariffs could slow down international trade, reduce investment flows, and even contribute to global inflation. Supply chains that rely on seamless cross-border transactions could be disrupted, increasing costs for businesses and consumers alike.

Furthermore, as trade tensions escalate, the risk of a full-scale trade war looms, potentially triggering a global economic slowdown. For India, this situation presents both challenges and opportunities.

While certain sectors may struggle, India's growing domestic market could help cushion some of the external shocks. Moreover, India could use this opportunity to strengthen trade relations with other nations, positioning itself as an alternative supplier to markets that might shift away from the US.

Additionally, deft trade negotiations could position India as a potential buyer to American crude which is already reeling under severe impact due to the fears of looming economic slowdown. This will reduce trade deficit between both nations while broadening our oil basket with cheaper crude supplies with reduced blackmailing.

THE WAY AROUND: STRATEGIC ADJUSTMENTS FOR INDIA

India must respond proactively to the changing trade landscape by adopting a diversified approach. Strengthening domestic manufacturing and reducing dependence on imports will be crucial for maintaining economic stability. The Indian government could consider policy measures such as tax incentives for domestic producers, easing trade agreements with other nations, and investing in technological advancements to boost industrial efficiency.

Furthermore, India could explore closer trade partnerships with the European Union, ASEAN countries, and Africa to offset potential losses from the US market. With news emerging of China willing to provide unhindered access to sell its goods for Indian companies and vice-versa it is expected that agreements on similar lines with other countries and trading blocs may happen sooner than later.

ECONOMIC AFFAIRS

A well-structured export strategy focusing on emerging markets could help Indian businesses sustain growth despite increasing trade barriers, rather leverage the crisis as an opportunity.

SECTOR-WISE IMPACT OVERVIEW

The upcoming 26% US tariffs imposed on India presents a mixed picture for Indian exports. While the textile sector, with $10 billion in exports, faces pressure, it retains a competitive edge over peers like Vietnam, Cambodia, China and Bangladesh, who face steeper duties of as high as 48%.

Electronics, valued at $14 billion, is among the hardest hit, though semiconductors—a strategic sub-sector—have been wisely exempted. Notably, India's pharmaceutical sector has emerged as a clear winner, with generics—accounting for 30% of India's total pharma exports—explicitly excluded from the new tariff list.

This not only reinforces the sector's strategic importance to the US healthcare system but also provides Indian drug manufacturers with critical breathing room amid global trade turbulence.

Agriculture sees a nuanced impact: though items like shrimp and rice now face tariffs, India's position remains relatively strong compared to countries with harsher levies as in the case of Cambodia, Vietnam, China, Bangladesh etc.

In contrast, the gems and jewellery sector could suffer due to its price sensitivity and labour costs. Automobiles remain under older 25% duties but are spared from the new hike. Overall, India's tariff position—lower than China but higher than Japan—offers both risk and opportunity, with pharma standing out as a stabilising force.

Strategic policy support and nimble supply chains will be key to navigating this new landscape and converting the problem areas into opportunities.

UNCERTAINTY IN GLOBAL TRADE

Essentially, while Trump's reciprocal tariff policy is designed to reduce trade imbalances and strengthen domestic industries, its wider implications could be detrimental to global economic stability.

Emerging economies, in particular, face heightened risks, with key sectors such as manufacturing and agriculture poised for significant disruptions. As nations retaliate and global trade networks adjust, the long-term consequences of these tariffs will be closely watched.

India, as a major global player, must navigate these uncertainties by adapting its trade policies, enhancing domestic production, and diversifying its export markets and positioning itself as a viable manufacturing hub better than its competitors like Vietnam, Cambodia, and China.

The higher rate of tariff imposed on these countries helps India gain traction in the long-run due to its competitive tariff positioning and assisting the US companies' withdrawal from these markets and gravitation towards India.

The forthcoming Indian trade discussions will play a pivotal role in mitigating the risks and setting up a benchmark in terms of negotiations for India in its own interest. Clearly, a message from the PMO underlines the seriousness of the topic with high chances of various critical sectors including agricultural subsidies to be kept under a 'Non-negotiable' list.

The US has played its card and it is India's turn to play its 'Trump Card' well. The future of international trade remains uncertain and gloomy but the current stalemate may help India to rise as an export centred economic superpower.

Chirayu Sharma is an MBA working as a finance professional and research analyst. He contributes insightful opinions on a diverse range of topics to various journals.

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INSIGHT

AI IN COMBAT: POWER AND PERIL

Artificial Intelligence is revolutionising modern warfare, empowering militaries with faster decisions, sharper intelligence, and secure operations. From AI-driven systems in global conflicts to India's Samvaad. Ai boosting, naval operations technology is transforming defence strategies worldwide. But with this rapid shift comes a tough question—how do nations harness AI's power without losing control?

LT COL NARENDRA TRIPATHI

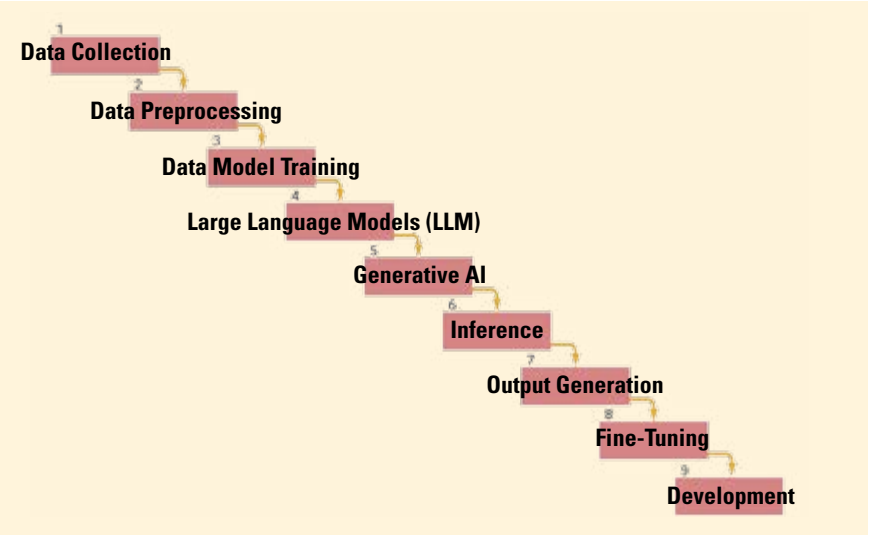
In 2021, the book *The Human-Machine Team* was published, proposing the development of a machine capable of processing vast data sets to identify military strike targets quickly. Initially conceptualised to address bottlenecks in target identification and decision-making, this technology has now become a reality. As modern warfare, intelligence operations, and decision-making processes rapidly evolve, incorporating cutting-edge Artificial Intelligence (AI) technologies has become crucial. The emergence of Generative AI (Gen AI) and advanced Machine Learning (ML) has enabled military forces worldwide to leverage AI for strategic decision-making, improving operational efficiency and real-time battlefield intelligence. Ongoing global conflicts, such as the Russia-Ukraine war and the Israel-Hamas conflict, have underscored the growing importance of AI in modern military strategies. Additionally, AI's integration into India's defence operations, particularly through initiatives like *Samvaad.Ai* for the Indian Navy, demonstrates how AI technologies are transforming military operations, enhancing security, agility, and mission success.

The evolution of Gen AI has paved the way for the development of advanced models capable of generating human-like content, ranging from text and images to music and more. Generative AI has opened new avenues across various sectors, particularly in defence, but also significantly impacting industries like customer service, content creation, and entertainment. A prime example is OpenAI's ChatGPT, which has revolutionised conversational AI. Its advanced language processing abilities have been widely adopted beyond traditional applications, offering personalised responses, and automating customer interactions. ChatGPT's impact has extended to businesses seeking to enhance customer support, automate writing tasks, and integrate AI into their workflow to improve efficiency.

One of the significant competitors in this field is DeepSeek, a Chinese firm offering models like R1, which provides robust performance and cost-effective solutions. DeepSeek's models have garnered attention for their ability to process large datasets and deliver competitive AI services, competing with well-established systems. These models cater to various applications, from natural language processing to sophisticated analytics, making them versatile for use in sectors such as defence, healthcare, and enterprise solutions.

Meanwhile, Ollama offers a practical solution for deploying Generative AI models locally, providing enhanced privacy and control over AI interactions. This platform allows users to run powerful Large Language Models (LLMs) directly on their systems, offering significant advantages in sensitive applications, such as military or financial sectors, where data security is paramount. Ollama facilitates seamless deployment and integration of models like ChatGPT or DeepSeek LLM, ensuring that organisations can maintain complete control over their data, reducing reliance on cloud-based systems and mitigating potential cybersecurity risks.

UNDERSTANDING GENERATIVE AI AND LARGE LANGUAGE MODELS (LLMS)



Workflow of Gen AI & LLM

Generative AI refers to algorithms that can create new content, such as text, images, or even music, by learning patterns from large datasets. These systems are designed to understand existing content and generate similar outputs that mimic human-like creativity. In its application, Generative AI is transforming industries by automating content creation, enhancing user interaction, and providing tools for more efficient decision-making. This technology spans multiple areas, from generating text-based content for marketing purposes to creating realistic images or 3D models in defence applications. Within the realm of Generative AI, Large Language Models (LLMs) represent a subset that specialises in processing and generating human language. Trained on massive text corpora, LLMs are capable of understanding and producing text that mirrors human syntax, semantics, and context. Well-known examples include OpenAI's GPT series and DeepSeek's LLM. These models are widely applied in areas like natural language processing (NLP), where they enable tasks such as machine translation, chatbots, automated content generation, and more.

These models are fine-tuned to meet specific industry needs. For instance, in military applications, LLMs can be used for intelligence analysis, generating reports, summarising documents, or providing automated translations in multiple languages. In defence and aerospace, LLMs can assist in processing vast amounts of data from satellites, drones, and reconnaissance missions, ensuring quick and actionable insights.

Ollama is a platform that supports the deployment of these advanced LLMs and AI models locally, on user-controlled infrastructure. Unlike cloud-based models, which raise concerns regarding data security and potential breaches, Ollama ensures that all AI-driven processes stay within a secure environment. This is particularly beneficial for sectors like defence, where maintaining the integrity and confidentiality of data is critical. Ollama's solution empowers users to run these models on local hardware, providing a higher degree of privacy, speed, and control over AI interactions. In defence and other sensitive sectors, where data sovereignty is critical, Ollama offers a way to integrate the latest AI technologies without compromising on security. By utilising on-premise or local deployments, users can harness the power of advanced LLMs while ensuring their data remains within the organisation's control, mitigating risks associated with remote cloud solutions.

AI IN GLOBAL CONFLICTS

The ongoing Russia-Ukraine conflict serves as a prominent case study in the integration of AI technologies in modern warfare. Russia has deployed AI-powered drones for reconnaissance and precision targeting, improving the speed and accuracy of its military operations. These drones, capable of autonomous operation, use advanced sensors and algorithms to process real-time data and provide actionable intelligence to military personnel. In contrast, Ukraine has embraced AI for cyber defence, employing machine learning to detect and neutralise Russian cyberattacks. Additionally, Ukraine utilises AI in surveillance systems that analyse satellite imagery and leverage computer vision algorithms to track Russian troop movements and artillery positions, giving the Ukrainian military a tactical advantage.

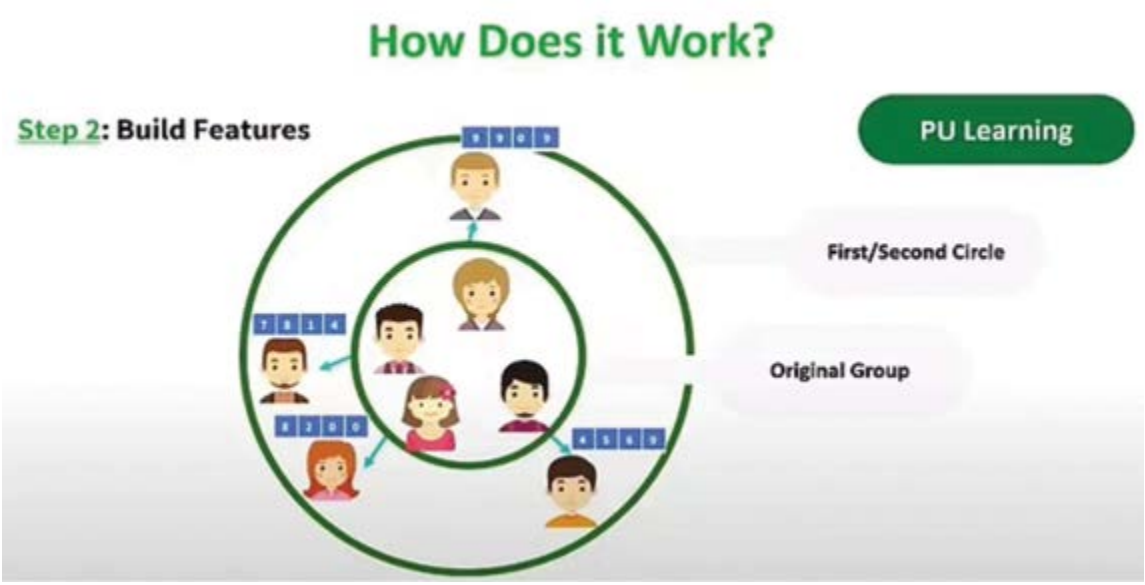
The AI system, named Lavender, has been used by the Israeli military to identify targets for airstrikes, particularly in the early stages of the Gaza conflict. Lavender was relied upon heavily, processing over 37,000 individuals as potential militant targets, including Hamas and Palestinian Islamic Jihad (PIJ) operatives, some of whom were low-ranking. In many cases, the outputs of Lavender were treated as though they were human decisions.

In addition to Lavender, Israel has deployed other AI systems, The Gospel with the Israeli

The Russia-Ukraine and Israel-Hamas conflicts highlight AI's growing role in warfare. Russia uses AI-powered drones for precision strikes, while Ukraine leverages machine learning to counter cyberattacks

INSIGHT

As AI takes on bigger roles in warfare, ethical concerns are mounting. Autonomous systems making life-or-death calls, as seen with Israel's Lavender, spark debates over accountability. Nations must balance AI's strategic benefits with humanitarian responsibilities to ensure it's used responsibly on the battlefield



A simplified presentation slide about Lavender AI working model from a lecture by commander of IDF unit 8200's Data Science and AI Centre at Tel Aviv university in 2023. *(Courtesy: https://www.dailymail.co.uk/sciencetech/article-13272487/israeli-army-lavender-ai-palestinian-militants.html)*

Intelligence Corps. "The Gospel" analyses large datasets to identify potential targets, such as individuals or structures associated with Hamas and PIJ. This system automates initial target selection and provides recommendations that are then reviewed by human analysts. The integration of "The Gospel" has significantly expedited the targeting process. For example, during the 2021 conflict, around 200 out of the 1,500 targets struck in Gaza were selected by "The Gospel." By contrast, since October 7, 2023, the IDF has reported striking over 22,000 targets, with "The Gospel" playing a pivotal role in this rapid escalation.

TACTICAL ADVANTAGE FOR INDIA

India is rapidly advancing its adoption of AI for defence applications, with a particular emphasis

Illustrative image of Gospel targeting system.
(Courtesy: https://www.newarab.com/analysis/gospel-israels-controversial-ai-used-gaza-war)

Gen AI project Samvaad.ai by Idex for Indian Navy

on integrating Generative AI into the Indian Army's operational framework. Initiatives such as Samvaad.Ai, developed as part of a challenge from the Indian Navy under the IDEX Disc, stand as a model for AI-driven knowledge management and analytical systems. Zenerative Minds, based in Hyderabad, is at the forefront of developing this innovative platform, which could also be deployed not only across other defence and paramilitary forces but also in various other civil domains having data sensitive critical operations. These systems are designed to enhance military decision-making and streamline operations by utilising AI for knowledge management, real-time data analysis, and automated reporting. What sets these systems apart is their flexibility, being on-premises solutions with cloud deployment options, and their ability to handle multi-format data sources, ensuring collaboration, high accuracy, and full security within a controlled environment.

EXPECTATIONS FROM AI FOR DEFENCE

The integration of AI in India's defence infrastructure is designed to enhance operational security. By deploying on-premise solutions within secure military data centres, the Indian Army ensures

complete control over sensitive data, minimising the risks of data breaches and cyber threats. This approach eliminates reliance on cloud-based data access, significantly enhancing cybersecurity.

The AI system is capable of processing both structured and unstructured data, such as surveillance footage, satellite images, battlefield communication logs, and geospatial intelligence. It integrates diverse data sources including text-based documents (e.g., operational manuals, tactical briefings), audio and video data, and real-time sensor feeds from UAVs, battlefield sensors, and IoT devices. This enables commanders to access a comprehensive, actionable intelligence repository, supporting mission-critical decision-making.

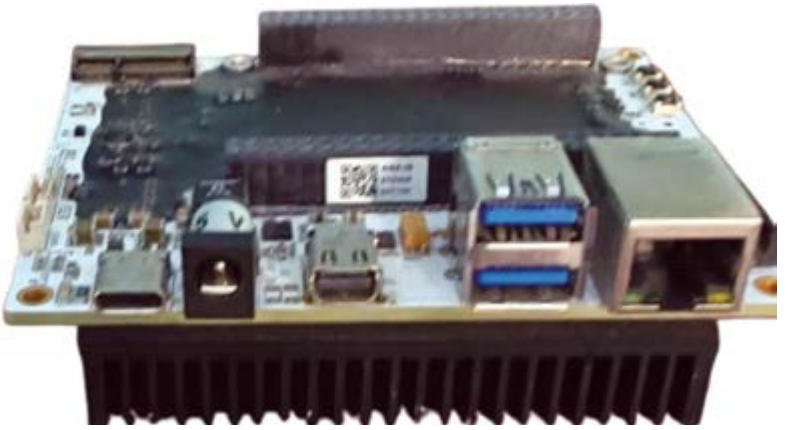
The system enhances battlefield awareness by enabling real-time information retrieval through natural language queries. AI-generated insights optimise logistics, troop movements, and mission strategies, ensuring faster and more accurate decisions. Integration with war-gaming simulations provides scenario-based decision support, allowing commanders to assess various tactical outcomes and refine their strategies.

The AI system automatically generates structured After-Action Reports (AARs), tactical briefs, and risk assessments, streamlining post-mission analysis and strategic planning. These automated reports consolidate critical intelligence, providing high-ranking officials and field commanders with timely, accurate data to enhance decision-making efficiency.

The system incorporates AI-powered military training modules, which tailor training programs based on specific roles, optimising skill development. It also utilises immersive and data-driven learning methods to enhance tactical drills, standard operating procedures (SOPs), and military doctrines. By offering personalised learning paths, it ensures mission readiness and effective knowledge retention.

The AI system enables secure, role-based access to critical data, allowing various Army units (e.g., Infantry, Artillery, Signals, Cyber, and Aviation) to retrieve mission-specific information. It facilitates AI-driven cross-referencing of intelligence, enhancing interoperability and ensuring coordinated military operations through seamless collaboration across branches.

AI plays a key role in continuous threat detection and cybersecurity. It proactively monitors military networks for potential cyberattacks, analysing patterns to detect intrusion attempts and electronic warfare threats. The system helps safeguard critical military infrastructure by adhering to CERT-In standards and other military-grade cybersecurity frameworks, ensuring resilience against cyber warfare and unauthorised access.

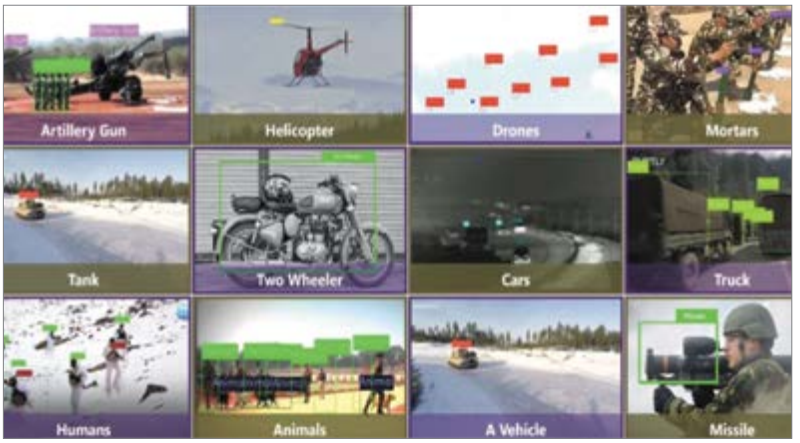


Custom GPU for attribute detection demonstrated to Senior Army hierarchy

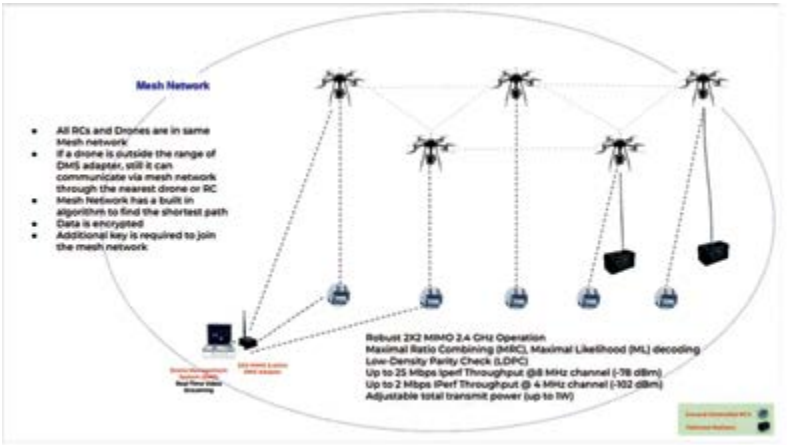
In remote military zones, such as mountainous regions or dense forests, deploying AI systems can be challenging. To address this, small-sized GPUs and compact computing units can be integrated into drones or mobile units, enabling real-time data processing on-site. This approach ensures commanders can access AI-powered analytics in isolated or conflict zones, even without cloud-based systems.

AI-integrated computer vision provides automated, real-time analysis of battlefield conditions. Drones equipped with cameras and sensors continuously monitor enemy movements, analyse terrain, and detect potential threats like weapons or vehicles. By combining Generative AI with computer vision, militaries can efficiently monitor vast areas, process visual data, and provide actionable intelligence to commanders within seconds.

INSIGHT



Variety of attributes being detected using AI based computer vision
(Courtesy: www.zenerativeminds.com)



Integrated drone surveillance system *(Courtesy: www.axldrone.com)*

Phase	Action Point	Sub-Phase
Phase 1	Data Collection & System Architecture Development	(a) Identify key military data sources for ingestion. (b) Design on-premise infrastructure for secure AI deployment.
Phase 2	AI Model Training & Fine-Tuning	(i) Train AI models on historical battle data, tactical reports, and classified archives. (ii) Develop customised NLP algorithms for military-specific query handling.
Phase 3	Pilot Testing in Strategic Commands	(i) Deploy initial prototype in select Army divisions for real-world testing. (ii) Gather feedback from commanders, intelligence officers, and operational units.
Phase 4	Full-Scale Implementation Across Army Formations	(i) Scale AI solution across theatre commands, corps HQs, and frontline units. (ii) Establish an Army AI command centre to oversee operations and updates.

The future of warfare is shifting towards integrated combat systems, where AI-driven drones, robotics, cyber capabilities, and human forces work in harmony. This integration allows military forces to act with greater speed, precision, and operational efficiency. India, through initiatives like Samvaad.AI, is at the forefront of this transformation, leveraging Generative AI for battlefield intelligence, strategic planning, and cyber defence.

KEY TAKEAWAYS

The integration of Generative AI and advanced machine learning into the operational framework of the Indian Armed Forces marks a significant advancement in enhancing national security. By utilising AI-powered knowledge management, real-time intelligence, and predictive analytics, the Indian Armed Forces can improve decision-making, operational efficiency, and readiness while maintaining control over its data infrastructure. Platforms like Samvaad.AI exemplify how these technologies can transform military operations, ensuring enhanced agility and mission success. Globally, AI's impact on defence strategies is clear, as demonstrated by its role in ongoing conflicts like the Russia-Ukraine war and the Israel-Hamas conflict, where AI has been used to improve targeting accuracy, operational speed, and strategic decision-making. However, the rapid adoption of AI in military operations also presents critical ethical concerns, particularly with regard to humanitarian implications and the potential for autonomous systems to make life-or-death decisions.

As AI technologies continue to evolve, it is essential for nations to implement robust ethical frameworks to balance the strategic advantages of AI with the responsibilities that come with using such technologies in warfare. The increasing deployment of LLMs, AI-driven drones, and other systems further highlights AI's potential in transforming defence systems. However, the growing use of AI also necessitates careful regulation and oversight to ensure that it contributes to global security while upholding international humanitarian standards. As India and other nations embrace AI for defence, integrating ethical considerations into the development and deployment of AI systems will be key to ensuring that these advancements are used responsibly and effectively.

–The writer is an SME consultant in military technology.
The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

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DEEP DIVE

INDIAN MILITARY MUST ADOPT EMERGING DISRUPTIVE TECHNOLOGIES

In recent times, novel technological ideas have been transformed into disruptive solutions, with militaries world over seeking to adopt disruptive technologies in warfare, as these technologies provide an overall edge in various realms of combat. Indian military too, needs to recognise, explore, adopt, and adapt to disruptive technologies to maintain an edge over modern inimical forces and to avoid getting surprised in combat by its known adversaries

COMMANDER SUMIT GHOSH

The new term '*disruptive technology*' refers to discoveries or innovations that significantly impact, alter, or transform industries, markets, businesses, or entire systems by introducing novel unthought-of methods, processes, or products that render existing technologies or commerce models obsolete. These technologies fundamentally change how things are executed, their new way of functioning often enhancing efficiency, reducing costs, easing out operations and offering quickest solutions.

The term 'disruptive technology' was first coined in the mid-1990s by Professor Clayton Christensen from the Harvard Business School. According to his theory, disruptive technologies typically overtake and overshadow the existing trends and processes in markets.

In the last two decades, novel technological ideas transforming into disruptive solutions, have gained momentum and militaries world over are seeking to adopt disruptive technologies in warfare since these technologies provide an overall edge in various realms of combat. Indian military needs to recognise, explore, adopt and adapt to disruptive technologies to gain edge over modern inimical forces and to avoid getting surprised in combat.

Some examples of disruptive technologies include *Block-chain systems, Electric Vehicles, Artificial Intelligence (AI) and Machine Learning, Smartphones, Cloud Computing, Unmanned/ Autonomous Vehicles, 3-D printing* etc.

In warfare, the impact of disrupting technologies is wide-ranging, rapid and economical as highlighted below;

Efficiency and Effectiveness: Novel technologies often streamline operations, reduce human error, and enable faster decision-making. Automation can take over routine tasks, allowing human focus on more complex missions. Autonomous drones and robots can reduce the need for human intervention in dangerous or tedious environments, such as defusing bombs, rapid deployment or gathering intelligence.

Technological Superiority: Nations with superior technological capabilities have more leverage in both strategic and tactical military situations. By adopting disruptive technologies, a military ensures it maintains an upper hand.

Boosted Combat Capabilities: The autonomous systems, Artificial Intelligence (AI), and advanced weapons, can enhance the effectiveness and precision of military operations through AI's predictive analysis of anticipation of enemy moves, targeting accuracy, minimising collateral damage etc.

Countering New Threats: As global threats evolve, militaries need to adapt with new technologies to

counter emerging threats effectively. For example, cyberattacks have become a significant concern, requiring the military to invest in cybersecurity technologies and AI-driven defence systems. Likewise, advanced missile defence systems or counter-drone technologies are critical in addressing modern warfare challenges.

Asymmetric Warfare: Disruptive technologies can level the playing field in situations where one side has a clear numerical or traditional advantage. Smaller or less resource-rich nations may use advanced technologies like cyber warfare, drones, or precision-guided munitions to offset superior conventional forces, which shifts the nature of warfare and introduces new strategies for defence.

Operational Flexibility and Adaptability: Modern warfare is increasingly dynamic and unpredictable. Disruptive technologies - such as advanced communication systems, AI, and quantum computing - provide military forces with more flexible and adaptable tools. They can quickly reconfigure operations, improve intelligence-sharing, and optimise battlefield coordination, which enhances responsiveness to fast-changing conditions.

Strategic Advantage in Hybrid Warfare: Disruptive technologies often support hybrid warfare tactics, combining conventional military power with unconventional methods such as cyber warfare, disinformation campaigns, and economic pressure. By incorporating such technologies, militaries can better integrate these multi-dimensional approaches to modern conflict, creating more opportunities for asymmetric advantages.

Cost-Effectiveness: In the long term, some disruptive technologies can reduce costs by increasing efficiency. For example, unmanned systems (drones, robots) can replace more expensive human-operated machinery or personnel in hazardous environments. Additionally, technologies that enable remote warfare can reduce the need for large ground forces, potentially saving on personnel, logistics, and operational costs.

Global Influence and Deterrence: The adoption of cutting-edge technologies can enhance a nation's global influence. Countries with advanced military technologies are often seen as leaders in global security and may hold significant power in international diplomacy. The mere potential use of these technologies can act as a deterrent, preventing adversaries from challenging the nation's interests or engaging in aggressive actions.

EMERGING DISRUPTIVE TECHNOLOGIES

Indian armed forces, like many visionary strategic forces around the globe, must necessarily adopt emerging disruptive technologies to enhance its combat power, operational effectiveness, strategic deterrence, and regional influence. These technologies promise to transform the military's role in both national defence and regional security. Some of the key emerging disruptive technologies in the military are:

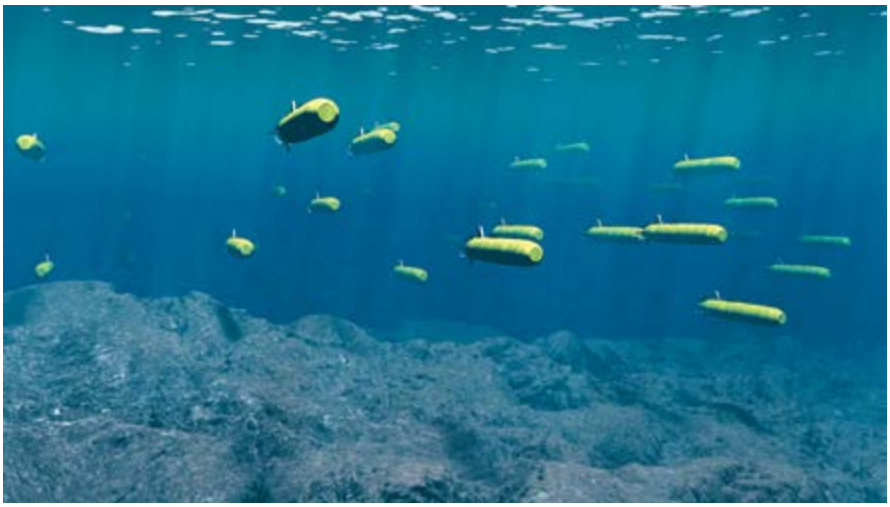
Autonomous and Unmanned Systems; Unmanned Aerial Vehicles (UAVs), Unmanned Underwater Vehicles (UUVs), Autonomous Surface Vessels (ASVs): Undeniably, the role of unmanned systems in reconnaissance, surveillance, and intelligence gathering and in launching strikes is a huge tactical advantage. They significantly enhance situational awareness and reduce the risk of human losses in war.

Artificial Intelligence (AI) and Machine Learning (surveillance, decision support, predictive analysis & maintenance): Military systems with AI enhance decision-making process by analysing vast amounts of data from multifarious sensors grids to predict real time threats, improve strategic planning, and optimise resource allocation. They can also predict failures in combat assets, thereby enhancing preventive maintenance procedures to improve op-efficiency aspects.

Hypersonic Missiles and Advanced Weapon Systems: Hypersonic missiles (higher than Mach 5), are difficult to track, intercept and engage with, which makes them evade most potent missile defence systems, thus providing a great combat edge. The development of next-gen missile defence systems that can intercept hypersonic or ballistic missiles more effectively is also a key area of innovation. These systems use

The term 'disruptive technology' was first coined in the mid-1990s by Professor Clayton Christensen from the Harvard Business School. According to his theory, disruptive technologies typically overtake and overshadow the existing trends and processes in markets

DEEP DIVE



Some examples of disruptive technologies include Block-chain systems, Electric Vehicles, Artificial Intelligence (AI) and Machine Learning, Smartphones, Cloud Computing, Unmanned/ Autonomous Vehicles, 3-D printing etc

various technologies of advanced radar tracking, directed energy weapons and accurate, fast moving interceptor missiles.

Cyber Warfare and Cyber Defence: Cyber threats significantly affect strategic planning. Cyber-attacks can target critical military infrastructure, communications and weapons systems to jeopardise operations, as most systems are computerised & digitally interlinked. Hence, ensuring cyber security and launching offensive cyber warfare (disrupt adversary operations, disable command-and-control systems, or degrade enemy networks) are crucial.

Space-Based Technologies: Various satellites enable real-time monitoring of traffic, routes and detection of hostile movements or potential threats in areas of interest. They improve domain awareness and aid in security operations. It is important to own space assets to gainfully employ them in critical times.

Quantum Technology (Cryptography & Sensing): Quantum computing is set to revolutionise encryption and data processing, making military communication systems more secure against cyber-attacks. Quantum-based accurate sensors are enhancing underwater navigation and detection, especially in UUVs and submarine warfare.

Advanced Submarine Technologies (AIP, stealth tech): Air Independent Propulsion technology enables conventional submarines to operate for longer durations without surfacing, greatly enhancing their stealth and endurance. Highly advanced, versatile, stealthier submarines are difficult to detect. With novel hydrodynamic designs, materials and propulsion systems, these submarines can operate in contested regions without being easily identified.

Directed Energy Weapons (DEWs): These technologies offer the potential to neutralise threats at long ranges with high accuracy without the need for traditional munitions. The DEWs, (laser systems and microwave-based technologies) can effectively disable enemy sensors, drones, and missiles.

Biotechnology and Health Systems: Biotechnology advancements are enhancing the medical support during extended operations. Telemedicine, advanced diagnostics, and biological systems can improve crew health and safety, enabling sustained operations in isolated environments.

Swarming Technology and AI-Powered Drones: Swarming tactics involve the coordinated use of multiple small, much cheaper autonomous vessels/drones in multiple missions to overwhelm enemy defences. With AI, these drones/vessels work autonomously and cooperatively, making them harder to counter.

Essentially, adopting disruptive technologies in the military domain, offers significant advantages in terms of operational efficiency, strategic superiority, and enhanced defence capabilities. It ensures that the military remains ahead of potential threats and responds effectively to the rapidly developing modern combat scenarios. As these technologies further evolve, our operational readiness, deterrence capabilities and regional influence will only grow stronger and embracing these technologies will undoubtedly shape the future of India's security.

–The writer, a former Indian Navy Submarine Officer is an alumnus of the Naval Academy, Goa, and DSCSC Mirpur, Dhaka, Bangladesh. He has served on Kilo Class Submarines and specialises in strategy, maritime warfare tactics and underwater technologies. He can be reached at sumit12in@gmail.com. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

SHAKTI WEARABLES: REVOLUTIONISING DEFENCE WITH INNOVATION

The innovative hand wearable that can be worn as a normal watch is backed by patented technologies focused on personal safety, seamless communication and connectivity in the remotest area for defence personnel to safeguard nation's security




Shakti Wearables is India's first street smart product organisation creating various innovative defence product in the category of personal safety and national security.

The journey started five years ago with an idea to find a more feasible solution for women safety, "anything" that allows a woman to react within seconds and be able to protect herself without any external help. Further research led to the invention of two (now patented) technologies – non-deadly electrocution and avoidance of self-electrocution.

Shakti Wearables' first launched product is for women safety - a hand wearable that can be worn like any normal watch by any woman and in case of any emergency / possible threat to safety, the attached button on the wearable can be pressed which activates an electrification feature and SOS feature. Under the electrification feature, when the dial of the wearable gets in touch with the skin of the attacker it ends up electrocuting them to an extent of making them numb/ stunned for 2-3 minutes without causing any death harm or health hazard. Simultaneously, the live location of the woman automatically gets shared to her friends and family and can be live tracked for next 2 hours. The innovation has been created with a vision to reduce women centric crimes like rapes, acid attacks, molestations in India and empowers the women of India in true sense!

"During this journey of inventing a wearable for women safety, the market feedback and further research made us realise that it's not a product we have invented but rather a technology, which now can have multiple use cases even in creating products for national defence," remarked Srishti Sharma, Founder – Shakti Wearables.

"During this journey of inventing a wearable for women safety, the market feedback and further research made us realise that it's not a product we have invented but rather a technology, which now can have multiple use cases even in creating products for national defence"
Srishti Sharma, Founder – Shakti Wearables

Shakti Wearables current offering for the defence sector is a customised hand wearable that can be worn by soldiers/jawan like a normal watch that helps them to stay connected to their management all the time via video calling, normal calling and access to be tracked all the time with the provision to get immediate help in case of any emergency. The company's mission is to help establish fastest and most convenient form of communication to the defence personnel while maintaining their privacy and security. The privacy during communication can always be maintained by assigning code words to specific regiments.

"It shall be our utmost honour to have the opportunity to serve our defence sector with our technology and we are always keen to understand more on how we can make products that can customise the needs on the borders and inside," says CTO Ashok Verma.

All Shakti Wearables products are invented in India and the company takes pride to say that today India is creating innovative technologies for the world. Their future offering to the defence sectors hold various products like:

- Non-deadly electrocuting batons – a replacement to conventional laathis / sticks
- Electrocuting shoes / boots
- Various Non-lethal weapons using patented technology.

For more details contact: sharmasrishti42@gmail.com | Visit: www.shaktiwearables.com

GUEST COLUMN

AMIT COWSHISH

A DECADE OF AATMANIRBHARTA IN DEFENCE PRODUCTION: AN ASSESSMENT

Though much is proclaimed as the positive results of Aatmanirbharta, yet the statistics proclaim something else. In real terms, Aatmanirbharta could only be described as self-reliance in defence with the ability to use Indian resources and powers to design and develop cutting edge technologies, remain ahead of adversaries in technological advancement and innovation, access without hinderance the raw material required for defence production, and to harness these resources for production of the state-of-art equipment, platforms, and weapon systems, completely in India

In its press release of March 24, 2025, the Ministry of Defence (MoD) proclaimed that 65% of the defence equipment is now being manufactured domestically, adding that this significant shift from earlier times when the import dependency was as high as 65-70% showcases India's increasing self-reliance in defence.

Presenting the union budget for the FY 2014-15 on July 10, 2014, the then Finance Minister Arun Jaitley had indeed bemoaned that India was the largest buyer of defence equipment and that our domestic manufacturing capacities were still at a 'nascent stage'. Does it then mean that this reversal of fortunes is the result of a decade of relentless pursuit of the disjointed policy of Aatmanirbharta, or self-reliance, in defence production?

First the facts. Going by the official data, the value of domestic defence production has jumped from ₹46,429 crore in FY 2014-15 to ₹1,27,434 crore in FY 2023-24. During the same period, defence exports went up from a meagre ₹1,941 crore to ₹ 21,083 crore. The latest data released by the MoD shows that exports increased by another ₹2,539 crore in FY 2024-25, registering an annual growth of 12.04%.

These facts are undoubtedly remarkable, and it would be unfair to disparage the achievement which they reflect, but the picture that emerges from them is at odds with India's image as a leading importer of arms. According to the March 2025 report of the Stockholm Internation Peace Research Institute (SIPRI), India was the second largest importer of arms in the world during 2020-24, accounting for 8.3% of the global imports, with war-torn Ukraine topping the list with 8.8% of the global imports.

It is another matter that the MoD is not impressed by the SIPRI data, which shows that India has been among the top two importers of defence equipment for more than two decades. When questioned by the Standing Committee on Defence in December last year about the factors that had led to India being the largest defence importer in the world (which was then the case), the MoD informed the committee that there was 'no reliable source of information confirming that India (was the) largest defence importer'.

One can question the methodology used by SIPRI to calculate the extent of a country's dependence on defence imports but dismissing the data altogether even as a useful trend indicator cannot serve any useful purpose. Afterall, it is the same March 2025 report which also shows that India's share of the global imports has fallen from 9.1% in 2015-19 to 8.3% in 2020-24. Can this fact also be dismissed as not being credible?

Be that as it may, it would be more appropriate to conclude from the MoD and SIPRI data that the import of defence equipment is gradually falling because of the increasing domestic production of defence equipment. It can also be conceded that this is the direct result of the putative 'Make-in-India' policy of preferring Indian manufacturing companies as the prime contractors and insisting on transfer of technology to them by the foreign companies for local manufacturing of equipment. This is borne out by another set of figures released by MoD on March 29, 2025.

Of the 193 contracts awarded by MoD in 2024-25, with the total contract value surpassing ₹2,09,050 crore, as many as 177 contracts, or 92% of the total contracts, were awarded to the domestic companies. The cumulative value of the contracts awarded to the domestic companies amounts to ₹1,68,922 crore, which is 81% of the total contract value.

The MoD also claimed that this 'significant focus on indigenous manufacturing aligns with the vision of self-reliance in defence production, boosting local industries and generating employment across the sector'. While the facts are indisputable, to equate rapidly expanding local manufacturing with self-reliance in defence production is questionable. It is deniable that in most of these cases, the Indian companies are manufacturing defence equipment with technology transfer from the foreign partners. This runs contrary to the idea of self-reliance.

A simple dictionary meaning of the term 'self-reliance' is reliance on one's own powers and resources rather than those of others. It would be legitimate to argue that this is too narrow

a definition and that in the contemporary world, it is not possible for any nation to become self-reliant by using only its own resources. There may be some exceptions like the USA but exceptions only prove the rule.

A more pragmatic and contemporaneous bare-bones definition of self-reliance in defence would be the ability to use one's own resources and powers to design and develop cutting edge technologies, remain ahead of adversaries in technological advancement and innovation, access without hinderance the raw material required for defence production, and to harness these resources for production of the state-of-art equipment, platforms, and weapon systems.

Viewed in this perspective, and when compared with the state of self-reliance of its immediate adversary to the north, India's self-reliance project has a lot of catching up to do. India is not yet self-reliant in design, development, and production - *entirely on its own or without any dependence on foreign sources, which are prone to being chocked for geopolitical considerations* - of large platforms like stealth fighters or even a multi-role fighter aircraft, diesel-electric submarines, armoured fighting vehicles, assault rifles, and the like.

Not that no major platform is being built in India; the problem, however, is that for each such platform being made locally, India is critically dependent, to varying degrees, on the foreign companies, whose continued and timely support cannot be taken for granted. This is best illustrated by the production schedule of the indigenous Light Combat Aircraft Tejas Mk-1A which was upset because of the delay in the delivery of F404-IN20 engines by GE Aerospace to Hindustan Aeronautics Limited (HAL).

The relations between the countries which have been the main providers of technology and exporters of defence equipment to India are becoming increasingly complex, queering India's pitch for self-reliance. It was not too long ago, for example, that India faced the prospect of being sanctioned by the USA because of its continued defence ties with Russia. Consequently, a pall of uncertainty loomed over many an ongoing and in-the-pipeline contracts with the USA.

Self-reliance is all about the ability to insulate itself from such potential complications in the shifting sands of the contemporary geopolitics. A closer analysis of the policy being pursued by the MoD to achieve self-reliance reveals three fault lines: equating increasing local production with self-reliance, disjointed efforts at indigenisation, and insufficient investment in defence research and development (R&D).

As for equating local production with self-reliance, much has already been said. While the MoD can continue to rightfully take the credit for promoting the local industry by pursuing the current policy of mainstreaming the Indian companies as the prime contractors in defence contracts, new quantifiable goals need to be set for achieving self-reliance in design, development, and production of some major platforms, with dependence on foreign companies being limited to technologies, expertise or raw material which could potentially be sourced from multiple sources.

It would be more appropriate to conclude from the MoD and SIPRI data that the import of defence equipment is gradually falling because of the increasing domestic production of defence equipment. It can also be conceded that this is the direct result of the putative 'Make-in-India' policy of preferring Indian manufacturing companies as the prime contractors and insisting on transfer of technology to them by the foreign companies for local manufacturing of equipment

This would necessarily mean focussing on development and production of technologies and platforms that are required, say, ten-fifteen years hence, for that would be the average time required for design and development of futuristic technologies. Meanwhile, India will have to continue to depend on transfer of technology for local production. This requires long-term planning, the absence of which has sadly been the bane of India's efforts to achieve self-reliance in defence production.

The second factor that has resulted in what one may call fragmented self-reliance is the focus on indigenisation of parts and components or development of minor technologies which go into manufacturing of a system, rather than indigenisation of the critical components or technologies for manufacturing a major platform, which are susceptible to denial regimes and without which the platform in question cannot be operationally exploited.

The prime example of this approach is the iDEX (Innovation for Defence Excellence) and Technology Development Fund (TDF), both of which are excellent schemes and have produced sterling results, but apparently these schemes have collectively not led to complete indigenisation of any equipment, platform, or weapon system.

And lastly, the money factor. Defence R&D is the backbone of self-reliance. Despite several efforts to rope in the private sector, Defence Research and Development Organisation (DRDO) continues to be the main defence R&D agency of the government. However, the proportion of the R&D budget to the total defence budget has come down from 5.47% in 2014-15 to 3.94% in 2025-26. As a proportion of the GDP also, the R&D budget has come down during the same period from a meagre 0.12% to 0.08%. Considering that a sizeable portion of the budget goes into payment of salaries and other revenue expenditure, the actual sums available for research are not enough to propel a major self-reliance push.

It is hard to believe that the South Block is not conscious of these snags in the current policy and, more importantly, what will it take to set the things right to make India truly self-reliant in defence production. What is holding it back from taking the necessary steps remains an enigma, though.

–The writer is a former Financial Advisor (Acquisition), Ministry of Defence. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

VIEWPOINT

A NEW FIGHTER PLANE FOR THE IAF

At present the Indian Air Force (IAF) is in desperate need of a new fighter plane to enhance its existing capacity, as it is operating at lesser numbers, despite threats from its two neighbours in the east and the west, in addition to the onerous task of keeping the Indo-Pacific Ocean free of any trespasses

ASAD MIRZA

The IAF currently has 31 fighter squadrons instead of its authorised 42. This gap creates real challenges when choosing a new fighter plane for India's mixed air fleet and to increase its numerical strength. The IAF is getting older day-by-day and requires much maintenance, as at any given time one squadron is stationed for maintenance, added to the fact that most of these planes are also scheduled for early phase-outs.

In this background there has been a lot of activity and promotion, both by the US and Russia to sell their F-35 and Su-57 fighter planes to India.

Meanwhile, India has its own plans to develop a fifth generation Advanced Medium Combat Aircraft (AMCA), but its first prototype will not be ready until the mid-2030s. And then also the production may take another ten years to formalise. The United States, Russia, and China are the only nations operating Fifth Generation stealth fighter jets today.

By the time India AMCA will be a reality, Chinese forces will likely have deployed about 1,000 J-20 Mighty Dragons by then, besides exporting them to Pakistan, thus creating a substantial air power imbalance across the region. India's air defence strategy thus faces a vital decision between Russia's Su-57 and America's F-35 or any other fighter plane to fill the shortfall at the earliest.

Chief of the Air Staff, Air Chief Marshal AP Singh has made his displeasure known several times publicly with Hindustan Aeronautics Limited (HAL), for not being able to supply the Tejas fighter planes as per schedule. However, recently a major impediment to HAL's efforts to supply the planes, as per schedule was eased when the American GE Aerospace shipped the first of 99 GE's F404-IN20 engines to HAL, last month. However, overcoming this obstacle might not immediately allow the IAF to get the desired number of planes available at the earliest.

So, the buzz around India choosing between F-35 or Su-57 continues unabated. But deciding between the two latest fighter aircraft is not a simple decision, says former Air Vice Marshal Manmohan Bahadur (Retd), as it is not feasible to do a one-to-one comparison, since issues of integrating the chosen aircraft with existing weapon systems would have to be considered, deciding between the two latest fighter planes is not a joke and also it is not feasible, as both these fighter planes claim to be 5th Gen fighters. Though technically a lot more is known about the F-35, very little details are known about the Su-57. As F-35 has been deployed in many countries, but the Su-57 has not flown outside Russia.

Last month, the US President Donald Trump offered Prime Minister Narendra Modi a proposal for India to purchase the advanced American F-35 Lightning II stealth fighter jets. Meanwhile, the Russian defence exporter Rosoboronexport has also increased its efforts to sell its fifth-generation fighter Su-57E to India.

Still, it is not going to be an easy task to decide between the two aircrafts. Giving a more clear picture, former Air Vice Marshal Sanjay Bhatnagar (Retd) opines that to make a comparison between the two fighters and assess whether they'll be a good fit for the IAF's requirements, several critical specifications have to be matched in terms of their stealth capability, their avionics systems, their payload etc., and these would be crystal clear only when the IAF conducts a Comprehensive Analysis of the two crafts, besides the challenges posed by the varied Indian terrain from east to west, as was done when the Rafale fighter planes

were purchased by India, after a complete MRFA Assessment.

Broadly, Su-57 delivers remarkable capabilities with its Mach 2 speed and compatibility with hypersonic missiles. Whereas, the F-35 stands out with proven reliability from over 1,000 units operating worldwide and enhanced stealth features. Su-57 has not been sold to any country by Russia, so far and its combat capability is also not yet proven.

Developed by Lockheed Martin, the F-35 is claimed to be a state-of-the-art single-engine, single-seat stealth multirole fighter aircraft designed to perform a variety of missions, such as air-to-air combat, air-to-ground strikes, and intelligence gathering.

F-35 has a top speed of Mach 1.6 (approximately 1,931 km/h), and a combat range of around 1,500 kilometres, along with advanced stealth capabilities making it less detectable to enemy radar systems. It is equipped with sophisticated avionics and sensor systems, the F-35 has enhanced situational awareness and combat effectiveness. The aircraft is known for its stealth capabilities.

Russia's Sukhoi company's Su-57 is a twin-engine, fifth-generation stealth multirole fighter aircraft designed for air superiority and strike missions. It is capable of engaging both aerial and ground targets.

The aircraft has advanced avionics, manoeuvrability, and stealth technology. It is designed for agility and speed to achieve air dominance.

However, when buying such a latest engineering marvel, cost also plays a very dominant role in the decision-making process. F-35 is one of the most expensive fighter jets in history, each unit of F-35 costs between $80 million and $110 million. Additionally, its lifetime operational cost is estimated to exceed $1.5 trillion over the program's lifespan.

In contrast, the Russian Su-57 is significantly cheaper, with an estimated unit cost of $35 million to $40 million less than half the price of an American F-35.

Though the American fighter jet, has a larger global supply chain, more advanced avionics, and extensive NATO interoperability. Yet, for India, increasing the cost would be to establish new maintenance and overhaul platforms for both the aircrafts. Though India operates a lot of Russian-made planes, yet the same old platforms could not be used, as Su-57 is a much more advanced fighter plane than those being used by India currently.

To overcome the aircraft's shortfall, our policy planners will have to think of innovative ideas. One school of thought is of the view that given the range of Indian fighter planes to safeguard the Indian airspace, India does not need a costly 5th generation fighter plane.

The Indian operational requirements could be fulfilled by much cheaper 4.5th generation fighter planes. HAL will be rolling out 4.5 gen fighters - LCA Mk-1A and Mk-2 - in large numbers over the next 10 years. So, to fill the shortfall India should not even go for acquiring any new 4.5 generation fighter plane, as it will not add to India acquiring any new technology.

Judiciously, this catch-22 situation could be overcome by taking a rather innovative and keeping with the times solution, that of increasing India's stealth drone capability.

At present global powers are focused on developing stealth combat drones that can operate under the control of stealth or non-stealth motherships to penetrate contested airspace and deliver weapon loads, and India can definitely copy this thinking, saving money in the process.

The US is using XQ-58A Valkyrie, besides, Boeing's MQ-28 Ghost Bat. Many Europe nations are using Dassault's nEUROn and BAE Systems' Tempest & LANCA. China has its own, GJ-11 (Sharp Sword), a stealth UCAV. Russia possesses S-70 Okhotnik-B, in addition to Okhotnik-B, which has already been deployed in combat as part of Russia's Special Military Operation (SMO) in Ukraine. Further, DRDO's Aeronautical Development Agency (ADA) is developing the Ghatak UCAV, a stealth, autonomous combat drone designed for deep-strike missions, reconnaissance, and electronic warfare. It features a flying wing design for enhanced stealth capability.

Prioritising UCAVs over manned fighters will not only restore IAF's combat strength but also future-proof its capabilities in an era of autonomous warfare. And will effectively add to IAF's might at a lower cost, till the time HAL is able to deliver Tejas in large numbers.

The IAF currently has 31 fighter squadrons instead of its authorised 42. This gap creates real challenges when choosing a new fighter plane for India's mixed air fleet and increasing its numerical strength

–The writer is a political commentator and media consultant, based in New Delhi. He can be contacted on www.asadmirza.in. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

DIFFERENT STROKE-I

STEALTH SHOOTOUT: F-35, SU-57 OR AMCA?

As India faces the stealth threat from two adversaries, the IAF's Medium-Role Fighter Aircraft project is coming under increasing scrutiny. In the background of rising costs, slow delivery and doubts about long-term viability, India should pursue a more strategic and collaborative approach in order to enhance its air combat capabilities

RAKESH KRISHNAN SIMHA

Ever since Donald Trump dangled the prospect of two squadrons of F-35s for India, and especially after the stunning aerial ballet of the F-35 and Su-57 at Aero India this past February, the Indian aviation community has been abuzz with talk of a potential stealth fighter deal.

So, what path should India take? Let's begin with the costs - a key factor for a developing country. Germany is spending a whopping $9 billion for thirty-five F-35s. The flyaway cost of the F-35 hovers around $110 million, meaning the price tag likely includes setup, support, spares and training for an eventual total of about $257 million per aircraft. But what if India diverted that colossal sum toward its Advanced Medium Combat Aircraft (AMCA)? That kind of investment could turbocharge the AMCA programme, potentially bringing it years ahead of schedule. It could also allow the project to be hived off from HAL to a private sector special-purpose company, possibly led by industry giants like Tata, Adani or Godrej, allowing India to take the reins of its cutting-edge aerospace future.

The AMCA is a single-seat, twin-engine, all-weather stealth marvel designed for multi-role combat. Like many HAL projects, the AMCA has faced delays, but that doesn't mean it's destined for failure. Look at the Tejas light combat aircraft – a project that, despite its early challenges, now serves as a reliable workhorse for the Indian Air Force. Under the leadership of the late Defence Minister Manohar Parrikar, HAL successfully delivered the Tejas. However, unless there's a drastic timeline shift, an AMCA prototype may not take to the skies before 2030, and an operational squadron could be at least five more years down the road.

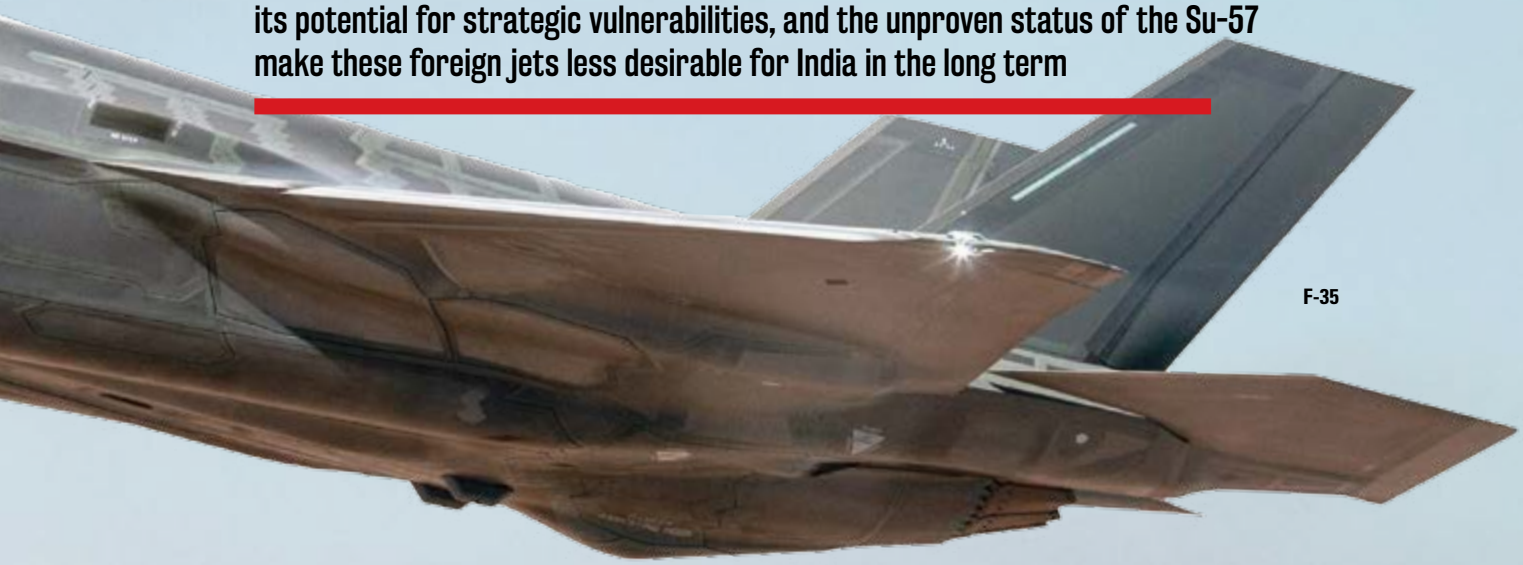
If the AMCA is too distant a dream, India could opt for a more immediate solution: acquiring a limited number, perhaps two squadrons, of F-35s or Su-57s to catapult the IAF into stealth warfare realms. The decision comes down to what the IAF values most - more stealth at the cost of manoeuvrability, or high manoeuvrability at the expense of stealth.

F-35 - NETWORKED BEAST

The F-35, the ultimate networked combat system of the United States, is a powerhouse when it comes to data-sharing in combat, stealth, supercruise, and long-range detection and elimination of targets via air-to-air missiles. But it is not a nimble dogfighter. Its stealth design limits its weapon capacity, with internal bays restricting the number of armaments it can carry. Externally mounted weapons would increase its radar cross-section and, in turn, compromise its stealth.

Speed-wise, the F-35 lags at a top speed of 1,200 mph, while the Su-57 soars ahead at 1,616 mph.

Both the F-35 and Su-57 are formidable options, but each has inherent limitations for India. The F-35's dependence on US-controlled software updates, its potential for strategic vulnerabilities, and the unproven status of the Su-57 make these foreign jets less desirable for India in the long term



F-35

Range? The Su-57 is an endurance champion, boasting a remarkable 3,107-mile combat radius compared to the F-35's more modest 1,380 miles. The Su-57 also outdoes the F-35 in altitude, reaching a staggering 65,617 feet, well beyond the F-35's 50,000-foot ceiling. Clearly, the Su-57 holds the advantage in these areas of combat.

But these factors don't bother the US much. America's military strategy hinges on swarming the enemy with overwhelming numbers, ensuring that enemy air defences are crushed, and frontline forces obliterated. With nearly 800 F-35s in service in the US military and an eventual fleet of over 2,000 planned, the F-35's volume alone is a war-winning asset. Short of Russia – with its specialised stealth-detecting radars; swarms of formidable air-defence fighters; and powerful air defence systems like the S-400 – no air force can realistically survive an all-out F-35 assault. Just ask the Iraqi pilots who tried (and failed) to fend off thousand-bomber raids during Desert Storm.

KILL SWITCH

Contrary to speculation, both in mainstream and social media, the F-35 does not have a kill switch that can turn a stealth fighter into the world's most expensive static display model. But here's the problem - in the unlikely event that the US would want to ground an F-35 sold to another country, it has other ways to do so. Because the aircraft is designed as a completely software-driven weapons platform, the F-35 is effectively a giant kill switch. Simply cutting off software updates would start impacting the aircraft's war-fighting capabilities. But still, the impact wouldn't be immediate - that is, F-35s won't suddenly start

AMCA

DIFFERENT STROKE-I

The flyaway cost of the F-35 hovers around $110 million, meaning the price tag likely includes setup, support, spares and training for an eventual total of about $257 million per aircraft. The Su-57's lower price tag – around $40 million or roughly the same as the indigenous Tejas – makes it an attractive option

tumbling out of the sky.

The F-35 is essentially a flying networked combat system, dependent on software-driven upgrades for mission success. Without these updates, the F-35 can still take off and fly, but its ability to fight, adapt to new threats, and penetrate advanced defences will be severely compromised.

Secondly, let's say you are an F-35 operator and you decide to override Lockheed and try to reboot your stealth fighter with the help of your own software engineers. Good luck with that. According to the 350th Spectrum Warfare Group's F-35 Program Support Cell, international F-35 operators are not allowed to conduct independent test operations outside the continental United States. US government security rules and National Defense Policy require that only US citizens perform specific functions in order to protect critical US technology.

But what if you ignore US rules, hack the onboard system and fly the F-35 anyway? Well, minus the updates from Lockheed, the combat effectiveness of your stealth aircraft would progressively decline - just like your phone slows down and becomes vulnerable to viruses once Android, or Apple stops sending updates to that particular model.

The harsh reality of the fifth/future-generation fighters is that they will be highly software-dependent aircraft that will forever be connected to the manufacturer for the life of that system. In such a scenario, countries that are dependent on imports for their frontline air superiority fighters will have a window of vulnerability that can be exploited by the supplier country. How they navigate will depend on their ties with the US.

While the F-35 will be the primary air superiority fighter for several NATO countries, Japan, Israel and Australia, the risk of dependence on foreign software and hardware in a combat system as sophisticated as the F-35 is a genuine concern for countries like India that value sovereignty in defence matters.

SU-57 - DOGFIGHT DUKE

The Su-57, by contrast, embodies a Russian philosophy that prioritises super-manoeuvrability over stealth. While many jet fighters are designed for long-range kills, Russian doctrine acknowledges that aerial combat often ends in a knife fight. In these close-quarter engagements, manoeuvrability reigns supreme – a belief that resonates strongly with the IAF whose pilots are trained to excel in this very scenario. Plus, the Su-57's lower price tag – around $40 million or roughly the same as the indigenous Tejas – makes it an attractive option.

Moreover, the Su-57 is the only fighter equipped with Directed Infrared Counter Measures, an innovative system that uses laser turrets to blind incoming IR missiles, preventing them from homing in on their target. This could be a game-changer in modern aerial warfare, as such systems have previously been reserved for transports and helicopters. For the Su-57 to carry this system shows Russia's commitment to innovation in air combat.

That said, the Su-57 still faces significant hurdles. It lacks a true supercruise engine, though the forthcoming AL-51 engine could potentially remedy this shortcoming. Its most pressing issue, however, is its immaturity as a programme. With fewer than 30 units delivered and only 76 more on order, the Su-57 is still very much in the prototype stage. Also, there are rumours of Sukhoi working on the more advanced Su-75 stealth fighter. If true, will it remain committed to the Su-57?

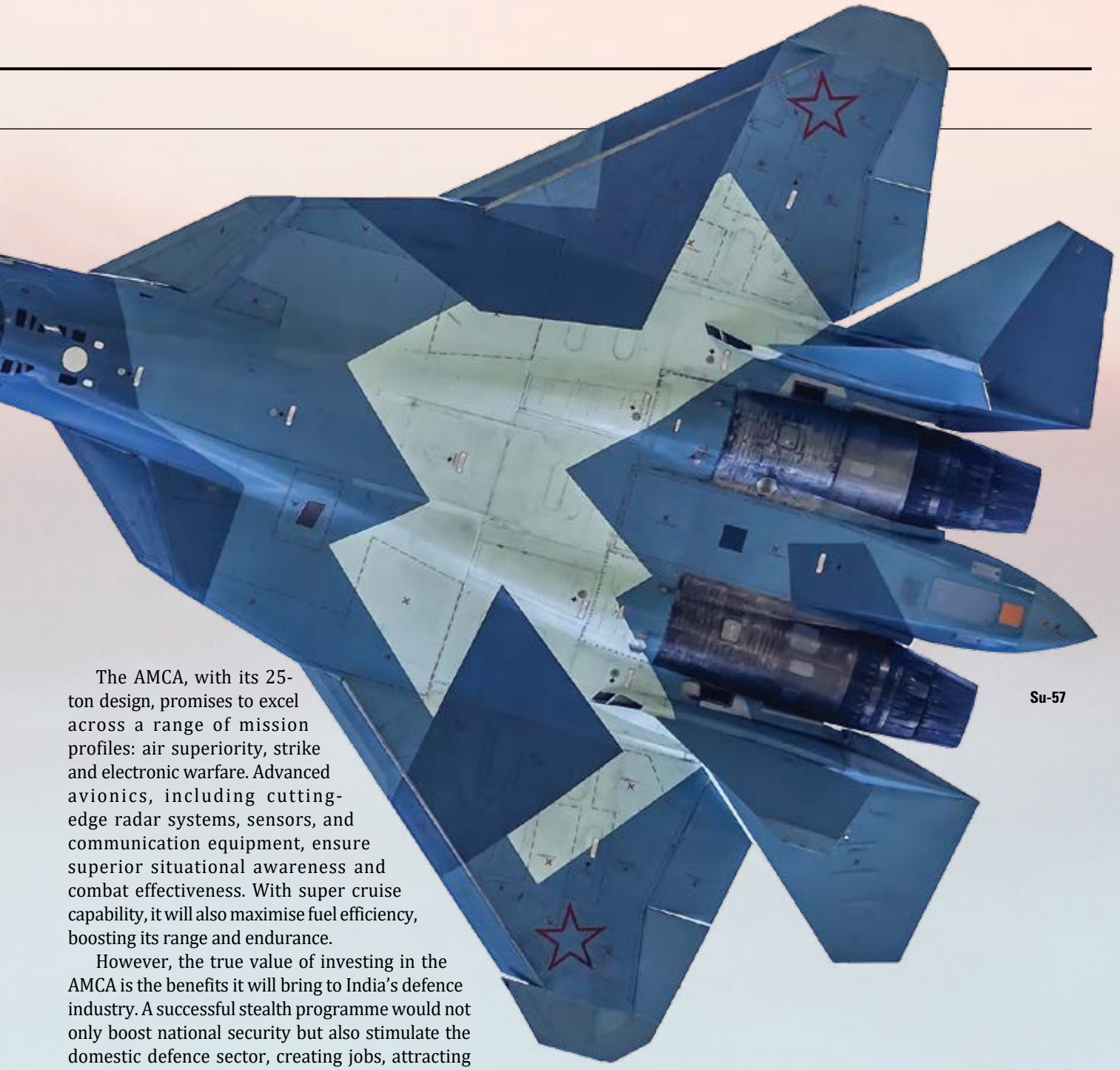
By contrast, the F-35 has already racked up over 1,100 deliveries. In fact, Russia's stealth programme has been playing catch-up for over two decades. As India considers the Su-57, it should weigh this reality – especially since the US has long been flying the highly classified F-22, a fighter that outclasses the Su-57 in many aspects, and has been in service since 2005.

India's flirtation with the Su-57 dates back to 2010, when it inked a deal with Russia to co-develop the fighter. Both sides agreed to invest $6 billion each. However, the project quickly became mired in delays, lack of transparency and technology-sharing disputes. By 2018, the IAF had pulled out of the programme, citing concerns over cost, performance, and the Russians' unwillingness to share critical technologies.

WHICH BRINGS US TO THE AMCA

Rather than splurging billions on an unproven foreign fighter, India would be wiser to fast-track its indigenous AMCA programme. The AMCA – a fifth-generation tactical deep-strike fighter – has the potential to drastically enhance India's strategic position, offering both technological sovereignty and the ability to address emerging threats with homegrown solutions.

India is already moving to accelerate the AMCA's development. A top-level committee led by the Defence Secretary has been working hard to reduce development timelines and ramp up production efficiency. The programme's urgency has been underscored by growing regional security concerns, including Pakistan's interest in acquiring China's J-31 stealth fighters and Beijing's deployment of the Chengdu J-20 near India's borders.



Su-57

The AMCA, with its 25-ton design, promises to excel across a range of mission profiles: air superiority, strike and electronic warfare. Advanced avionics, including cutting-edge radar systems, sensors, and communication equipment, ensure superior situational awareness and combat effectiveness. With super cruise capability, it will also maximise fuel efficiency, boosting its range and endurance.

However, the true value of investing in the AMCA is the benefits it will bring to India's defence industry. A successful stealth programme would not only boost national security but also stimulate the domestic defence sector, creating jobs, attracting investment and bolstering India's position as a global player in the arms market. With countries increasingly looking for advanced yet cost-effective fighter aircraft, the AMCA could become a key export product, positioning India as a serious player on the global aviation stage.

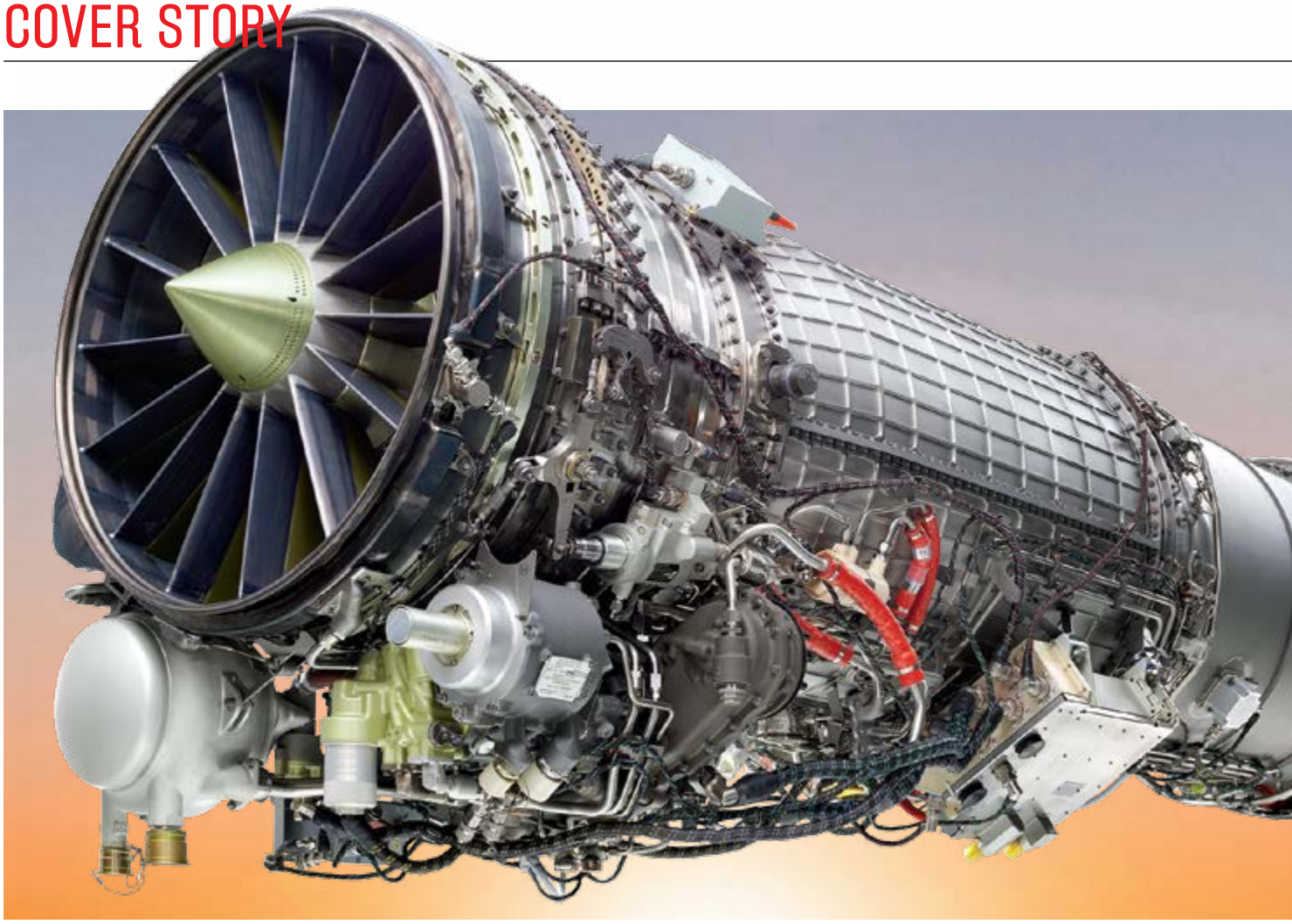
With key figures from the IAF, DRDO and ADA overseeing the project, the AMCA is on track for a first test flight by 2028. If India stays the course, it could leapfrog into the next generation of stealth fighters, solidifying its strategic position for years to come.

CONCLUSION

While the F-35 and Su-57 are both formidable options, they come with inherent limitations, especially for India. The F-35's dependence on US-controlled software updates and the potential for strategic vulnerabilities, coupled with the unproven status of the Su-57, make these foreign fighters less desirable for India in the long term. The AMCA, by contrast, represents an opportunity for India to build a world-class fighter tailored to its specific needs, while securing technological sovereignty and strengthening its domestic defence industry. Therefore, India should prioritise the acceleration of the AMCA programme to ensure its future air superiority and strategic autonomy.

– The writer is a globally cited defence analyst based in New Zealand. His work has been published by leading think tanks, and quoted extensively in books on diplomacy, counter terrorism, warfare and economic development. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

COVER STORY



INDIA'S AEROENGINE CHALLENGES

Caught off-guard with the unexpected delay in the supply of GE's 404-IN20 aeroengines, India's strategic priority now should be on overcoming the aeroengine challenges that have derailed its indigenous fighter jet programme. India's balanced approach should simultaneously prioritise an alternate engine strategy and the maturation of its Kaveri aeroengine programme

AIR MARSHAL M MATHESWARAN

India's manufacturing schedule of Tejas series aircraft has been significantly derailed and delayed by the non-availability of aeroengines. General Electric's (GE) contract with Hindustan Aeronautics Limited (HAL) mandated the supply of 99 F404-IN20 aeroengines for Tejas Mk 1A aircraft. This was one of the largest contracts, valued at US$ 716 million, signed by HAL. The contract, signed in 2021, envisaged the first set of engines to begin arriving in 2022 and the supply of all 99 engines to be completed by 2029. The programme, however, is now nearly three years behind schedule, with the first engine yet to arrive in India as of March 2025. In turn, the development testing and series production of Mk 1A is now behind schedule by more than three years.

Tejas Mk2, which is planned to be a 4.5 generation aircraft in the Rafale class, will be powered by another GE engine, F414-INS6. Mk2, a bigger aircraft with much higher operational capability, will become the backbone of the IAF and hence, will be produced in large numbers. However,

GE-404 Engine

MK 2 is considerably delayed and may also face significant supply chain problems. Concerned by these delays, the IAF obtained the government's approval for an additional order of 97 Mk 1As. HAL has also chipped in by establishing three production lines for a production rate of 24 aircraft per year. However, supply chain issues, starting with GE's F404-IN20 engines, could prove to be a spoiler.

General Electric has now confirmed that it can, at best, supply 10 × F404-IN20 engines a year as against the contractual commitment of higher numbers. This is clearly at odds with HAL's production plans. This issue raises questions about the US as a reliable source for defence supplies, geopolitical issues at play, and India's inability to leverage its defence purchases effectively. The IAF will need to find better solutions to its force structure problems and advise the government accordingly.

GEOPOLITICS OF AEROENGINE SUPPLIES, PRODUCTION, AND TECHNOLOGY ISSUES

General Electric stated that its production schedules for F404-IN20 engines have been hit by supply chain problems and, hence, delays. IN20 is an upgraded version of the 404 version, using new materials to handle higher temperatures to produce a wet thrust of 84 kN. While the financial insolvency of one of the critical suppliers from South Korea is cited as the main reason, one cannot ignore other geopolitical factors. One of the critical components is the Engine Charge Amplifier, supplied by Denmark's firm AVN Energy. The company withheld the supply of these engine charge amplifiers due to EU sanctions on Russia because of the war in Ukraine, implying fears that India might route these products to help Russia. Not only is this preposterous, but it also raises the serious problem of US unreliability. Since India has taken a neutral stance over the Russia-Ukraine conflict, a stand that has not gone down well with the USA and the EU, this delay may be another way of sending a calibrated message to India.

A recent *New York Times* article alleging that HAL may have rerouted critical aerospace components to Russia is proof of this thought process in the governments concerned. India dismissed the NYT article as a hyperbole and voiced serious objections to

India is fiercely protective of its strategic autonomy and occupies a unique geopolitical position, as it balances its long-standing ties with Russia against a growing partnership with the West, particularly the United States

IN TEJAS PROGRAMMES

Tejas Mk1 aircraft

COVER STORY

GE-414 Engine

Grp Capt Kapil Bhargava in cockpit of HA-300

such false propaganda. Notwithstanding this, Western nations continue to suspect that India could serve as an intermediary, potentially rerouting sensitive technologies to Russia. This is part of a larger strategy, as the USA has explicitly stated in the past, to wean India away from military equipment dependency on Russia in the years to come.

India is fiercely protective of its strategic autonomy and occupies a unique geopolitical position, as it balances its long-standing ties with Russia against a growing partnership with the West, particularly the United States. By being part of the Quad and with increased defence collaborations with Western nations, India is deepening its strategic alignment with the US and countries like France, Germany, Australia, Sweden, and the UK. However, Denmark's decision to enforce sanctions on a critical aerospace component underscores the tension created by this dual engagement. These issues highlight the vulnerabilities in India's defence supply chain when geopolitical pressures disrupt access to critical components.

That HAL tasked an Indian private company to indigenise the product through substitution engineering is a validation of the geopolitical connotations of this delay. Indigenisation of this product may take up to two years, further adding to the delays. Indigenisation strategy, however, is a smart move.

HAL should have foreseen these problems while signing the contract in 2021. Delays were inevitable as GE had closed the production lines of GE 404 engines in 2016. Reviving it involved design work for upgrading engine performance, re-establishing supply chains, and addressing sanction-related issues.

All these issues highlight the urgency for India to make the right strategic decisions with short-term

solutions and long-term strategic gains in aeroengine capabilities. To adopt the most effective strategy, India will need to review its past mistakes, consider geopolitical barriers, and adopt solutions solely in our national interests.

INDIA'S STRATEGIC DECISION-MAKING AND PROBLEMS OF STRATEGIC DISCONTINUITY

India's struggles to find optimal aeroengines for indigenous fighter programmes go back a long way. India was one of the first countries in the global south to design, develop, and manufacture a supersonic fighter aircraft, the HF-24. The government displayed considerable foresight in bringing Dr Kurt Tank of Messerschmitt fame to HAL to establish and lead a design team to develop HF-24, India's first indigenous fighter aircraft. This aircraft had the best design in the 1960s, and was distinctly ahead of its time. It was, however, underpowered due to the non-availability of an optimal jet engine, a victim of Cold War geopolitics.

At the same time, as HF-24 was being developed, Egypt engaged the services of Willy Messerschmitt and his team to design and develop a supersonic interceptor for the Egyptian Air Force. This was the HA-300. Indian test pilot Group Captain Kapil Bhargava performed the aircraft's first test flight. In addition, with the Egyptian government's support, Willy Messerschmitt brought the Austrian Ferdinand Brandner to design and develop the E-300 engine of 10,582 lbf thrust output with reheat and first ran in July 1963. Joining hands with Egypt (both countries were NAM partners and founding members), India shared funding for engine development to use it as the powerplant for HF-24 aircraft. Egypt invested a huge amount of 135 million Egyptian Pounds.

The engine recorded its first flight on the second prototype aircraft on July 22, 1965. However, on account of geopolitical and economic factors that arose from Egypt's defeat in the 1967 war with Israel, Egypt abandoned the programme in 1969. This was a great opportunity for India to take charge of the E-300 engine programme. However, with Egypt's exit, India also abandoned the programme.

India not taking over the E-300 engine programme is a fascinating case of missed opportunity shaped by strategic, technical, and geopolitical factors. India's decision on E-300 was not only a missed opportunity, but also strategically short-sighted. The problem is related to the orientation of India's leadership, which, for some strange reason, had not grasped the fact that aeroengines are the cornerstone of great power status – vital for autonomy and influence – like China did post the Sino-Soviet split or Egypt under Nasser. India saw them as technical add-ons and not strategic imperatives. This was further complicated by India's low and delayed funding, short-term focus, and the lack of appreciation for failures as stepping stones to success.

The lack of a long-term coherent strategy with respect to aeroengine development resulted in decisions characterised by strategic discontinuity. For example, India had Kurt Tank for the HF-24 Marut design but did not pair him with an engine push like Egypt's Nasser did with Brandner's E-300 for the HA-300 aircraft.

Aeroengine development is a complex national security challenge and should have been at par with other strategic programmes such as nuclear and space capabilities. It needed vision, strategic continuity, and investments to establish strengths in advanced metallurgy and materials, precision manufacturing, and robust testing facilities. This strategic vision needed to come from the nation's apex leadership. China is a good example of how such a vision, long-term strategic focus, and investments have resulted in mastering critical capabilities, including aeroengine technology and manufacturing. Like China, India also has a centralised and top-down approach when it comes to strategic programmes in nuclear, space, and defence. However, in a vibrant democracy, centralised intent translates into bureaucratic control, fragmentation, and siloed execution, with little accountability.

In China, on the other hand, its centralised intent and decisions integrate the ecosystem in execution with accountability. The lack of technocratic knowledge at the apex of leadership adversely impacts the progress of strategic capability. This is the major difference between China and India. China's CCP elite often comes from engineering and technocratic backgrounds. Although authoritarian, China's meritocratic system elevates leaders who grasp strategic technologies and steer projects. India's leaders often see technology as a slogan (Aatmanirbhar Bharat), not as a hands-on priority, leaving execution to an underpowered bureaucracy.

India's failure to master aeroengine capability, despite numerous opportunities such as the E-300 in the 1960s and the Kaveri since 1989, reflects a persistent lack of strategic foresight and acumen. The result is self-evident: China today operates its fully developed, mature indigenous engines like WS-10 and advanced versions like WS-15; India is still dependent on engine imports from the US, France, the UK, and Russia.

India's failure to master aeroengine capability, despite numerous opportunities such as the E-300 in the 1960s and the Kaveri since 1989, reflects a persistent lack of strategic foresight and acumen

COVER STORY

India's struggle for aeroengine capability remains a continuous search characterised by strategic discontinuity, lack of long-term focus, low and disrupted investments, inadequate testing infrastructure, lack of accountability and inefficiency, and poor recognition of the importance of this capability at the national leadership level

ENGINE CHALLENGES FOR TEJAS: THE WAY FORWARD

The production schedules of Tejas Mk 1As have been seriously impacted by delays in General Electric's supply of F404-IN20 engines. This, in turn, adversely impacts the IAF's force structure. It is time that the government and the IAF dealt with this problem from a long-term perspective. Leading engine manufacturers are loath-to-part with critical technologies. America's policies make it even more difficult for American companies to share even basic production technologies. The only effective way is to leverage the large orders we give to these companies by locking them into a stake-holder partnership and through ruthless competition. HAL's contract with GE for the manufacture of F414-INS6 engines for Tejas Mk2 is still to be concluded as it is stuck on technology transfer issues. Given these challenges, India's approach should be well-focused: achieving mastery over aeroengine capabilities by the end of these contracts.

TEJAS MK 1A: FIRST BATCH OF 83 AIRCRAFT

The manufacture of the first batch of 83 aircraft is already behind schedule by three years on account of delays in the delivery of 99 × F404-IN20 engines. India's approach should pressurise and penalise GE to accelerate delivery. Because these are off-the-shelf buys, it does not involve ToT other than maintenance services.

SECOND BATCH OF 97 AIRCRAFT

Given the delays in the procurement of MRFA and the development of Tejas Mk2, the IAF has decided to proceed with an additional order of 97 × Tejas Mk 1A. The government and IAF must decide on an alternate engine strategy for this batch of 97 aircraft. Some argue that this will delay the program, as it requires redesign and testing to accommodate the new engine. The argument is weak if one keeps larger and long-term strategic issues in mind. Since GE has said it could supply only 10 engines a year, it makes no sense to continue with the same engine for the second batch of 97 aircraft, as the production schedule will extend beyond ten years, which is unacceptable. The contenders for this alternate engine strategy could be Snecma's M88-4E and Eurojet's EJ-200.

Snecma's M88-4E is a derivative of M88-2, which powers Rafale. It has slightly less thrust at 75 kN compared to 84 kN delivered by F404-IN20. However, in development tests, the thrust performance of 4E is reported to have gone up to 90 kN. The engine is smaller, has a better thrust-to-weight ratio, better fuel efficiency, and a much lower infrared signature. Because the IAF is already operating a Rafale aircraft, the commonality aspect is a distinct advantage.

Eurojet's EJ 200, which powers the Eurojet Typhoon, is a more advanced engine that produces a thrust of 90 kN. This is also a smaller engine with advanced technologies, lower infrared signature, comparable fuel efficiency, modular design for easy maintenance, and the distinct advantage of German metallurgy. It has a high thrust-to-weight ratio (9.17:1 vs F404's 7.8:1), is lighter (at 990 kg), and is punchier, thus enhancing manoeuvrability. The thrust edge of EJ 200 and its ease of integration make it a strong contender.

CHALLENGES AND ADVANTAGES

Both engines are smaller and lighter. It will require some

GTRE Kaveri Derivative Engine on display

HF-24 Marut aircraft


Helwan HA-300 aircraft (artistic image)

As an aspiring great power, India should have treated this as a strategic project—on par with its space, nuclear, and Integrated Guided Missile Development Programme (IGMDP) initiatives. A clearer understanding of the importance of aeroengine capability as a strategic multiplier would provide the right focus, support, and accountability

redesign of the fuselage and intakes to accommodate either of the engines, along with flight testing and certification. This can be done within three years if the project is taken up on a war footing.

India's second batch of 97 Mk 1A will require at least 120 engines, including reserves. This makes it an ideal case for production in India with significant technology transfer. The choice of an alternate engine for Mk 1A is a mandatory strategy for India to hedge against the vagaries of American dependency. More importantly, India can leverage this project by ensuring a stakeholder partnership in further engine developments for AMCA and other projects. While GE 414 can power Mk 2, this hedging strategy is equally applicable.

KAVERI ENGINE

India must leverage an alternate engine strategy to plug the gaps in the Kaveri engine programme and bring it to logical maturity. Smart partnership in this programme will enable India to finally master the aeroengine complexity.

MOVING FORWARD WITH A STRATEGIC ACTION PLAN

India's struggle for aeroengine capability remains a continuous search characterised by strategic discontinuity, lack of long-term focus, low and disrupted investments, inadequate testing infrastructure, lack of accountability and inefficiency, and poor recognition of the importance of this capability at the national leadership level. A country's ability to successfully design and manufacture an aeroengine is a strategic capability. Mastering this capability means control over many aspects of critical technologies in areas of metallurgy, advanced materials, electricals and electronics, thermodynamic optimisation, advanced design and manufacturing capabilities such as single-crystal blade design, precision engineering, heat treatments, and advanced testing processes, and robust test facilities such as high-altitude test facilities and flying test beds.

As an aspiring great power, India should have treated this as a strategic project—on par with its space, nuclear, and Integrated Guided Missile Development Programme (IGMDP) initiatives. A clearer understanding of the importance of aeroengine capability as a strategic multiplier would provide the right focus, support, and accountability. While addressing the short-term problems of GE engines for Tejas aircraft, India must implement a long-term strategy with a clear focus on mastering aeroengine capabilities. An alternative engine strategy for Tejas Mk 1A should be the start of a larger strategy in which India matures its Kaveri project and derives lessons to implement in the development of advanced engines using a risk-sharing stakeholder partnership approach. This would be a leapfrogging strategy with strong long-term strategic foundations.

– The writer, a AVSM VM PhD (V) is a former Deputy Chief of Integrated Defence Staff for Policy, Plans, & Force Development (DCIDS – PP & FD). He is currently the President of The Peninsula Foundation, a Chennai-based public policy research think tank. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

DIFFERENT STROKE-II

FIGHTER DILEMMA: BALANCING SHORT-TERM UPGRADES WITH LONG-TERM AIR SUPERIORITY

India is under US pressure to choose F-21 or F-15EX for the MRFA programme. The geopolitical landscape may play a role in this potential deal, with the United States keen to strengthen defence ties with India as part of its broader strategy to counterbalance China's growing influence in the Indo-Pacific region. Still, India must also explore 6th Gen European fighter initiatives

RAKESH KRISHNAN SIMHA

As the Indian Air Force seeks to upgrade, modernise and replenish its dwindling fighter fleet, India is under increasing US pressure to choose between Lockheed Martin's F-21 and Boeing's F-15EX for its Multi-Role Fighter Aircraft (MRFA) programme, an essential component of the IAF's modernisation strategy. The mounting pressure comes at a delicate time when trade negotiations between the two countries are ongoing, with the US hinting that India could receive trade benefits if it decides to buy American fighters.

At the same time, new developments in global fighter jet programmes, particularly in Europe, are opening up fresh opportunities for collaboration, which could align with India's long-term ambitious plans for air superiority. With these developments unfolding, India must weigh its strategic options carefully to solidify its position as a leading aerospace power.

MRFA CHOICES

The MRFA programme is critical for the IAF because it seeks to replace its ageing fleet with modern, multi-role fighter aircraft capable of performing a wide range of combat operations. The United States, through its defence giants Lockheed Martin and Boeing, is intensifying efforts to have India choose between two of their most advanced fighter jets - the F-21 and the F-15EX.

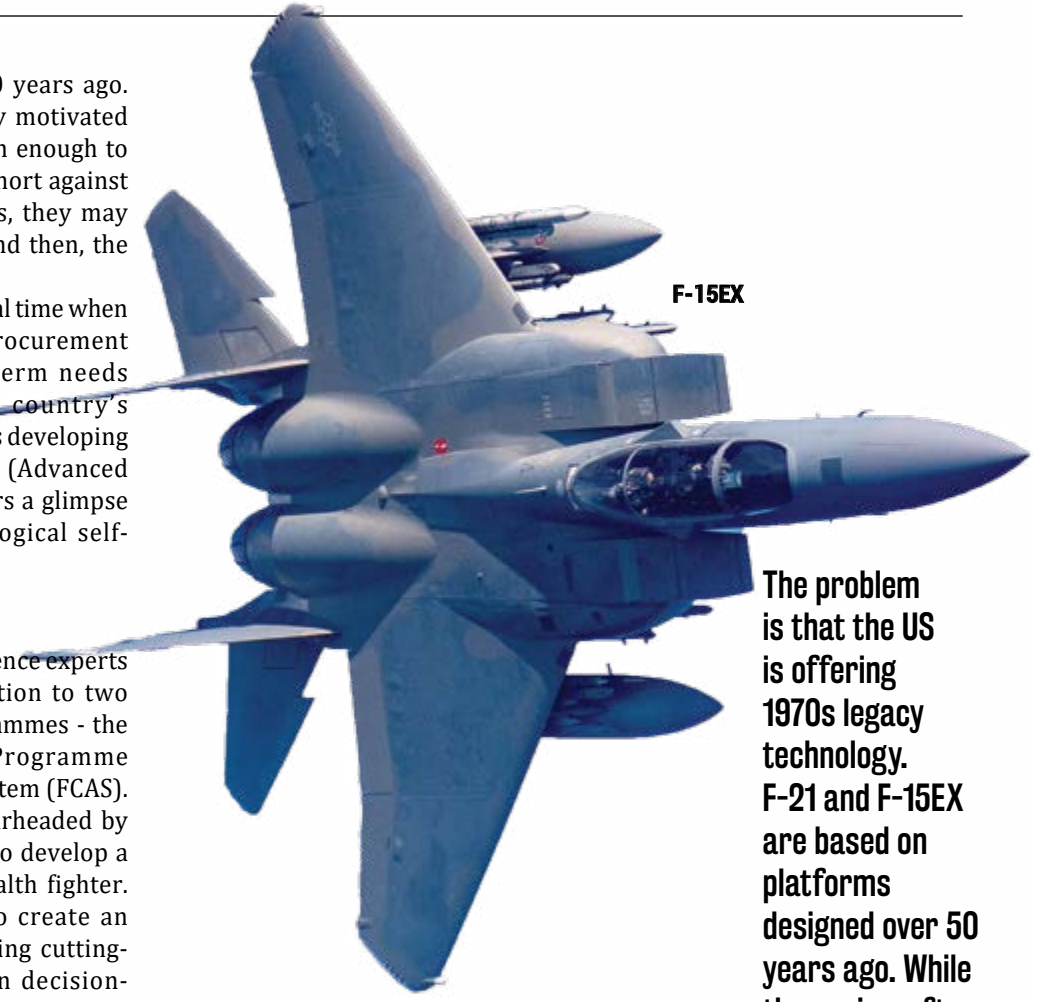
Lockheed Martin's F-21 is a variant of the F-16 fighter jet, tailored to meet India's specific requirements. The F-21 offers cutting-edge capabilities in avionics, weapon systems and multi-role operations. The F-15EX, an upgraded version of Boeing's long-serving F-15, is a powerhouse known for its payload capacity, combat readiness and versatility.

Washington has linked the MRFA choice to broader trade negotiations, with hints that India could receive favourable trade benefits if it opts for American fighter jets. The geopolitical landscape could also play a role in this potential deal, with the US keen to strengthen defence ties with India as part of its broader strategy to counterbalance China's growing influence in the Indo-Pacific region.

However, the problem is that the US is offering 1970s legacy technology while the MRFA aims at giving the IAF an edge in 21st-century warfare. F-21 and F-15EX are based on airframes and platforms

designed and conceptualised over 50 years ago. While these aircraft - flown by highly motivated and trained IAF pilots - are more than enough to take on Pakistan, they may come up short against modern Chinese stealth fighters. Plus, they may become obsolete in about 10 years and then, the IAF will have to restart the search.

American pressure comes at a crucial time when India, looking beyond short-term procurement solutions, is considering its long-term needs in aerial combat technology. The country's strategic priorities are shifting towards developing indigenous platforms like the AMCA (Advanced Medium Combat Aircraft), which offers a glimpse into India's aspirations for technological self-reliance and cutting-edge capabilities.



F-15EX

GCAP AND FCAS

Parallel to the US offerings, India's defence experts are increasingly turning their attention to two ambitious European fighter jet programmes - the Multinational Global Combat Air Programme (GCAP) and the Future Combat Air System (FCAS).

The GCAP is a joint initiative spearheaded by the United Kingdom, Japan and Italy to develop a next-generation sixth-generation stealth fighter. This ambitious programme seeks to create an advanced combat aircraft incorporating cutting-edge technologies such as AI-driven decision-making, advanced stealth features and autonomous capabilities. India's participation in the GCAP would not only place it at the forefront of military aerospace innovation but also allow the country to tap into the extensive technological expertise of these leading nations.

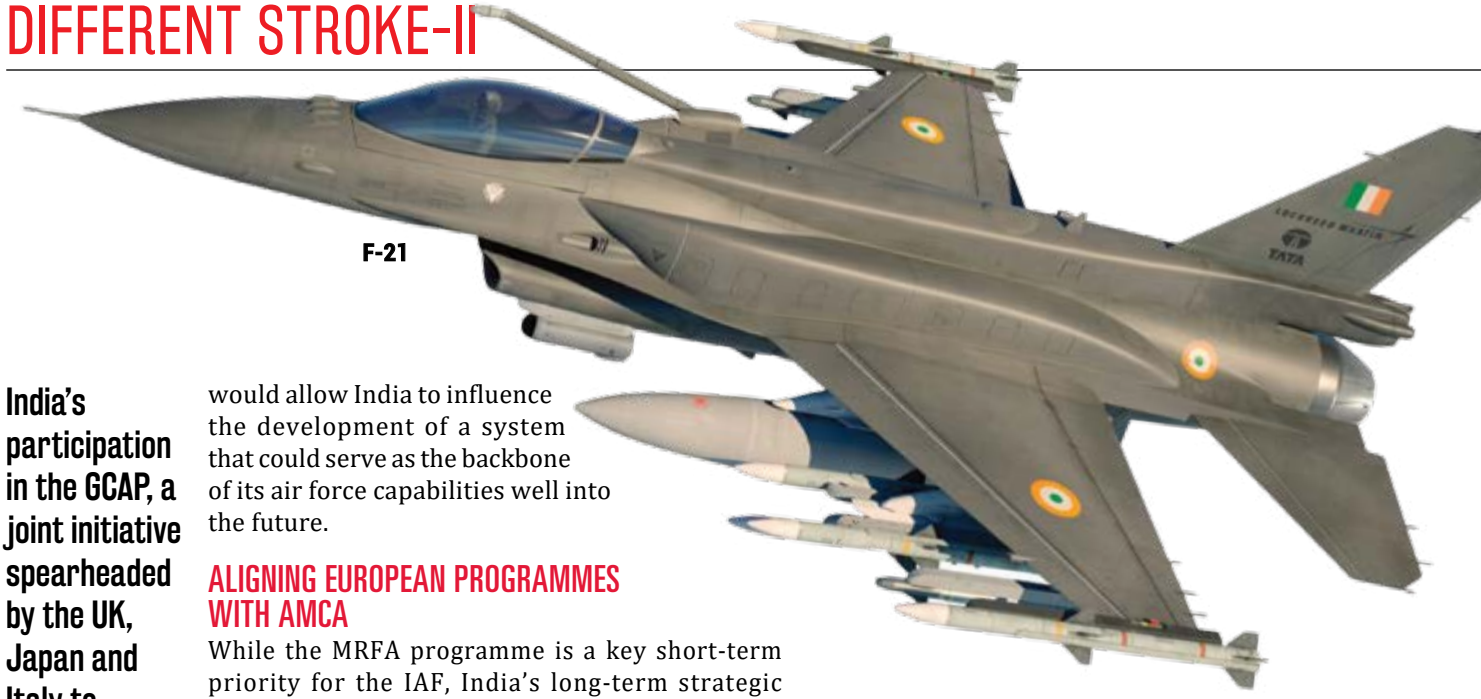
On the other side of the spectrum, the FCAS programme, led by Dassault Aviation, Airbus and Indra Sistemas, promises to be a game-changer in European defence technology. FCAS is designed to be a 'system of systems' with a sixth-generation stealth fighter at its core, complemented by unmanned aerial systems, advanced sensors and networked capabilities. The FCAS will integrate seamlessly into the future operational battlespace, offering capabilities that go well beyond conventional fighter jets, including enhanced situational awareness, autonomous operations, and highly effective multi-domain warfare integration.

India's engagement with FCAS would be a strategic step towards gaining access to some of the most advanced fighter jet technologies available. Participating in such a programme

The problem is that the US is offering 1970s legacy technology. F-21 and F-15EX are based on platforms designed over 50 years ago. While these aircraft, flown by highly motivated and trained IAF pilots, are more than enough to take on Pakistan, they may come up short against modern Chinese stealth fighters

AMCA

DIFFERENT STROKE-II



F-21

India's participation in the GCAP, a joint initiative spearheaded by the UK, Japan and Italy to develop a sixth-generation stealth fighter, would not only place it at the forefront of military aerospace innovation but also allow the country to tap into the extensive technological expertise of these leading nations

would allow India to influence the development of a system that could serve as the backbone of its air force capabilities well into the future.

ALIGNING EUROPEAN PROGRAMMES WITH AMCA

While the MRFA programme is a key short-term priority for the IAF, India's long-term strategic focus is on developing indigenous capabilities, particularly the AMCA. Designed by the Aeronautical Development Agency, it represents a bold step towards technological self-reliance, with features such as stealth, advanced avionics and multi-role versatility.

However, the development of the AMCA is likely to take several more years, with a projected timeline for its induction into service extending into the 2030s. This creates a gap that must be filled by advanced platforms, either through direct procurement or partnerships with foreign nations. The European 6th-generation fighter jet programmes GCAP and FCAS could play a pivotal role in bridging this gap, offering India access to the latest technologies while India continues to develop its next-gen fighter.

India's participation in these programmes could allow for significant technology transfer and joint development opportunities, directly benefiting the AMCA project in due course. Moreover, aligning with the European countries could help India achieve its broader defence objectives, strengthening its position in the global aerospace market and expanding its military partnerships.

NAVIGATING THE STRATEGIC LANDSCAPE

India faces a complex dilemma. On the one hand, the United States is dangling lucrative trade benefits and strengthening defence ties through its fighter jet offerings, on the other hand, the European 6th-generation fighter jet programmes provide an opportunity for India to collaborate with leading aerospace powers on the next frontier of air combat technology.

The decision will ultimately depend on India's broader defence strategy. Should it prioritise short-term operational needs, opting for American aircraft like the F-21 or F-15EX to bolster its current capabilities? Or should it look to the future, aligning with Europe to gain access to technologies that will shape the air forces of tomorrow?

A balanced approach may be the most prudent, with India continuing to push forward with the indigenous AMCA. By doing so, India can build a future-proof air force that combines the best of both the world's state-of-the-art foreign technology and a self-reliant, indigenously developed combat fleet.

CONCLUSION: CHOOSE WISELY

India stands at a pivotal moment in its defence evolution, with critical decisions to be made that will shape its air combat capabilities for decades to come. Pressure from the United States to select the F-21 or F-15EX is undeniable, still, India must also consider the long-term strategic benefits of collaborating with European nations on next-generation fighter programmes like GCAP and FCAS. Additionally, India's ongoing development of the AMCA demonstrates its commitment to self-reliance in defence technology.

In the backdrop of these developments, India's path forward will require a delicate balance of foreign partnerships and domestic innovation. By carefully navigating these opportunities, the country can ensure air superiority for the future while achieving technological self-reliance.

– The writer is a globally cited defence analyst based in New Zealand. His work has been published by leading think tanks, and quoted extensively in books on diplomacy, counter terrorism, warfare and economic development. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

PBS INDIA: STRENGTHENING INDIA'S AEROSPACE AND DEFENCE CAPABILITIES

The company's efforts directly support India's defence modernisation goal, offering advanced, ready-to-deploy propulsion technologies to the armed forces

RA EDITORIAL DESK

PBS India Pvt Ltd is a company of the globally renowned PBS Group Czech Republic, which is actively contributing to the growth of India's aerospace and defence sectors through advanced technology, localised innovation, and strategic collaboration. With decades of expertise in turbojet engines, auxiliary power units (APUs), and environmental control systems, PBS India is focused on supporting the nation's self-reliance mission by integrating global engineering excellence with the Make in India initiative.

PBS India is making significant advancements in the aerospace and defence industry by expanding in manufacturing, engine testing, and overhaul repair and services. These initiatives align with India's vision of self-reliance in defence technology and PBS India as a key player in the turbojet engine market.

This article highlights PBS India's major initiatives and their impact on India's aerospace and defence sector.

Initiated production of critical turbojet engine components. Enhancing quality, reducing lead times, and strengthening India's defence manufacturing ecosystem. A full-fledged engine test setup is underway to validate turbojet engine performance, align with global safety standards, and accelerate R&D cycles.

PBS India plans for full engine assembly in India—offering faster delivery, custom solutions, and seamless integration with local defence programs. A dedicated technical team is focusing on the integration, configuration and support of the engine platform for the Indian unmanned UAV Program

PBS India plans for full engine assembly in India—offering faster delivery, custom solutions, and seamless integration with local defence programs. A dedicated technical team is focusing on the integration, configuration and support of the engine platform for the Indian unmanned UAV Program.

ROH facility to ensure engine/APU uptime, reduce lifecycle costs, and provide full-service support for customer fleets. India supplies compact, high-performance engines for UAV applications, offering end-to-end technical support and propulsion customisation for unmanned systems. Our efforts directly support India's defence modernisation goal, offering advanced, ready-to-deploy propulsion technologies to the armed forces.

EVENT REPORT

FUTURE TECHNOLOGIES SUMMIT 2025

Livingstone Institute of Future Technologies, under the leadership of Lt Cdr John Livingstone (Retd), organised FTS 2025 in New Delhi on March 26. The Summit set a transformative precedent for the future of technology, business, and innovation

RA EDITORIAL DESK

As the world undergoes rapid technological transformation, industries across the globe are evolving at an unprecedented pace. The Future Technologies Summit (FTS) has emerged as a milestone event, bringing together an elite gathering of thought leaders, innovators, and industry experts from diverse sectors. The FTS 2025 provided a though provoking platform for in-depth discussions, collaborations, and the showcasing of breakthrough technological advancements across various domains, including defence, artificial intelligence (AI), quantum computing, space, mobility, fashion, media, and more. Designed to explore the future of multiple industries, FTS 2025 set the stage for visionary innovations and strategic alliances that will shape the future.

Sanat Kaul, Chairman – International Foundation of Aviation, Aerospace, and Drones (IFFAAD) and a summit partner, set the ball rolling for the panellists by highlighting the crucial role to be played by AI in our everyday life, yet also raised a valid question about how our privacy is going to be ensured.

In his keynote address, Maj Gen SK Sharma, VSM, CEO & MD – Indo Russian Rifles Pvt Ltd (IRRPL), emphasised the pivotal role of emerging technologies in defence and warfare. He elaborated on the integration of AI-driven defence systems, autonomous warfare tools, and the strategic shifts required to address contemporary security challenges. His address set the tone for the event, underscoring the importance of technological advancements in national security and global stability.

The first panel discussion on Future of Defence & Warfare delved into the future of defence and warfare, exploring advancements in military strategy, technology, and national security. The panellists provided deep insights into AI-powered defence mechanisms, autonomous warfare systems, cybersecurity threats, and ethical considerations in modern warfare. Discussions focused on the necessity of global cooperation, policy innovations, and robust technological frameworks to address emerging security threats.

The session on Future of AI, Quantum Computing & Space highlighted the convergence of AI, quantum computing, and space exploration. Experts discussed AI-powered decision-making in space missions, advances in satellite technology, and the transformative potential of quantum computing in solving complex scientific and commercial challenges. The dialogue emphasized how these cutting-edge technologies will revolutionize research, industrial applications, and interstellar exploration.

With global supply chains and transportation networks facing unprecedented challenges, the session on Future of Mobility, Media & Cinema focused on groundbreaking innovations in mobility and logistics. Panellists explored electric vehicles, autonomous delivery systems, AI-driven logistics solutions, and their potential to combat congestion and climate change issues. The session also expanded into the evolution of digital media, discussing the transformation of cinema and content distribution in an AI-driven era. The session on Future of Fashion, Media & Cinema explored how AI, virtual reality,

and digital media are revolutionizing the fashion and entertainment industries. Experts highlighted AI-driven fashion design, immersive filmmaking technologies, and the evolution of digital platforms that redefine audience engagement.

A major highlight of FTS 2025, was the FutureTech Startup Pitching & Investor Panel, this engaging session provided an exclusive platform for startups to pitch their revolutionary ideas to leading investors. Startups showcased innovations in AI, blockchain, automation, and cybersecurity, receiving critical insights and investment opportunities. The session bridged the gap between visionary entrepreneurs and seasoned investors, fuelling the next wave of technological advancements.

A highly anticipated session featured an exclusive coffee chat with Major Samar Toor, a veteran of UN Mission Operations. He shared valuable insights on global security, leadership, and the impact of emerging technologies on modern military strategies. This interactive session provided attendees with an opportunity to engage in candid discussions and gain knowledge from his extensive experience in international peacekeeping and defence operations. Overall, FTS 2025 successfully facilitated cross-industry dialogue, collaborations, and knowledge sharing. The event served as a catalyst for innovation, inspiring new ideas and partnerships that will shape the future of technology and business. Discussions and networking opportunities paved the way for groundbreaking advancements, ensuring a more connected, efficient, and technologically advanced future.

IN CONVERSATION

SKY IS THE LIMIT FOR INDIAN TECHPRENEURS: ABINASH SAHOO

BonV Aero is a pioneering logistics drone manufacturing company, based in Bhubaneswar, Odisha. It specialises in Transport Class UAVs for high altitudes and challenging terrains. BonV Aero's drones, with a payload capacity of up to 20 kg, are currently operationally deployed between 14,000 ft to 17,000 ft AMSL. In a chat with *Raksha Anirveda's* Consulting Editor, ***Asad Mirza, BonV Aero's Co-founder and CTO, Abinash Sahoo*** and ***Satyabrata Satapathy, Co-founder and CEO*** traced the company's challenging as well as rewarding journey

Nostalgically speaking about the idea which finally germinated in the form of BonV Aero, Abinash said that during the last decade he was stuck at an advance frontier position of the Indian Army while demonstrating a product for the company, for which he worked. However, his team was stuck due to an avalanche and with road broken and thick ice, they could see the movement down at the base camp, but it was inaccessible due to rough weather conditions. At that point of time he wondered if a flying unmanned machine could be developed which could fly at high altitude with small payloads, and this idea he shared with Satyabrata Satapathy, Co-founder and CEO, BonV Aero.

So, for the next two years i.e. from 2020 to 2021 the time and energy were spent on designing an unmanned aerial vehicle, their and their team's efforts finally culminated in the first prototype of the company's first UAV, Air Orca. By 2022 BonV Aero was able to produce the first full prototype of Air Orca for the Indian Army (IA) and got it tested and approved by the IA. Since then, many Air Orcas are deployed in the high altitudes of Himalaya.

Abinash Sahoo | Satyabrata Satapathy

Commenting on the support given by the IA and the Army Design Bureau (ADB), Abinash was all praise for the recent sea-change of approach of the IA and its different organisations to support and handhold the new startups with innovative ideas and products.

Giving details about the company's first UAV, Air Orca, Abinash said that Air Orca is a revolutionary logistic aerial vehicle designed to excel in challenging terrains and harsh conditions. With the capability to carry payloads up to 20kg, it serves as a lifeline for the armed force in challenging terrains. Developed by BonV Aero, this fully autonomous aerial vehicle features cutting- edge self-flying technology, enabling it to operate beyond the visual line of sight. Air Orca represents the pinnacle of indigenous innovation, delivering essential logistics with unrivalled efficiency and reliability.

Another BonV product is Air Pelican, which could be described as a game-changing logistic aerial vehicle designed to conquer demanding terrains and harsh conditions. With a payload capacity up to 50kg, it serves various applications with state-of-the-art self-flying

Starting its journey in 2020, by 2022 BonV Aero was able to produce the first full prototype of Air Orca for the Indian Army and got it tested and approved by the Indian Army. Since then, many Air Orcas are deployed in the high altitudes of Himalaya

technology, operating beyond the visual line of sight. Successfully demonstrated at Rupa Valley at 8530 feet, ongoing R&D aims to enable flights at 16,000 to 17,000 feet AMSL. Pelican exemplifies indigenous innovation, delivering critical logistics with unmatched efficiency and reliability for diverse use cases, from commercial logistics to emergency response.

Last year, BonV Aero conducted a hover flight test at Umling La Pass in Ladakh, considered the world's highest motorable mountain pass, at an altitude of 19,024 feet. During this flight, a UAV carried a 30 kg payload setting a world record for such operations in high-altitude regions. With a total take-off weight of 100 kg, the aerial vehicle successfully hovered at the extreme altitude, showcasing its superior lifting capability in harsh conditions where traditional helicopters like Cheetah face payload limitations.

According to Abinash, BonV Aero's products are optimised for high-altitude operations, the propulsion system is fine-tuned to achieve the desired torque and RPM with minimal energy consumption. This results in enhanced operational efficiency, particularly in high-altitude, low-density air environments where traditional systems may struggle. The system is engineered for optimal performance while ensuring reduced energy consumption, which is critical for extended flight times and sustainable operations.

The BonV's proprietary algorithm enables seamless drone operations in high-altitude environments. Designed for efficiency in low air density conditions such as fog and snow, it operates reliably even in extreme temperatures as low as -20°C. This ensures optimal performance in the most challenging terrains, enhancing mission success rates in harsh conditions.

In addition, Advanced AI continuously monitors vehicle health, subsidiary sensors, flight cycles, maintenance schedules, airframe condition, and battery performance to predict potential issues before they arise. This technology safeguards the integrity of the vehicle, reduces downtime, and ensures operational reliability, providing a comprehensive approach to proactive maintenance.

Expressing full confidence in the country's defence eco-system, Abinash was of the view that during the last 10 years, an atmosphere has been created in the country, which facilitates and encourages young entrepreneurs with innovative ideas to come forward and provide their ingenuity and skills to the Indian Army. The only factor inhibiting them is the cost of finance or how to access the initial funding. In this regard, if the Government of India could evolve a mechanism, by which the initial financial burden of the techpreneurs could be taken care of, then it may help a lot many young techpreneurs to take the plunge to boost the country's defence capability.

Commenting on the same issue, Satyabrata Satapathy said that India is emerging as a global hub of technology. Many global companies are coming and setting up facilities seeing the intellectual talent pool available in India. Indian deep tech companies have started receiving a lot of VC fundings. Even the current geopolitical situation is going to help Indian companies to supply defence equipment to USA, Europe, and the Middle Eastern countries.

ANALYSIS

CHINA'S RISING DEFENCE BUDGET: IMPLICATIONS FOR INDIA

China's escalating defence budget is both a challenge and a catalyst for India to enhance its defence capabilities and achieve self-reliance in defence production. The Aatmanirbhar Bharat initiative represents a strategic endeavour to build a robust indigenous defence industry, reduce dependency on imports, and position India as a significant player in the global defence arena

NEERAJ SINGH MANHAS

China's defence expenditure has been on a consistent upward trajectory, reflecting its strategic ambitions and growing geopolitical assertiveness. In 2025, China announced a 7.2 per cent increase in its defence budget, bringing it to approximately US$246 billion. This marks the tenth consecutive year of robust growth in military spending, underscoring Beijing's commitment to modernising its armed forces and expanding its influence, particularly in the Indo-Pacific region.

This expansion directly affects India's strategic environment. Both nations share a complex history characterised by territorial disputes, notably the Galwan Valley conflict in 2020. China's increased military budget and enhanced capabilities along the Line of Actual Control (LAC) pose serious strategic challenges for India, raising concerns about future assertiveness or potential conflicts.

Moreover, China's growing naval influence in the Indian Ocean region further complicates India's security landscape. China has established overseas bases, notably in Djibouti, and regularly deploys naval assets in areas traditionally under Indian influence. This development significantly pressures India to recalibrate its maritime security strategies and bolster its naval capabilities.

CHINA'S DEFENCE BUDGET: TRENDS AND STRATEGIC OBJECTIVES

China's defence budget has seen substantial increases over the past decade. In 2015, the budget was approximately US$141 billion, and by 2025, it surged to US$246 billion, representing a 74 per cent increase over ten years. This consistent growth reflects China's focus on enhancing its military capabilities across various domains, including land, sea, air, space, and cyber.

SEVERAL FACTORS DRIVE CHINA'S ESCALATING DEFENCE EXPENDITURE

1. Modernisation of the People's Liberation Army (PLA): China aims to transform the PLA into a world-class military force by 2049, coinciding with the centenary of the People's Republic. This involves upgrading equipment, improving

training and readiness, and integrating advanced technologies.

2. Regional Influence and Territorial Claims: China's assertiveness in the South China Sea, its stance on Taiwan, and border tensions with neighbouring countries necessitate a formidable military presence to support its geopolitical objectives.
3. Countering US presence in Asia: As the United States strengthens alliances and military deployments in the Asia-Pacific, China perceives a need to bolster its capabilities to deter and respond to potential contingencies.

INDIA'S AATMANIRBHAR BHARAT INITIATIVE

In response to these challenges, India has accelerated its Aatmanirbhar Bharat initiative, aimed at achieving self-reliance in defence manufacturing. Initiated to reduce dependency on foreign imports and strengthen indigenous production, the initiative includes substantial policy reforms such as the release of positive indigenisation lists banning imports of specific defence equipment. By 2023-24, India allocated 68 per cent of its defence capital outlay towards domestic procurement, highlighting its commitment to nurturing an indigenous defence industry.

ROLE OF PUBLIC-PRIVATE PARTNERSHIPS

Public-private partnerships have also become central to India's defence strategy. The Strategic Partnership model promotes collaboration between state-owned enterprises and private firms, aiming to build a robust industrial defence base. The Defence Research and Development Organisation (DRDO) supports innovative startups and medium-sized enterprises through schemes like the Technology Development Fund (TDF) and Innovation for Defence Excellence (iDEX), recently increasing project funding caps significantly.

NOTABLE ACHIEVEMENTS

India's self-reliance journey has already recorded significant milestones. Notably, the commissioning of INS Vikrant, India's first domestically built aircraft carrier, in 2022 was a crucial achievement in Naval capabilities. The indigenous Light Combat Aircraft (LCA) Tejas marked India's advancements in aerospace, while the Advanced Towed Artillery Gun System (ATAGS) underscored progress in artillery systems. India's defence export capabilities also expanded, with the Akash Surface-to-Air Missile system being exported to countries like the Philippines, marking a pivotal shift towards becoming a global defence exporter.

IMPLICATIONS FOR INDIA'S SECURITY LANDSCAPE

China's expanding military prowess poses significant strategic challenges for India. The two nations share a complex history marked by border disputes and strategic competition. The 2020 Galwan Valley clash, resulting in casualties on both sides, highlighted the

India and China share a complex history characterised by territorial disputes. China's increased military budget and enhanced capabilities along the LAC pose serious strategic challenges for India, while raising concerns about potential conflicts. Moreover, China's growing naval influence in the Indian Ocean region further complicates India's security landscape

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China's Defence Budget Since 2015 (Approx.)

Year	Chinese GDP (US $ Trillion)	Defence Budget (US$) Billion	Def Budget Growth Rate	% of GDP	% of Govt Expenditure
2015	11.06	145	10.1	1.31	5.9
2016	11.2	146.6	7.6	1.30	5.8
2017	12.3	151	7.0	1.23	5.6
2018	13.9	175	8.1	1.26	5.5
2019	14.2	178	7.5	1.25	5.4
2020	14.7	183	6.6	1.24	5.1
2021	17.7	209	6.8	1.18	5.4
2022	17.9	229	7.1	1.27	4.8
2023	17.79	225	7.2	1.26	5.0
2024	18.5	235	7.2	1.27	5.1
2025	19.5	249	7.2	1.27	5.2

Source: *World Bank, IIS Military Balance, Chinese news reports and official figures*

The Aatmanirbhar Bharat initiative has made significant strides but technological gap remains a huge challenge. Certain critical technologies, such as advanced jet engines and complex weapon systems, still require foreign collaboration

volatility of their border tensions. China's increased defence spending enhances its ability to project power along the Line of Actual Control (LAC) and in the Indian Ocean Region (IOR), areas of critical importance to India's security.

INDIA'S STRATEGIC RESPONSE: THE AATMANIRBHAR BHARAT INITIATIVE

In response to these challenges, India has embarked on the Aatmanirbhar Bharat Abhiyan (Self-Reliant India Initiative), aiming to reduce dependence on foreign defence imports and build a robust indigenous defence industry. This initiative encompasses several key strategies:

1. ***Policy Reforms and Indigenisation Lists:*** The Ministry of Defence has introduced positive indigenisation lists, restricting the import of specific defence equipment to promote domestic production. As of 2025, over 500 items have been identified for indigenous manufacturing.
2. ***Enhanced Defence Production Targets:*** India aims to achieve a defence production turnover of ₹1.75 lakh crore (US$23 billion) by 2025, including exports of ₹35,000 crore (US$4.6 billion).
3. ***Public-Private Partnerships and MSME Involvement:*** The initiative emphasises collaboration between public sector undertakings (PSUs), private enterprises, and micro, small, and medium enterprises (MSMEs). Notably, the private sector's share in defence production reached 22 per cent in FY2024, the highest in nearly a decade.
4. Technological Innovation and R&D: Organisations like the Defence Research and Development Organisation (DRDO) play a pivotal role in developing indigenous technologies. Projects such as the Akashteer air defence control and reporting system exemplify India's commitment to creating advanced defence systems tailored to its strategic needs.

CHALLENGES IN ACHIEVING SELF-RELIANCE

While the Aatmanirbhar Bharat initiative has made significant strides, several challenges remain:

1. ***Technological Gaps:*** Certain critical technologies, such as advanced jet engines and complex weapon systems, still require foreign collaboration. Bridging these gaps necessitates sustained investment in research and development and strategic partnerships for technology transfer.
2. ***Infrastructure and Capacity:*** Developing the necessary infrastructure and manufacturing capacity to support large-scale production of defence equipment is a complex endeavour. Ensuring quality control and meeting stringent standards are essential for maintaining credibility in domestic and international markets.
3. ***Global Competition:*** Establishing a foothold in the global defence market requires navigating a competitive landscape dominated by established players. India must leverage its unique strengths, such as cost-effective production and a skilled workforce, to carve out a niche in this market.

CONCLUSION

China's escalating defence budget serves as both a challenge and a catalyst for India. It underscores the imperative for India to enhance its defence capabilities and achieve self-reliance in defence production. The Aatmanirbhar Bharat initiative represents a strategic endeavour to build a robust indigenous defence industry, reduce dependency on imports, and position India as a significant player in the global defence arena. While challenges persist, the progress made thus far provides a strong foundation for future advancements. By fostering innovation, encouraging public-private partnerships, and investing in research and development, India can navigate the complexities of regional security dynamics and assert its strategic autonomy in an increasingly multipolar world.

–The writer is a Special Advisor for South Asia at the Parley Policy Initiative, Republic of Korea. He regularly provides commentary on India-China border issues, water security, and transboundary river challenges in South Asia. You can follow his updates on X at @The_China_Chap. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

ANALYSIS

STEEL, STRATEGY AND NARI SHAKTI

Indian Navy expands its strategic footprint with cutting-edge indigenous warships, a historic push for gender inclusion, and maritime diplomacy. It is transforming itself into a 21st century force while shouldering greater responsibility across the Indian Ocean region

CMDE RANJIT B RAI

The commissioning of three major warships by Prime Minister Narendra Modi at Mumbai's Naval Dockyard on January 15 marks a significant stride in the Indian Navy's ongoing journey towards *Aatmanirbharta* (self-reliance) in defence production. Built by Mazagon Dock Shipbuilders Limited (MDL), these three state-of-the-art platforms are a showcase of indigenous capability—over 75 per cent of their components are sourced from within India, and each was completed within the scheduled timelines. All three vessels have now been inducted into the Western Fleet as frontline combatants.

INDIGENOUS WARSHIP CONSTRUCTION: A TECHNOLOGICAL LEAP FORWARD

Constructed using 16,000 tonnes of Indian-made steel, the trio includes the 6,800-tonne INS Surat—the fourth and final warship in the Project 15B class of guided-missile destroyers; INS Nilgiri, a 6,400-tonne stealth frigate and the first of seven under Project 17A; and the last of six Scorpène-class submarines, INS Vagsheer. The frigate INS Nilgiri represents a significant upgrade over the earlier Shivalik-class, designed by the Indian Navy's Directorate of Naval Design. It features the Lanza-NG 3D air surveillance radar, co-developed by Tata Advanced Systems Limited, Spain's *Indra* Sistemas, and Italy's Leonardo, alongside advanced stealth and combat systems.

INS Vagsheer, designed by France's Naval Group, incorporates the Submarine Tactical Integrated Combat System (SUBTICS) suite and is armed with underwater-launched SM39 Exocet anti-ship missiles and SUT-B torpedoes, currently deployed in a transitional fitment from the Navy's existing inventory.

INS Surat and INS Nilgiri are globally competitive warships. They feature an upgraded version of the 76mm Super Rapid Gun Mount from Italian defence manufacturer Otobreda, now produced by Bharat

The recent commissioning of three indigenous warships marks the beginning of India's maritime ascent. The Indian Navy is expanding its regional presence with cutting-edge indigenously-built platforms, enhanced logistics, and greater inclusion of women and Agniveers. It is breaking traditions while building formidable new capabilities

Heavy Electricals Limited (BHEL). Both ships are equipped with eight BrahMos supersonic cruise missiles—with a strike range of 750 km—supplied by Bharat Dynamics Limited (BDL), widely regarded as one of the most potent missile systems globally. Air defence is provided by 32 Barak-8 surface-to-air missiles, co-developed by the Defence Research and Development Organisation (DRDO) and Israel Aerospace Industries (IAI).

The Indian Navy's decision to adopt the EL/M-2248 MF-STAR (Multi-Function Surveillance, Track and Guidance Radar) supplied by Israel's ELTA Systems Ltd as a standard sensor suite demonstrates forward-thinking procurement. This radar is widely rated superior even to the United States Navy's AEGIS system in certain aspects. DRDO's heavyweight torpedoes, the Varunastra, integrated with launchers from Larsen & Toubro, add to the anti-submarine warfare suite. Combat operations are further supported by recently acquired MH-60R Seahawk helicopters for both anti-ship and anti-submarine roles.

Command and control infrastructure aboard these vessels is indigenously developed by the Weapons and Electronics Systems Engineering Establishment (WESEE), with installations carried out by Bharat Electronics Limited (BEL). These systems are backed by satellite communications terminals using the Indian Space Research Organisation's GSAT-7 and GSAT-8 satellites, along with secure digital links and a full suite of electronic warfare (EW) systems, including receivers and jammers.

The ships' internal layouts reflect modern

naval thinking, with ergonomically designed accommodation for over 300 officers and sailors, including facilities tailored for the growing number of women now serving in the Navy. Onboard systems include advanced technologies such as artificial intelligence (AI), quantum computing applications, and software-defined radios, highlighting the Navy's embrace of technological modernity.

NARI SHAKTI AND AGNIVEERS: RESHAPING THE NAVY'S WORKFORCE

A key area of transformation lies in the human element of the force. The Navy is aligning with India's broader push for *Nari Shakti* (women's empowerment), particularly in combat and technical domains. A rejuvenated Logistics Branch has emerged as a professional corps populated by graduate-level

ANALYSIS

From commissioning advanced destroyers and submarines to supporting foreign policy through defence diplomacy and humanitarian missions, the Navy is emerging as a modern, agile and technology-driven maritime force

officers—both men and women. The introduction of the *Agnipath* scheme has added a fresh dynamic to the naval workforce, with *Agniveers*—young male and female recruits entering for a four-year term—now undergoing rigorous training and evaluation. Only the top 25 per cent are retained for permanent service, adding a competitive edge that is likely to raise the performance bar across the board.

Traditionally, most naval officers were men between the ages of 16 and 18, inducted through the tri-service National Defence Academy (NDA) at Khadakwasla near Pune—an institution curiously distant from any actual sea exposure. It offered training on an inland lake and a lifestyle shaped heavily by Army protocols. Today, officer training has evolved significantly. The Indian Naval Academy (NAVAC) at Ezhimala, in Kannur district, Kerala, now produces officers with Bachelor of Technology (B Tech) degrees. The Academy's motto, Vidyayaa Amritam Ashnute, translates to "Through knowledge, one attains immortality"—a fitting mantra for a Navy that is betting on a technologically savvy force.

The Navy's Logistics Branch, now almost entirely digitised, runs naval messes and recreational institutes along commercial hotel lines, bringing a level of professionalism to service support. Women junior officers have also proven their mettle as administrative aides and secretarial staff to flag-rank officers.

Enlisted sailors—recruited at a similarly young age—receive initial training at INS Chilka in Odisha, where they learn basic seamanship, physical conditioning, swimming, and naval subjects. They are now joined by the well-educated Agniveer recruits, who receive the same orientation and undergo the same standards of discipline and training.

MARITIME DIPLOMACY AND STRATEGIC INFRASTRUCTURE

India's maritime outreach and regional influence have grown steadily in recent months, guided by high-level engagements and defence diplomacy initiatives. Prime Minister Modi's visits to neighbouring nations like Mauritius, Sri Lanka, and Thailand have paralleled the Navy's growing presence in the Indian Ocean Region (IOR). India's naval strategy is now deeply intertwined with foreign policy, particularly through the lens of "Defence Diplomacy and Exports", with naval officers embedded in the Ministry of External Affairs (MEA) to coordinate efforts.

The defence budget for 2025-26 has increased by 9.5 per cent, rising to ₹6.8 trillion (approximately USD 75 billion), placing India fourth globally after the United States, China, and Russia. The Indian Navy has emerged as the biggest beneficiary of the capital outlay, allocated ₹57,950 crore—amounting to 41 per cent of the ₹1,40,691.24 crore capital budget. This allocation likely factors in the purchase of 26 Rafale Marine fighter jets. The Indian Air Force receives ₹54,570 crore (39 per cent), while the Indian Army gets ₹27,421 crore (19.5 per cent).

FROM COMBAT TO HUMANITARIAN MISSIONS

The Navy's operational tempo has remained consistently high, reflecting its dual role as a combat-ready force and a first responder in regional crises. In early April, Operation Brahma saw Indian naval ships deliver critical aid to Myanmar following a devastating earthquake. The Navy's participation in Exercise Tiger Triumph (April 1-13) alongside the US Navy underscored its growing interoperability in humanitarian assistance and disaster relief (HADR) operations.

Meanwhile, the Indra-14 naval drills with Russia (March 28-April 2) reaffirmed the long-standing defence partnership between the two nations. On the western front, INS Tarash's interception of 2,500 kg of narcotics in the Arabian Sea—in coordination with Combined Task Force 150—highlighted the Navy's role in regional maritime security.

The Navy continues to operate at a high tempo despite its size. It participated in the 14th edition of the bilateral naval exercise *Indra* with the Russian Navy from 28 March to 2 April in the Bay of Bengal, reaffirming long-standing defence ties. Following a severe earthquake in Myanmar in early April, the Navy rendered humanitarian aid under Operation

Brahma. Exercise *Tiger Triumph*—held from 1 April—saw Indian forces train alongside the United States Navy and Marine Corps in humanitarian assistance and disaster relief (HADR) operations in and around Visakhapatnam. Participating US vessels included the USS Comstock (LSD 45) and the guided-missile destroyer USS Ralph Johnson (DDG 114).

On the western seaboard, INS Sunayna hosted trainees from nine nations in a regional maritime security exercise inaugurated by Defence Minister Rajnath Singh. Around the same time, INS Tarash, operating in coordination with Combined Task Force 150 (CTF 150), intercepted and seized 2,500 kg of narcotics in the Arabian Sea.

BEYOND WARFARE: SOFT POWER AND SYMBOLISM

Prime Minister Modi's two-day state visit to Mauritius from 11 March 2025, as Chief Guest for the island nation's 57th National Day, marked a key moment in India's strategic outreach. India is assisting Mauritius in developing Agalega Island as a strategic facility. An airstrip capable of handling a P-8I maritime patrol aircraft has already been tested. The Indian Navy may also gain future access to the Diego Garcia base—leased by the United States. India's upgraded vision from SAGAR (Security and Growth for All in the Region) to MAHASAGAR (Mutual and Holistic Advancement for Security and Growth Across Regions) further reflects the evolving nature of India's maritime ambitions. INS Imphal made her first port call to Port Louis, participating in Mauritius's National Day celebrations.

The Navy also acknowledges the need for cultural expression and soft power. On 24 March, the Indian Navy Band delivered a stellar symphonic performance at Bharat Mandapam in Pragati Maidan, Delhi. Featuring a fusion of Western classical and Indian music traditions, the concert was described by media outlets as a tribute to India's cultural mosaic. Defence Minister Rajnath Singh graced the event as Chief Guest.

THE ROAD AHEAD

Indigenous shipbuilding is now the Navy's norm. Of more than 90 ships currently under construction, only one—the Krivak-class frigate INS Tamata (earlier INS Tushil)—is being built abroad at the Yantar Shipyard in Kaliningrad, Russia. Domestically, India has already built two nuclear-powered submarines and an aircraft carrier, underscoring a robust trajectory towards strategic autonomy.

The collective transformation of the Indian Navy—powered by *Nari Shakti*, the Agniveer scheme,

and a revitalised Logistics Branch—is reshaping it into a self-sufficient, technologically advanced force. The recent success of the *Navika Sagar Parikrama II* (NSP-II) underlines this shift. Two naval women officers—Lieutenant Commander Dilna K and Lieutenant Commander Roopa—completed the fourth and final leg of their global circumnavigation aboard the Indian Naval Sailing Vessel (INSV) Tarini, reaching Cape Town in early April. They are expected to receive a hero's welcome in Goa.

As the Indian Navy cements its role as the IOR's preeminent security provider, it must balance combat readiness with diplomatic outreach. Sustaining indigenisation, retaining skilled personnel, and adapting to emerging technologies will be critical in the coming decade. With a mix of modern warships, a diversified workforce, and strategic partnerships, the Navy is poised to play a defining role in India's rise as a maritime power.

Sam No Varuna—May the Ocean God be with us.

–The writer is a Navy veteran and has commanded the Naval Academy. Currently, he curates a Maritime Museum at C 443 Defence Colony, New Delhi. His latest book is - India and its Navy@2025: A Pictorial Journey; ISBN 9 789381 722343; Sabre and Quill Publishers. The views expressed are personal and not of **Raksha Anirveda**

SPOTLIGHT

AKSI AEROSPACE GROUP: PIONEERING AEROSPACE TECH GOES GLOBAL

AKSI Aerospace secures ₹85 crore manufacturing order from FIXAR—a new milestone in aerospace innovation

(L to R): Archit Chandak, Founder Director, AKSI Aerospace Group with Pankaj Akula, Founder Managing Director and Chief Technologist, AKSI Aerospace Group and Vasilii Fainveits, Founder, FIXAR Global

In a significant development for India's aerospace sector, Aksi Aerospace, an indigenous aerospace technology company revolutionising the industry with cutting-edge digital technologies and an unwavering commitment to quality, as a leading player in the defence and aerospace manufacturing space, has secured an ₹85 crore order for the manufacturing of key components from FIXAR, a prominent global leader in unmanned aerial vehicle (UAV) technologies. This landmark deal highlights Aksi Aerospace's growing influence in the field and underscores India's increasing prowess in advanced aerospace technologies.

A NEW ERA OF COLLABORATION: AKSI AEROSPACE AND FIXAR

FIXAR, an industry pioneer known for its cutting-edge unmanned aerial systems (UAS), selected Aksi Aerospace for this prestigious order. This reflects the company's deep technical expertise and its ability to meet the rigorous standards required in the aerospace and defence sectors. FIXAR, recognised for its state-of-the-art unmanned aerial systems, chose Aksi Aerospace as a trusted partner for its capabilities in precision manufacturing and on-time delivery.

As part of the agreement, Aksi Aerospace will provide FIXAR with critical parts and components required for their next-generation UAV systems. The deal comes at a time when the global aerospace industry is seeing a surge in demand for drone technologies, with applications ranging from surveillance and mapping to agriculture and logistics.

MEETING THE DEMANDS OF THE FUTURE AEROSPACE MARKET

The collaboration between Aksi Aerospace and FIXAR is a testament to the growing synergies between the Indian aerospace sector and international players. The UAV market, projected to grow exponentially in the coming years, presents a lucrative opportunity for aerospace manufacturers. Aksi Aerospace has strategically positioned itself to take advantage of this expansion. The company's tech enabled state-of-the-art facilities spread over more than 30000 sq. ft., with strong focus on R&D and well-defined cutting-edge manufacturing processes have enabled it to emerge as a formidable player in the global aerospace landscape.

STRATEGIC IMPLICATIONS FOR AKSI AEROSPACE

This significant contract is not just a financial boon but also a strategic win for Aksi Aerospace. It strengthens the company's position as a key player in the aerospace manufacturing sector and opens up new avenues for growth. With FIXAR being a recognised global leader in UAV technology, the partnership offers Aksi Aerospace valuable exposure to international markets, which could lead to further collaborations and orders from other global UAV manufacturers.

Moreover, the order is expected to result in the creation of more jobs and drive further technological advancements at Aksi Aerospace, helping to foster innovation within India's aerospace manufacturing ecosystem. The increased demand for components for high-tech systems like UAVs is also likely to have a ripple effect on the local supply chain, benefiting both small and medium-sized enterprises in the region.

STRENGTHENING INDIA'S AEROSPACE CAPABILITIES

The collaboration between Aksi Aerospace and FIXAR also has broader implications for India's aerospace industry. India has been making strides to become a hub for defence and aerospace manufacturing, and this deal underscores the nation's growing capabilities in producing advanced technologies. By securing international contracts like this one, Aksi Aerospace is contributing to India's ambitious plans of increasing its share in the global aerospace market.

Furthermore, the successful execution of this order will strengthen Aksi Aerospace's credentials, allowing it to participate in larger defence and commercial aerospace projects, not just within India but on a global scale. This is part of a broader push by India to position itself as a key player in high-tech manufacturing, particularly in the defence and aerospace sectors.

LOOKING AHEAD: A BRIGHT FUTURE FOR AKSI AEROSPACE

Aksi Aerospace is well-positioned to capitalise on the growing demand for high-quality components and precision-engineered systems.

With its advanced manufacturing capabilities, strong international partnerships, and unwavering focus on innovation, Aksi Aerospace is set to play a pivotal role in shaping the future of aerospace technology. The deal with FIXAR is a clear indication that Aksi Aerospace is not only a key player in the Indian aerospace sector but is also making its mark on the global stage.


Research Centre


Manufacturing

Aksi Aerospace's ₹85 crore manufacturing order from FIXAR represents a significant achievement for the company and a positive step forward for India's aerospace and defence sectors. This collaboration is expected to pave the way for further technological advancements, job creation, and growth within India's manufacturing ecosystem. With an eye on the future, Aksi Aerospace is poised to continue its upward trajectory in the global aerospace market, further cementing its reputation as a trusted partner for cutting-edge aerospace technologies.

With its advanced manufacturing capabilities, strong international partnerships, and unwavering focus on innovation, Aksi Aerospace is set to play a pivotal role in shaping the future of aerospace technology

IN PERSPECTIVE

EUROPE'S ELUSIVE DREAM

Strategic autonomy has long been a tantalising vision for Europe. Yet, as the Russia-Ukraine war drags on and US President Donald Trump's bold moves sideline European partners, the gap between perception and reality grows starker

NIRANJAN MARJANI

Strategic autonomy—a state's capacity to make decisions insulated from external pressures—sounds simple enough. At its core, it's about exercising sovereign choice driven by national or collective interests. For Europe, however, this concept has been a riddle wrapped in history, ambition, and uncertainty for over three decades.

The debate ignited in the 1990s, sparked by the Balkan Wars, when Europe's fragmented response highlighted its dependence on NATO and the United States. Fast forward to December 2009: the Lisbon Treaty birthed the Common Security and Defence Policy (CSDP), aiming to enable the European Union (EU) to manage military crises—either alongside NATO or independently. The EU Global Strategy of 2016 doubled down, spotlighting strategic autonomy as a cornerstone of Europe's future. Then came French President Emmanuel Macron's bold 2018 call for a European army, endorsed by then-German Chancellor Angela Merkel, followed by EU High Representative Josep Borrell's 2020 plea for "a certain degree of autonomy" amid US-China tensions. Borrell's cautious phrasing— "a

certain degree"—betrayed the ambiguity still plaguing Europe's vision.

Why the hesitation? Much of it stems from a lingering Cold War mindset. Europe's history is a paradox: once a hub of colonial powers, it later became a battleground for superpower rivalries. Two World Wars ravaged the continent, followed by a Cold War tug-of-war between the US and the Soviet Union. Post-1991, NATO's eastward expansion kept tensions simmering with Russia, even as outright hostility waned. This backdrop has left Europe caught between its past and its aspiration to chart its own course.

Enter the Russia-Ukraine war—a crucible testing Europe's resolve. Initially, it seemed to delay the autonomy debate, as NATO unity took precedence. But Donald Trump's return to the White House in 2025 has upended that narrative. His proactive push to end the conflict—halting military aid to Ukraine, negotiating directly with Vladimir Putin (securing a 30-day pause on energy strikes), and bypassing European NATO allies—has rattled the continent. These moves, executed without consultation, signal a potential unravelling of the post-World War II security framework that Europe has leaned on for decades.

TWO PERSPECTIVES ON TRUMP'S GAMBIT

Trump's actions can be viewed through dual perspectives. First, they align with his "America First" ethos—a transactional diplomacy prioritising US interests. His second term has amplified this stance: withdrawing from the World Health Organization (WHO), slashing over 90 per cent of the contracts of US Agency for International Development's (USAID), and cutting $60 billion in global aid. His frustration with NATO's European members, whom he accuses of freeloading, is no secret. Trump's approach suggests a recalibration of America's global role, pulling back from its traditional mantle as Europe's protector.

Second, on a broader canvas, Trump's moves reflect a world where Europe's strategic clout is waning. Asia and the Middle East are stealing the spotlight. Saudi Arabia and Türkiye, for instance, have emerged as key players in the Russia-Ukraine conflict, hosting peace talks and leveraging flexible diplomacy to engage all

Europe's strategic autonomy debates, born in the 1990s post-Balkan Wars, remain tangled in a Cold War mindset, complicating its path to independence. Meanwhile, Trump's America First approach, evident in halting aid to Ukraine to unilateral talks with Putin, has jolted Europe

IN PERSPECTIVE

As Saudi Arabia and Türkiye broker peace in Ukraine, Europe's waning influence signals a global shift toward Asia and the Middle East. Decoupling from NATO and the US may be Europe's only shot at staying relevant—but can it muster the will and resources?

sides. Their multilateral agility contrasts sharply with Europe's more rigid, unilateral stance—a posture that some argue exacerbates the war's complexities rather than resolving them.

EUROPE'S MOMENT OF TRUTH

Trump's sidelining of Europe has laid bare a harsh reality: the continent struggles to navigate crises without US support. As America steps back, European nations are frantically cobbling together a coalition to bolster Ukraine independently. Yet, this scramble underscores a deeper truth—Europe's on-again, off-again flirtation with strategic autonomy remains unresolved. Over three years of war, coupled with Trump's disruptions, have thrust the continent into a familiar fog of indecision.

Europe's challenge isn't just about security; it's about relevance. The economic and strategic epicentre has shifted toward Asia, eroding Europe's once-formidable bargaining power. The rise of players like Saudi Arabia and Türkiye—nations adept at balancing ties with conflicting parties—highlights Europe's diminishing traction. Strategic autonomy isn't a luxury; it's a necessity if Europe hopes to reclaim its voice in a multipolar world.

Achieving this means decoupling from the US and NATO—a daunting, long-term goal. It requires not just political will but also economic muscle and military cohesion, both of which Europe has struggled to muster. The CSDP and EU Global Strategy are steps forward, but they're incomplete without a unified resolve to act independently. Macron's army proposal, though visionary, remains a distant dream amid budgetary squabbles and divergent national interests.

IN SUM

Strategic autonomy transcends defence—it's about Europe's place in a changing global order. The continent must move beyond reacting to crises and start shaping them. This shift demands introspection: Can Europe shed its Cold War baggage and embrace a proactive role? Or will it remain a junior partner, overshadowed by Asia's dynamism and America's unilateralism?

As Trump redraws the lines of global engagement, Europe faces a stark choice: pursue autonomy with purpose or risk fading into irrelevance. The perception of strategic autonomy has long outpaced its reality. Now, the clock is ticking for Europe to bridge that gap.

–The writer is an Independent Political Analyst and Researcher based in Vadodara. Follow him on Twitter: @NiranjanMarjani.

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BUSINESS INITIATIVE

Alpha A900 UAV Lake

UKAY GROUP: FROM AUTO PARTS TO AEROSPACE

Leveraging decades of expertise in precision engineering and manufacturing, the Ukay Group has partnered with global leaders to bring cutting-edge UAV technology to India under its groundbreaking venture, Ukay Aerodynamics. At the heart of this initiative are the Alpha 900 and Alpha 800, two fuel-powered helicopter UAVs designed for endurance, versatility, and mission-critical operations

RA EDITORIAL DESK

Founded in 1988, Ukay Metal Industries Private Limited has built a reputation as a leader in manufacturing precision components for the automotive and industrial sectors. With over 1,200 professionals specializing in design, engineering, and systems integration, the company has diversified into advanced domains like polymer processing, embedded systems, and 3D imaging.

The group's core strengths lie in automotive integration, supplying OEM with press metal parts, injection-molded components, and air-conditioning systems. Its global footprint includes exporting products to international markets, such as branded air coolers and luggage, while its innovation hub drives advancements in photonics, material science, and robotics. This strong foundation positioned Ukay to venture into aerospace, culminating in the birth of Ukay Aerodynamics. (Aviation wing).

STRATEGIC COLLABORATION

A path breaking moment in Ukay's trajectory was its technical collaboration with Pentagon Performance Industries LLC, a US-based firm led by Veteran Anthony La Sure. With a background in NASA's Integrated Systems Research Program and UAS Traffic Management initiatives, La Sure brought unparalleled expertise in unmanned aerial vehicle (UAV) payloads and mission systems. The PPI team of Rafael Padilla, Vinny Cooper & Karen Di Meo have in depth knowledge in the industry of UAV and its Mission program.

The collaboration's key highlights include La Sure's team overseeing budgets exceeding $500 million for UAV traffic systems, joint drills conducted by engineers from India, the US, and Madrid, in Spain, and alignment with India's national goals to indigenous defence and aerospace technology.

"This collaboration elevates Ukay to a new level of innovation,"quips Rajendra Katore, Chairman of Ukay Group, Accompanied by Mr Bartholomeo Paul (COO) of Ukay Aero dynamics during a demonstration of the Alpha UAVs.

ALPHA 900 AND ALPHA 800

The Alpha 900 and Alpha 800 are Vertical Take-Off and Landing (VTOL) UAVs designed for endurance and adaptability. Their fuel-powered systems offer advantages over battery-dependent drones, especially in extended missions.

These UAVs boast payload versatility, supporting EO/

Ukay's Chairman Rajendra lifting the Alpha 800, highlighting its lightweight construction

The international team during joint drills in Madrid

IR cameras, LIDAR, and custom sensors for surveillance, mapping, or marine patrol. Their autonomous operation enables fully automated flights from take-off to landing, controllable via Ground Control Stations (GCS), or ship-based Vessel Control Station (VCS).

Control Stations (VCS). Portability is another standout feature, with the systems compact enough to fit in two flight cases and transportable by small vehicles.

Proven applications include marine security, with successful trials demonstrating the Alpha's ability to land on moving vessels—a boon for coastal surveillance. Military reconnaissance also benefits from their long endurance (up to 4+ hours) and resilience in harsh environments. In a symbolic test, Chairman Katore lifted the Alpha 800 to underscore its portability—a feature critical for field deployments.

ENGAGING WITH DECISION-MAKERS

Alpha Unmanned Systems has been actively engaging with defence leaders and decision-makers at major international forums, reinforcing the strategic value of its helicopter UAV technology. Recent participation at Xponential Europe in Düsseldorf and the ENDR European Naval Event in Cartagena provided critical platforms to demonstrate the Alpha 900 and Alpha 800 systems to military and civil stakeholders. At these events, the Alpha team held highlevel discussions on adapting UAV capabilities for diverse operational needs—from maritime patrol to battlefield reconnaissance. The dialogues underscored the increasing tactical reliance on unmanned systems in modern defence architectures, particularly for missions requiring endurance, payload flexibility, and ship-based operations.

The Xponential Europe in Düsseldorf and the ENDR European naval event in Cartagena provided critical platforms to demonstrate the Alpha 900 and Alpha 800 systems to military and civil stakeholders

THE ROAD AHEAD

Ukay Aerodynamics aims to position India as a hub for UAV manufacturing and innovation. Key initiatives include localised production to scale assembly lines for the Alpha series -900/800 and the new version of 900T under Make in India, training programs to certify pilots and technicians through simulators and remote support, and bidding for defence contracts in security and disaster management.

With its blend of engineering prowess and global technology partnerships,Ukay Aerodynamics is poised to revolutionise India's UAV sector with help of Eric Freeman CEO of Alpha. The Alpha series exemplifies how homegrown innovation, coupled with international collaboration, can yield world-class defence solutions. As the company gears up for production, the skies over India may soon witness a new fleet of UAVs— bearing the stamp of Ukay. "Our goal is to democratise advanced UAV technology for national development," says the Ukay's Chairman.

EXPERT VIEW

BUILDING A SELF-RELIANT INDIAN DRONE ECOSYSTEM AND STRENGTHENING CYBERSECURITY

Highlighting the role of government policy, the importance of cybersecurity, and the strategic steps needed to position India as a dominant player in the global drone market, **Sai Pattabiram, Founder & MD, Zuppa** explores how India's drone industry can leverage AI-driven technology, cost advantages, and secure manufacturing to become a global leader

The global drone industry is undergoing a major shift as security concerns push countries to ban Chinese drones like DJI, creating a market gap that India is poised to fill. Indian drone manufacturers, with strong government support and growing technological expertise, have a unique opportunity to seize and compete on a global scale.

HOW INDIA CAN LEAD THE GLOBAL DRONE MARKET

The worldwide drone market is at a crossroads. Advanced technology and competitive pricing have for years given Chinese businesses, especially DJI, a stranglehold over the industry. Still, growing security worries and geopolitical tensions have caused countries like the United States, the United Kingdom, and India to prohibit or limit Chinese drone use.

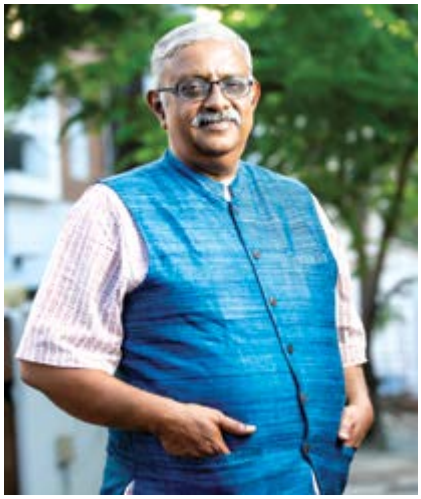
In this background, Indian drone producers are ideally placed to fill a large void in the market.

SEIZING THE MARKET OPPORTUNITY

Worries about data security and foreign power over delicate information underlie the move to prohibit Chinese drones. If exposed, drones employed for defence, surveillance, and infrastructure monitoring could cause major security issues from their sensitive data.

The ban has left businesses and governments looking for safe non-Chinese solutions, indeed a great opportunity for Indian enterprises. With Aatmanirbhar Bharat (Self-Reliant India) and the Production Linked Incentive for drone manufacturing complementing government assistance for drones, India's expanding technological base has provided Indian producers with a solid foundation on which to grow quickly.

Valued currently at around $30 billion, the world drone industry is forecasted to hit $54 billion by 2030.



Indian businesses now, could make much of this growing demand.

THE TECHNOLOGICAL EDGE

Indian drone manufacturers have made significant strides in developing AI-driven and cyber-secure systems. Advanced autopilot technology powered by AI enables drones to make real-time decisions, navigate complex environments, and detect threats with precision. This level of autonomy and responsiveness positions Indian drones on par with the best global offerings.

Secure communication architecture is another key advantage. Unlike imported drones, which are vulnerable to hacking and data breaches, Indian drones are being designed with secure, encrypted communication systems to protect sensitive data loss. This makes them particularly attractive for defence and government operations where data integrity is critical.

COST AND PERFORMANCE ADVANTAGE

Although Western companies like Skydio and Parrot provide cutting-edge drones, their higher production costs make them less attractive in the international market. In contrast, Indian firms have a cost-effective production environment and a big labour supply. This lets them maintain rigorous quality standards while also producing top-flight drones at a fraction of the price of Western competitors.

The price-performance balance places Indian unmanned aircraft systems as an attractive option for military as well as commercial uses. Indian enterprises have already shown themselves to be able to provide sophisticated features - such as real-time obstacle avoidance, target tracking, and autonomous flight agility - at most competitive cost points. Global growth depends on this blend of cost-effectiveness and performance.

STRATEGIC GLOBAL EXPANSION

Markets with limited Chinese products, including the US, UK, and sections of European, offer Indian drone manufacturers' a golden opportunity. As secure, dependable drone systems are in demand, defence and surveillance industries offer especially lucrative openings.

Already looking into tactical alliances with government agencies and defence companies, Indian enterprises are speeding-up market presence. Products meant to satisfy international regulatory standards and operating needs will enable Indian producers to penetrate these important markets over the next couple of years.

Achieving success in these critical industries will help boost the reputation of Indian drone technology, thereby opening the door for more general use in commercial areas including agriculture, infrastructure monitoring, and logistics.

BUILDING A SELF-RELIANT ECOSYSTEM

India's drone sector needs to create a completely

Worries about data security and foreign power over delicate information underlie the move to prohibit Chinese drones. If exposed, drones employed for defence, surveillance, and infrastructure monitoring could cause major security issues emanating from their sensitive data

EXPERT VIEW

Already looking into tactical alliances with government agencies and defence companies, Indian enterprises are speeding-up market presence. Products meant to satisfy international regulatory standards and operating needs will enable Indian producers to penetrate these important markets over the next couple of years

self-sufficient system to maintain long-term development. This would boost national supply chains, lower dependence on foreign components, and support next-generation technology research and development.

This process depends largely on government assistance. Already evolving is the Indian government's focus on indigenisation via defence procurement policies and rewards for domestic manufacturing. India can increase strategic autonomy and lower exposure to global supply chain disturbances by creating a strong domestic economy.

KEY TAKEAWAYS

- **The ban on Chinese drones opens new market opportunities for Indian manufacturers.**
- **Indian drones offer a competitive edge with AI-driven technology and secure architecture.**
- **Lower production costs give Indian manufacturers an advantage over Western competitors.**
- **Government support and policy alignment are key to scaling the global markets.**
- **Strengthening cybersecurity will enhance trust and boost adoption of Indian drones.**
- **Leveraging India's Reputation as an Ethical and Trustworthy Technological partner**

ADDRESSING CYBERSECURITY CHALLENGES

As drones become more connected and data-driven, the risk of cyberattacks increases. Imported drone controllers have been particularly vulnerable to hacking, raising concerns about data integrity and operational security. Indian manufacturers are addressing this challenge by developing secure systems with real-time threat detection and encrypted communication channels.

Cyber-resilient architecture ensures that operational data remains protected, even in high-risk environments. This focus on security makes Indian drones ideal for sensitive applications in defence and critical infrastructure. By positioning cybersecurity as a key differentiator, Indian manufacturers can build trust and drive broader adoption in global markets.

In the current situation, the shift away from Chinese drones presents a rare and valuable opportunity for Indian drone manufacturers to establish themselves as global leaders. With advanced AI-driven technology, secure architecture, and cost-efficient production, Indian companies are well-positioned to fill the gap left by DJI and other Chinese players. The coming decade will be defined by technological leadership and strategic autonomy - and this is the chance for the Indian drone industry to take flight.

–The writer established Zuppa Geo Navigation Technologies Pvt. Ltd., popularly known as ZUPPA in 2008. He is a recognised thought leader and author on the subject of Cyber Security of Drones. He has a deep understanding of India's Drone Ecosystem both from a regulatory and manufacturing perspective and is a well-known name in the Aerospace and Defence Industry. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

INDIAN ARMY SUCCESSFULLY TESTS FPV DRONE

The Indian Army's Fleur-De-Lis Brigade has successfully tested an FPV drone armed with a kamikaze-style anti-tank munition designed for impact-based attacks, in a first of its kind project

RA EDITORIAL DESK

Indian Army's, Fleur-De-Lis Brigade (2nd Independent Armoured Brigade) has reached a significant milestone in tactical drone warfare by successfully designing, testing, and validating an FPV drone fitted with a kamikaze-style anti-tank munition, marking the first project of its kind of the Indian Army.

In partnership with the Terminal Ballistics Research Laboratory (TBRL), Chandigarh, this initiative, which began in August 2024, has involved thorough research, development, and testing to improve the effectiveness of low-cost, high-impact aerial strike systems.

The system underwent thorough testing, starting with explosive trials, followed by assessments of the aerial vehicle and the trigger mechanism. Each phase was validated by TBRL scientists, ensuring the drone's effectiveness, precision, and dependability in delivering the payload. The successful outcomes position this pioneering FPV drone project as a transformative force multiplier in contemporary tactical operations.

THE FPV DRONE

A FPV Drone is a First-Person View drone, traditionally, pilots fly RC aircraft while looking at drones, called "line of sight" (LOS) flying. However, thanks to technological advances, pilots can now fly unmanned aerial vehicles by watching streaming real-time video from the drone's camera connected to goggles.

The FPV drone was fully constructed in-house at the Rising Star Drone Battle School, which has produced over 100 drones within the unit by March 2025. This self-sufficient approach provided full control over the build quality, component integration, and real-time adjustments based on TBRL guidelines. It also enhanced the drone's structural integrity, weight distribution, and flight dynamics, ensuring superior manoeuvrability and efficiency for operational use. It also optimises structural integrity, weight distribution, and flight dynamics, making the drone highly manoeuvrable and effective for operational deployment.

The Indian Army in a statement, about the versatility of the drone said that the trigger mechanism of the drone has been carefully crafted to integrate dual safety features, guaranteeing that the payload can only be armed and released under tightly regulated conditions. It is activated solely by the pilot using the radio controller, preventing accidental detonation, increasing reliability, reducing risks for pilots and the personnel handling the drone and ensuring accurate deployment during missions.

The Indian Army's 2 Para, has already inducted five of these new, yet unnamed drones, and a larger order for 95 is being followed up. Each system cost about Rs 1.4 lakh, but the cost will tend to come down once the production increases

Furthermore, a live feedback relay system delivers real-time updates on the payload's status to the pilot through the FPV goggles, allowing for better decision-making while operating the drone.

FPV drones gained prominence during the Russia-Ukraine war, where they demonstrated their capacity to alter battlefield dynamics by effectively neutralising substantial and costly military assets such as tanks.

The FPV drone was fully assembled in-house at the Rising Star Drone Battle School, which has produced over 100 drones as of March 2025. Reportedly, the system has been developed by Major Cephas Chetan in conjunction with a team of the Chandigarh-based Terminal Ballistics Research Laboratory.

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SUMMIT REPORT

BETTING HIGH ON INDIA, AIRBUS CONSOLIDATES INDIA STRATEGY

At the Airbus Summit 2025, India drew significant attention for its potential to produce 8–10 million tonnes of Sustainable Aviation Fuel (SAF) annually

RA EDITORIAL DESK

The Airbus 2025 summit on sustainable aviation at Toulouse in March saw gathering of prominent stakeholders to discuss the progress and roadmap to decarbonise aviation by 2050.

At the summit, in the backdrop of US President Donald Trump's shadow and the speculation that he may chooses to target the aviation sector, there was a general consensus that it will damage the US more. But Airbus CEO Guillaume Faury's statement, "We have to hope for the best and prepare for the worst," clearly pointed that aerospace industry captains were circumspect.

Airbus' ambitious hydrogen plane mission was also in for a reality check at the summit. Airbus CEO Guillaume Faury admitted that while his company can make a hydrogen-powered plane that works, it's not the right time for it due to commercial non-viability and absence of the right ecosystem.

Thus sustainable aviation fuel (SAF) emerges as the biggest hope to achieve the 2050 net-zero target. Given India's abundance of agricultural residues, ethanol, biomass, non-edible oil, municipal wastes, it drew much interest and attention of the global aerospace industry at the Airbus Summit 2025.

With the potential to produce 8-10 million tonnes of SAF annually, as against the global production of 2 million tonnes of SAF in 2024, India can become a major contributor in SAF production.

Gabrielle Walker, co-founder of CUR8, a leading market-maker on carbon removals, said, "You can use this feedstock (for SAF) and also control pollution."

LanzaJet CEO Jimmy Samartzis, CEO, spoke about how there was high interest in building a self-production facility and how his company is working with India on this. LanzaJet is a sustainable aviation fuel producer and alternative fuels technology company and is reportedly negotiating with Indian Oil Corporation for a joint venture to build an SAF plant in India.

As per Julie Kitcher, Chief Sustainability Officer at Airbus, what is happening in India and China in terms of sustainable fuel should not be underestimated.

Airbus has been in touch with SAF stakeholders in India and according to Airbus CEO there is a unique opportunity for India to contribute to the growth of aviation and decarbonisation. "We want to play catalyst to help grow the SAF ecosystem in volumes and also on manufacturers, regulators, airlines

to pool the use of SAF. That's a collaborative effort that needs to be done. India has a lot of potential for SAF and we are hoping that India will be showing the way and leading on the growth of SAF," said Faury.

The discussions on SAF potential forms only a small part as Airbus, Europe's biggest aerospace company, is betting high on India. According to Faury, Airbus is expecting procurement of components and services from India to grow by about 50 percent in the next five years: from $1.4 billion today to $2 billion by 2030. That means a four-fold increase in Airbus' procurement spending in India in a decade, up from $500 million in 2019.

In addition, the French company is also sourcing complex components from India, such as A320neo cargo doors (Tata), A320/A330 flap track beams (Dynamatic) and A220 doors (Dynamatic). In the last four years, the number of engineers hired by Airbus in India has more than trebled, from 1,000 in 2021 to over 3,500 today.

Says Airbus CEO, "India is not only a market for aviation. It's also supplying to the world, to Airbus—many parts, systems, equipment, and that's growing very fast. India is very strong in software, in equipment manufacturing, IT and engineering. That's where there is really appetite from outside to collaborate.

In the Airbus' scheme of things, India's importance is on the upward trajectory, according to company officials. The company is developing a holistic aviation and aerospace ecosystem in India across all dimensions—assembly, manufacturing, engineering, innovation, digital, training, education, maintenance and leasing, they said.

Already having set up two final assembly lines in India, for C295 aircraft and H125 choppers, Airbus has now also started two pilot training centres with a capacity of 14 full flight simulators in India. It is also partnering with the IITs (Indian Institutes of Technology) and Gati Shakti Vishwavidyalaya, with Tata Strive for academic curricula, developing R&D centres, creating Aerospace Chairs at universities, investing into skill centres and offering scholarships.

Airbus is conscious of the fact that India's importance is on the upward trajectory, The company is developing a holistic aviation and aerospace ecosystem in India across all dimensions—assembly, manufacturing, engineering, innovation, digital, training, education, maintenance and leasing

For Airbus, 'Make in India', 'Design in India', 'Innovate in India' and 'Train in India' is said to be the guiding Indian strategy. Airbus has built its South Asia headquarters and a pilot training centre in New Delhi. It has also announced a joint venture with the Tata Group to set up a second pilot training centre in Gurgaon, which will have 10 simulators.

According to Airbus CEO Faury, Indian companies were scouting in Europe, looking at potential targets for M&A and trying to extend their footprint. There are opportunities in Europe. "Therefore, I like the idea of the best Indian players going from India to the world. That's what we see and we are encouraging. I am putting them in touch with the chairman of GIFAS, French aerospace and defence association… I have put some of them in touch with GIFAS in charge of SMEs."

Last October, the Airbus CEO, who visited India as head of GIFAS, said, "We had 60 companies joining and creating contacts in India with Indian partners, suppliers, customers. India in integrating itself in the global aerospace industry."

POST EVENT REPORT

AERO INDIA 2025: TIME TO DELIBERATE

The 15th edition of Aero India 2025 provided an opportunity to country's defence planners and strategists on how to make the show a global one and how to leverage the opportunities offered by the show to India's advantage, both in terms of buying new hardware and evolving as an integral part of the global aircraft manufacturing ecosystem

ASAD MIRZA

The 15th edition of Asia's biggest aero show, Aero India 2025 - held at the Air Force Station, Yelahanka in Bengaluru, Karnataka from February 10 to 14, 2025 aimed at forging new partnerships and explore avenues to fast-track indigenisation process. With the broader theme *The Runway to a Billion Opportunities*, the event provided a platform for forging partnerships between foreign and Indian firms and identifying newer avenues in the global value chain to accelerate the indigenisation process of Indian aero-defence companies.

The highlights of the Aero India were the Defence Ministers' Conclave, CEOs' Round-Table, *Manthan* start-up event, breath-taking air shows and a display of indigenous manufacturing capabilities.

However, the past achievements of the event also compel one to act as the devil's advocate and ask country's defence planners and strategists that what holds them back to shape-up Aero India as a *numero uno* global air show, or at least endeavour to establish it amongst the top five global air shows.

Concurrently, they should also ponder over how to leverage the huge pool of India's skilled and technologically savvy workforce to become a part of the global aircraft manufacturing ecosystem.

Evolving as a future partner of the global aircraft manufacturing system will not only boost the country's aero-defence manufacturing industry, but also provide access to the Indian Air Force (IAF) to the best available air machines, in addition to helping it to fulfil its numerical shortfall. Further, becoming a part of the global aircraft manufacturing system will generate ample job opportunities for the large pool of skilled manpower available in the country.

On how to become a part of the global aircraft manufacturing ecosystem, India can take lessons from three global cases, where different nations have pooled together their technical prowess and economic resources to develop new global aircrafts, by shortening the plan to delivery time gap and pitching-in with their area of expertise.

GLOBAL COMBAT AIR PROGRAMME (GCAP)

The first example is that of the Global Combat Air Programme (GCAP), which is a multinational initiative, led by the United Kingdom with Japan and Italy to jointly develop a 6th generation stealth fighter. The programme aims to replace the Eurofighter Typhoon in service with the Royal Air Force (RAF) and Italian Air Force, and the Mitsubishi F-2 in service with the Japan Air Self-Defence Force.

The strategically important multilateral partnership of GCAP, brings together the governments of the UK, Italy and Japan, and their respective industries, led by BAE Systems (UK), Leonardo (Italy) and Mitsubishi Heavy Industries (Japan) to collaborate on shared military and industrial objectives in the delivery of a next generation combat air capability.

The combat aircraft, called Tempest in the UK earlier, is set to be in service by 2035 and will be one of the world's most advanced, interoperable, and adaptable fighter jets in service.

This unique partnership not only drives innovation and technological advancement but also promotes significant economic growth in each nation, securing the future of their respective combat air industries for decades. Reportedly, the Swedes, the Germans and the Saudis may also join this multilateral programme, soon.

FUTURE COMBAT AIR SYSTEM (FCAS)

Secondly, Germany, France, and Spain are mutually developing the European weapon system of the future, the Future Combat Air System (FCAS).

The FCAS project itself has now reached the demonstration phase. Germany and France began planning a combat aircraft in 2017. In 2019, Spain joined the project and the defence ministries of three nations signed a framework agreement on the mutual development of the FCAS. In June 2023, Belgium became an Observer to the FCAS programme, and is set to join the programme by June 2025

EURODRONE PROGRAMME

Third, comes the example of Eurodrone, which is a 4-nation development programme comprising Germany, France, Italy, and Spain, led by the Organisation for Joint Armament Cooperation (OCCAR). Airbus Defence and Space (GER) is the industrial prime contractor for the project, together with Leonardo (ITA), Dassault Aviation (FRA) and Airbus Defence and Space (SPA) acting as major subcontractors. Germany is the lead nation for the programme.

Moreover, OCCAR has accepted India's application as an Observer for the Eurodrone programme. This will provide New Delhi with an opportunity to closely monitor the four-nation drone project. It would keep India better informed for future procurement of the platform or allow it to incorporate the lessons into its own domestic projects. As an Observer, India could gain access to briefings on the drone's technical specifications and operational capabilities.

INDIA'S TECH PROWESS AND GROWING CONFIDENCE

Indian Navy's MiG-29K made its debut at Aero India. The backbone of the Indian Naval Air Arm, was on static display at Aero India 2025. The aircraft has been upgraded with new mission computer developed by HAL and cutting-edge armament with ASTRA missiles and enhanced avionics suite in the recent years. It was inducted in the Indian Navy in 2010 and has proved to be the backbone of Indian Navy's air arm, till date.

Also, India's advanced indigenous Intermediate Jet Trainer - IJT (HJT 36) also known as Sitara is a testament to HAL's commitment to developing indigenous defence technologies and overcome technical challenges. Its anticipated full-scale production by 2028 will be a significant milestone for

The past achievements of Aero India compel one to play the devil's advocate and ask the country's defence planners and strategists: what holds them back from shaping Aero India into a truly global air show—or at the very least, striving to place it among the world's top five?

POST EVENT REPORT

India can also initiate a joint manufacturing project for its AMCA programme on its own with like-minded countries like Taiwan to achieve its Aatmanir-bharta targets and develop a machine which could be touted as an example of indigenous and self-reliant pursuit

India's *Aatmanirbharta* in aero-defence manufacturing and will provide the IAF with a much-needed modern trainer aircraft.

The above two examples demonstrate the tenacity of the Indian engineers and technicians to maintain aircrafts which have ceased production in their host country, yet they continue to operate by the Indian defence forces. IJT is an example of perseverance by Indian engineers developing their expertise in developing the IJT, albeit with delays. Such technical prowess and experience can be used in any future aircraft manufacturing process also.

THE WAY AHEAD

The above examples show clearly that multilateral cooperation is the way ahead for the future, when nations aspire to gain a tactical and technological upper hand over their adversaries but either a lack of technical prowess or financial strength prohibits them from doing so alone.

India can learn valuable lessons from the Eurodrone programme and our defence honchos can leverage this to get India inducted into any foreseeable multilateral aircraft manufacturing programme or also try to get involved in the current programmes like the GCAP and FCAS. This may not only help them to fulfil the IAF's requirements but also generate jobs for the huge skilled manpower pool available in India.

If questions are raised as if to what India would bring to the table, a similar point raised by Japan for including Saudi Arabia in the GCAP programme, then India could counter it by offering the vast technologically sound and skilled workforce for the programme, besides the lower cost of manufacturing through its already booming aero manufacturing sector.

Additionally, India can also initiate a novel joint manufacturing project for its AMCA programme with like-minded countries like Taiwan - sensitive considering geostrategic implications but a worthwhile option, or the UAE and Saudi Arabia - both of which want to be part of an international platform to develop viable options particularly in the aerial domain, to achieve its *Aatmanirbharta* targets and develop a machine which could be touted as an example of indigenous and self-reliant pursuit.

Adopting such an innovative approach will surely help the defence ministry to achieve its armaments export targets by 2029 and also helping in achieve the complete *Aatmanirbhar* and *Viksit Bharat* initiatives by 2047.

Being ambitious is not the only goal, to achieve that goal one is also required to think out of the box and apply some innovative measures to achieve success and fly proudly.

AGNISHWAR JAYAPRAKASH
Founder and CEO
Garuda Aerospace

Aero India 2025 was a transformative three-day event filled with innovation and connections. We launched the Amaraan MV1000 drone, a cutting-edge missile-launching system, and engaged with industry leaders, building key collaborations. The energetic atmosphere inspired meaningful discussions with fellow founders and enthusiasts. Strategic MOUs were also signed, combining serious business with the excitement of aerospace advancements, reinforcing my vision for the future of defense technology.

JAJATI MOHANTY
Chief Executive Officer
Schiebel India

Since making it foray into the Indian market, Schiebel's has been a regular exhibitor at Aero India. This years' experience was on the expected lines. Our display of CAMCOPTER® S-100 and S-300 drew attention of business visitors and dignitaries who visited our stall. The smooth adoption of CAMCOPTER® S-100 by Indian Navy into its operation has opened up exciting opportunities for Schiebel which has been continuously contributing to India's Aatmanirbharta initiatives.

This years Aero India was a true embodiment of Aatmanirbhar Bharat. Lots of startups and MSME participated. For us, it was particularly helpful as dignitaries like COAS, VCOAS, DCOAS, ADG ADB and many other dignitaries visited to see our smart and autonomous munitions. We could show how we have been pioneers in guidance of launched systems. With encouragement from Army, we will go places, no doubt about it.

DR BASANT KUMAR GUPTA
CEO, Zeus Numerix

India is a long-term strategic partner for us at Israel Aerospace Industries, and our presence at Aero India demonstrated our continued commitment to strengthening this relationship. It was a wonderful opportunity to meet with key stakeholders in India's defence ecosystem, develop new partnerships and present our latest state-of-the-art solutions. We are particularly excited to have announced that BEL IAI Aerosystems, a landmark joint venture between BEL and IAI, commenced its operations, heralding a new chapter in Indo-Israel defence and security cooperation.

BOAZ LEVY
President and CEO
of Israel Aerospace Industries

PUNEET KAURA
Managing Director & CEO,
Samtel Avionics

Aero India 2025 was a testament to India's growing self-reliance in aerospace and defence. Samtel Avionics witnessed an overwhelming response to our cutting-edge cockpit displays and optronics solutions, reinforcing the industry's confidence in indigenous technology. The event highlighted the crucial role of private-sector innovation in strengthening India's defence ecosystem. Engaging with global and domestic partners reaffirmed our commitment to 'Aatmanirbharta' and shaping the future of Indian aerospace manufacturing.

INSIGHT

BITING THE SILVER BULLET: UNCONVENTIONAL FIREARMS AND FIREARM COMPONENTS

Understanding the firearms in totality is important. Continuing the series - Biting the Silver Bullet, **SANJAY SONI** now provides a detailed account of unconventional firearms and analyses the gun at the component level to help users understand how they work

Having discussed different types of guns and how they work in the last article, a more detailed analysis of a gun at the component level takes centre stage in the current article for better understanding the way guns work. But before we do that, let us take a look at some unconventional firearms.

'OTHER' TYPES OF FIREARMS

In addition to the categories of firearms listed in the earlier article, this category encompasses various types of firearms which may overlap with those mentioned but are deserving their own classification.

Firearms in this last generic category may borrow features from the commonly accepted category, but their modality of production or modification makes them very difficult to be identified and traced. Weapons in this category also represent a legal challenge, either not being legally covered, especially in what concerns new technologies, or their transfer and possession is at the edge of the law, or takes advantage of existing legal loopholes.

CRAFT PRODUCTION AND RUDIMENTARY ARMS

There is a category of weapons which are custom designed and made. These are called 'craft weapons'. Essentially, the practice consists of weapons and ammunition being fabricated by hand in relatively small quantities. Artisanal in nature, they can range


Katta – Illegal Handmade Pistol


3D Printed Gun

from pistols and shotguns to the more advanced assault rifles, and also include very expensive design weapons used in sport shooting, hunting, and other areas.

In contrast to the craft or artisanal production, there are also the generically called rudimentary arms. These arms are generally homemade and are more likely to be found in criminal contexts. Rudimentary arms are essentially arms manufactured by parts or components that were not originally designed to be parts of a firearm or made out of parts from other firearms. You would have heard of the rudimentary arms industry in some parts of India which turns out weapons known as the 'Katta'. These are quite unreliable and numerous instances of them blowing up during firing and injuring the user abound.

Gunsmiths and handcraft production can be found in all regions. 'The artisanal firearm industry is especially widespread and developed in countries like USA, UK, Australia, Pakistan, India and some African countries like Nigeria, Burkina Faso and Ghana, with some gunsmiths reportedly able to produce assault rifles.'

'The Peshawar district in Pakistan (one of 22 districts in the North-West Frontier Province) is reportedly home to 200 workshops producing a wide range of inexpensive small arms, including revolvers and shotguns'. The most famous craft production site is in the city of Darra in Pakistan as presented in the video The Gun Market of Pakistan.

3D PRINTED FIREARMS

An area of concern for policymakers and law enforcement officials is the 3D printed firearm. This is a new phenomenon which has emerged due to the notable advances made in the field of 3D printing. In essence, the firearm is manufactured by building layer upon layer of plastic, for example, creating various complex and solid objects. The Liberator, a single-shot gun, is an example of such technology.

Policy discussions have intensified, at national and international level throughout the world, around the use of modern technology such as 3D printed arms, their potential impact on security, and the legal responses to them.

3D printed guns have some qualities that make them more attractive to criminals. The material of these arms is difficult to detect by current detectors and scanners. These firearms are easy to destroy after a crime, making it almost impossible to recover the murder weapon. They are also untraceable. Taken together, these features make 3D printed weapons the perfect weapons for high profile crimes, once the technology advances enough to make them safer and more technologically advanced.

The technological development and the availability of cheap CNC machines and 3D printers will make the production of 3D firearms far simpler and more difficult to regulate. The real problem is not so much the 3D printer but the fact that the blueprint for the firearms can be easily and openly accessed through the Internet.

As far as the legal regime for these arms is concerned, there seems to be a gap in both domestic and international legislation. No international legal instruments explicitly refer to them. Some countries have started to capture this new phenomenon in its domestic law. In the United States, the Undetectable Firearms Act of 1988 states that 'any firearm that cannot be detected by a metal detector is illegal to manufacture…' In practical terms, 3D printed firearms would need a metal plate inserted.

In the United Kingdom, the Firearms Act of 1968 'bans the manufacturing of guns and gun parts without government approval.'

UNLICENSED COPIES

The unlicensed copies are encountered in situations when manufacturers either:

- Produce a larger number of firearms that they are allowed to produce under their license
- Or they produce firearms other than those they have a license to produce

Small Arms Survey estimates that '530,000 to

Policy discussions have intensified, at national and international level throughout the world, around the use of modern technology such as 3D printed arms, their potential impact on security, and the legal responses to them

INSIGHT

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580,000 military small arms are produced annually either under license or as unlicensed copies.' This is a form of illicit manufacturing.

These unlicensed firearms are not registered, and they usually end up on the illicit market, being sold at a fraction of the price of the original firearm. Lack of registration or serial number duplication makes these weapons very difficult to trace using conventional tracing methods through identification of firearm type, serial number, model and manufacturer.

REPLICA AND IMITATION FIREARMS

A replica firearm is a device that is manufactured to resemble an existing design of a firearm but is not intended to fire. Typically, replica firearms are manufactured for firearm collectors, especially collectors of antique firearms.

An imitation firearm is a device that is not a real firearm, but is designed to look exactly or almost exactly like a real firearm (very realistic toy guns, or moulded guns either in rubber or metal).

Although technically unable to fire projectiles, both replica and imitation firearms have the capacity to intimidate since they can easily be mistaken for real firearms. There are many such imitation firearms available in India that look and feel quite realistic. They fire gas powered pellets which can cause tissue damage if hit at close range.

DEACTIVATED AND CONVERTED FIREARMS

A deactivated firearm is any firearm that was modified in such a way that it can no longer fire and expel any form of projectile. Usually, the deactivation process has to be permanent, such as filing the firing pin. Because these deactivated firearms do not fall under the same regulations as the activated firearms, they are often purchased by criminal organisations who either remove the deactivation systems or convert the weapons with spare parts and these reactivated firearms then enter the illicit market.

Conversion is a process that modifies a non-lethal (e.g. blank or gas weapon) into a lethal weapon that is further pushed into the illicit market. I have seen examples of such weapons made by Anti-national elements in the state of Chhattisgarh, India. These have been effectively used against the police and anti-terrorist forces.

MODULAR FIREARMS

Modular weapons are produced with components that are interchangeable in a way that can change or improve the characteristic of a firearm. In addition, changing essential components like the barrel, extractor/ejector, firing pin etc. will make ballistic identification extremely difficult, if not impossible.

Glock modular kit 100 rounds automatic

One good example in this range is the Glock pistol, which, although not conceived as a modular weapon, bears the modularity characteristics and can be easily transformed from a semi-automatic pistol into a fully automatic sub-machine gun with 50 or 100 rounds magazine, scope, silencer, shell recovery system and other modular parts.

Fully Automatic Glock silenced conversion kit

CONCEALABLE FIREARMS

The term refers to firearms that have the resemblance of harmless items, but that can be lethally fired. The pen gun, the phone gun, or the flashlight gun are good examples. Concealable firearms can be legally produced or can be crafted in an illicit way. Although firearms that are legally produced are

Concealed phone gun

Magpul FMG9 Foldable Machinegun

registered and theoretically can be traced, the main danger resides in their physical characteristics that makes them difficult to be recognised as a firearm, hence identification and detection possibilities are drastically reduced.

FIREARMS KITS

A kit weapon is usually made from a series of parts and components. In most situations the kit provides the components that require additional machining for full completion. Machining the kit for firearms completion requires high level of technological skills.

1911 80% Build Kit 5" GI .45 ACP

FIREARMS PARTS AND COMPONENTS

In addition to understanding the classification of firearms, we will now look at the parts of the firearm and how they operate.

MAIN COMPONENTS OF A FIREARM

For the practitioner, key aspects of firearm identification include major components like the working mechanism, both external and internal.

Firearms can comprise of hundreds of parts and components. The more common parts include the barrel, magazine, hand guard, pistol grip, trigger and the trigger guard. All firearms have a receiver, which is comprised of springs, levers and pistons.

It is important to differentiate between the key components of a firearm, and the other parts and components. The key components of a firearm are those that are essential for the proper functioning and identification of a firearm. Since replacement of these components can impact the proper identification of a firearm, their trading and manufacture is also regulated.

A key part of any firearm is the barrel. The projectile or bullet travels through the barrel by way of an explosive charge (propellant). The barrel is linked to a receiver, which houses the operable parts of the firearm, including a magazine which holds the ammunition.

INSIGHT

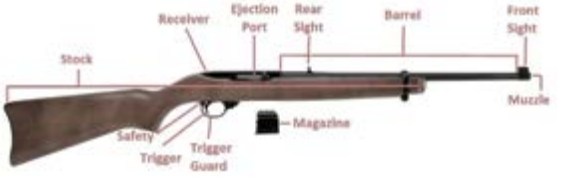
It is important to differentiate between the key components of a firearm, and the other parts and components. The key components of a firearm are those that are essential for the proper functioning and identification of a firearm

GENERAL ANATOMY OF A REVOLVER

Part/Component	Description	Example
Bolt	The bolt is a mechanical part of a firearm [mostly semi-automatic pistols] that blocks the rear chamber while firing but moves aside to allow another cartridge to be inserted.	
Breech	The essential part of the firearm that holds the firing mechanism where the cartridge is inserted.	
Breech block	The movable part of the firing system that seals the moment of firing, preventing gases from escaping. Most modern small firearms use a bolt.	
Chamber	The portion of the barrel or barrel extension which supports the cartridge case while it is in firing position.	
Clip	A device which contains several cartridges that is fed into the magazine of a firearm.	
Cylinder	The cylinder is a cylindrical, rotating part of a revolver that contains multiple cartridge chambers.	
Magazine	A magazine is the ammunition storage and feeding device of a firearm within or attached to a repeating firearm. Magazines can be removable or integral to the firearm.	
Slide	A majority of semi-automatic pistols have a slide which generally houses the firing pin and the extractor, and serves as the bolt. It is spring-loaded to chamber a fresh cartridge provided that the magazine is not empty.	
Trigger	The trigger is the mechanism that actuates the firing sequence of the firearm.	

GENERAL ANATOMY OF A SEMI-AUTOMATIC PISTOL

GENERAL COMPOSITION OF A RIFLE



GENERAL COMPOSITION OF A SUB-MACHINE GUN

For example, changing a firearm barrel will make it impossible to identify a bullet fired with the same weapon, since the markings of the new barrel are different from the markings of the original barrel. Also, the new barrel may have a different serial number or no serial at all, creating difficulty in the physical identification of the firearm.

In the next article we shall look at the different types of bullets and their functions.

–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 – Bangalore, he has been involved with the ammunition industry in India and abroad for the last eight years

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PATIENT CAPITAL: THE MISSING INGREDIENT IN INDIA'S DEFENCE TECH STRIDE

India possesses the technological talent and the industrial base but needs patient capital to realise its defence technology plans. The government should set up a Defence Innovation Fund sourced through public funds and contributions from sovereign wealth funds. Large conglomerates must be incentivised to contribute to this funds

DR SHIVARAMAN RAMASWAMY

No one in the country would dispute the pressing need for indigenous development of Defence Technology. Time and again, access to critical technologies has been denied based on the geopolitical situation and the whims and fancies of individual leaders.

Early steps to build the Indian defence technology ecosystem are today seeing green shoots. Since 2018, iDEX (Innovations for Defence Excellence), the flagship programme of the Ministry of Defence, has ushered in changes in the Indian defence sector, creating a foundation for R&D in the country. iDEX has provided startups and MSMEs with critical early-stage grants to develop prototypes, offering a much-needed initial boost to innovation in defence technology. By reducing entry barriers, iDEX has paved the path towards building the defence technology ecosystem.

However, there is a dearth of patient capital available for Defence Tech startups and MSMEs, whose needs are very different from those of your typical B2C and B2B startups.

TRAVERSING THE VALLEYS OF DEATH

Defence Tech startups face considerable challenges, particularly in navigating the 'valleys of death' that exist between different stages of development – from lab research to scaled production.

The 'Valleys of Death' phenomenon, periods of extreme difficulty for startups between initial development and commercialisation, is significantly more pronounced and perilous for defence startups compared to their civilian counterparts. Whereas a normal startup might need 1-3 years to succeed due to lack of market fit, or funding, defence startups may see it in 5+ years due to the elongated R&D, Testing and Certification phases.

Unlike software or internet-based startups that can often iterate and scale relatively quickly, Defence Tech ventures typically require lengthy and protracted research and development phases because they rely on fundamental scientific or engineering breakthroughs that must be validated, prototyped, and rigorously tested before a commercially viable

product or service can be launched.

The first 'Valley of Death' occurs between lab research and prototype development, where early-stage ideas struggle to secure funding and move beyond theoretical concepts. This phase involves high-risk, exploratory work that may or may not yield viable solutions. iDEX provides funding support in this early phase, but the funding remains insufficient for those projects requiring extended R&D cycles.

Once a prototype is developed, the second valley emerges, wherein companies must transform a working prototype into a fully developed product. The third and most critical valley is the transition from a validated product to large-scale production.

Unlike countries like the United States, which have extensive funding pipelines for defence technology at each stage, India lacks structured financing mechanisms to help startups cross these valleys. While iDEX covers the first valley, the second and third valleys remain largely unfunded, leaving promising innovations and companies stranded before they are deployed at scale.

This is where there is a strong need for patient capital. The patient capital concept refers to investments made with a long-term horizon, without expecting immediate returns.

Recent statistics show that iDEX has actively collaborated with more than 600 startups and MSMEs. Even if a fraction of these companies succeed in developing products as per the requirements of the Indian Armed Forces, it would need at least a billion dollars of patient capital to nurture these startups all the way through to large-scale production.

If this patient capital is unavailable to these startups and MSMEs, the country's ambitious plans in Defence Tech would fall short.

This leads us to the next dilemma: Where will this patient capital come from?

INDIAN VCS: MASTERS OF PLAYING IT SAFE

In the United States, Venture Capital (VC) has become almost synonymous with financing Technology ventures, Moonshots, and Hi-Tech startups in their nascent stages. The success of companies like Fairchild Semiconductor, Intel, and later SpaceX, Palantir, and even Anduril was built on VC firms willing to make significant risky bets.

In contrast, Indian venture capital has forgotten what the 'V' stands for in 'VC'.

Indian venture capitalists have instead mastered the art of playing it safe - funding yet another hyperlocal delivery app while ignoring startups solving India's real strategic challenges. Indian VCs often behave like private equity players, investing only in proven business models with assured cash flow, rather than supporting new ventures and helping businesses take shape.

The 'Valleys of Death' is the period of difficulty for startups between initial development and commercia-lisation. It is more pronounced for defence startups. While normal startups might need 1-3 years to succeed, defence startups may require 5+ years due to the enhanced R&D, testing and certification phases

DEFENCE TECH FUNDING

The recent emergence of specialised venture capital funds like Mount Tech Growth Fund and Jamwant Ventures is welcome. However, Indian Defence Tech startups require much more firepower in patient capital, which would ensure the development of a robust Defence Tech ecosystem

If India is to build world-class defence, AI, and hardware startups, its investors must rediscover the courage they often demand from founders.

FAMILY OFFICES AND NICHE FUNDS TO THE RESCUE

It looks quite unlikely that Indian VCs will be able to deploy patient capital in the volumes required.

However, there are encouraging developments.

Indian family offices, known for their ability to deploy patient capital and take a longer-term investment perspective, are increasingly exploring opportunities within the Deep tech and Defence Tech startup space in India.

The recent emergence of specialised VC funds like Mount Tech Growth Fund and Jamwant Ventures, which focus on startups working in the national security, defence & aerospace, and digital communications sectors, is a positive sign.

However, Indian Defence Tech startups require much more firepower in terms of patient capital; only this would ensure the development of a robust Defence Tech ecosystem in the country.

THE CASE FOR A DEFENCE INNOVATION FUND

To address this large gap in patient capital, India should establish a joint Defence Innovation Fund.

The Defence Innovation Fund would require an initial corpus of around $500 million, anchored by the government and sourced through a combination of public funds and contributions from sovereign wealth funds. A public-private co-investment model should be adopted, inviting major Indian conglomerates, pension funds, and institutional investors to participate. This ensures industry buy-in and fosters a collaborative environment.

Setting up this sort of Fund is not unprecedented; India has experience with sovereign investment vehicles like the National Investment and Infrastructure Fund (NIIF), which manages $4.9 billion and blends government and private capital. The NIIF was set up by the Indian government in 2015 with the primary goal to optimise the economic impact largely through investing in infrastructure-related projects. In fact, the nature of infrastructure projects typically requires long-term commitments, often spanning several years or even decades. Therefore, NIIF's approach can be characterised as providing patient capital for infrastructure development in India.

In a similar approach, the Defence Innovation Fund would provide patient capital to ensure the development of technologies critical to the nation's security and defence needs.

Apart from the anchor funds infused by the government, large Indian conglomerates must especially be incentivised to contribute to this Defence Innovation Fund, where top industrial houses invest a fraction of their profits into the joint defence innovation fund. In order to incentivise large conglomerates to contribute to a Defence Innovation Fund, the government can offer tax incentives and structured exit pathways.

This would result in a significant win for large Indian conglomerates as this co-investment model allows these established conglomerates to diversify their portfolios, tapping into the high-growth potential of the defence sector while leveraging their existing financial strength and market influence. The fund could also offer large Indian conglomerates a strategic pathway to the outright acquisition of promising defence technology companies.

PATIENT CAPITAL: THE KEY TO DEFENCE SELF-RELIANCE

India possesses the technological talent and the industrial base; it primarily needs strategic and patient capital to realise its defence technology ambitions.

A joint defence innovation fund, backed by both government and private industry is necessary for long-term self-reliance. Without such sustained and patient capital support, India will continue to lag in defence innovation, unable to compete with nations that have successfully integrated public and private funding for strategic technological advancements.

*–The writer is Founder and Director of Big Bang Boom Solutions Pvt Ltd. The views expressed are of the writer and do not necessarily reflect that of **Raksha Anirveda***

MQ-9B: THE ULTIMATE ADVANTAGE FOR INDIA'S AEROSPACE INDUSTRY AND ITS ARMED FORCES

The SeaGuardian has enabled India to greatly expand and improve its intelligence, surveillance, and reconnaissance capabilities from its own shores to the east coast of Africa and beyond

As India looks toward growing its roles and responsibilities on the world stage, there seem to be no limits in sight.

One core part of the foundation for this new structure in the 21st century is with durable partnerships that benefit India's allies and friends, as well as the nation itself, and which already are bearing fruit in terms of upgraded capabilities.

Look no further, for example, than uncrewed aerial systems. The Indian Navy is a pioneer user of some of the most advanced new unmanned multi-mission aircraft in the world, the MQ-9B SeaGuardian®, built by the American contractor General Atomics Aeronautical Systems, Inc.

The Navy got its start with two preproduction-model MQ-9Bs in a lease-hire agreement. Following that success over tens of thousands of operational hours, the Indian government has announced that it is acquiring 31 new full production-model MQ-9Bs over the coming years: 15 for the Indian Navy and eight apiece for the Indian Air Force and Indian Army.

GA-ASI's MQ-9B SeaGuardian® Unmanned Aircraft

MAJOR INDIAN CONTRIBUTIONS

The forthcoming slate of aircraft for the Indian military will incorporate heavy use of Indian production support in the Subcontinent. The program follows in the footsteps of other collaboration agreements in which users of advanced unmanned aircraft contribute much themselves—for example, British industry to the Royal Air Force fleet. Work is underway to build a similar team in India.

Over more than 10,000 flight hours of operations, the SeaGuardian has enabled India to greatly expand and improve its intelligence, surveillance, and reconnaissance capabilities from its own shores to the east coast of Africa and beyond. The new possibilities for SeaGuardian's various missions are vast.

The forthcoming slate of aircraft for the Indian military will incorporate heavy use of Indian production support in the subcontinent. The program follows in the footsteps of other collaboration agreements in which users of advanced unmanned aircraft contribute much themselves

An artist's rendering of MQ-9B SeaGuardian conducting a maritime surveillance mission

ISRAEL DIARY

ISRAEL: THRIVING ON

ARIE EGOZI

Israel has emerged as a global powerhouse in defence technology on the back of seasoned military experience and a deeply ingrained entrepreneurial spirit. From AI-driven combat systems to space-age surveillance, Israel's startups are rewriting the rules of modern warfare

Israel, a nation synonymous with technological innovation, has undergone extraordinary advancement in its defence technology sector. This growth has transformed the country into a global hub for cutting-edge defence solutions. Its unique ability to seamlessly blend military and civilian applications has fostered a robust ecosystem encompassing novel technologies, dynamic startups, and globally recognised aerospace and defence enterprises. Amidst profound shifts in the global security landscape, Israel's defence industry is strategically positioned to address emerging challenges and capitalise on unprecedented opportunities.

According to Startup Nation Central, Israel's vibrant startup scene pioneers technologies that tackle critical needs in air defence, homeland security, aviation, dual-use applications, space exploration, and beyond. This convergence of innovation has positioned Israel as an exceptionally attractive destination for investors seeking high-quality, groundbreaking opportunities.

Defence tech, at its core, involves the development of advanced equipment and systems tailored for naval, aerial, and ground forces. This includes secure communication networks, electronic intelligence gathering, sophisticated navigation systems, advanced sensors, and signal processing capabilities. Beyond traditional weaponry, innovations extend to enhancing military capabilities in airpower, intelligence dominance, and strategic battlefield advantage.

Israel's young innovators possess an unparalleled understanding of battlefield needs, transitioning seamlessly from combat to the lab. This intimate knowledge of operational realities drives rapid development and deployment of cutting-edge solutions

TECH

Homeland Security (HLS): Homeland security in Israel encompasses a comprehensive suite of measures and technologies designed to protect the nation from both internal and external threats. This includes sophisticated counterterrorism strategies, advanced border security systems employing AI-driven surveillance, robust cyber defence mechanisms safeguarding critical infrastructure, intelligence gathering platforms utilising advanced analytics, rapid emergency response systems enhanced by real-time data, smart city technologies integrating security measures, and advanced law enforcement tools.

Dual-Use Technologies: Dual-use technology refers to equipment, software, and knowledge that can serve both civilian and military purposes. These technologies, often initially developed for civilian applications, can be rapidly adapted for military operations, making them invaluable for national security and capable of addressing diverse defence needs. Prime examples include GPS systems, now integral to military navigation and civilian logistics, and drone technology, which finds applications in both commercial aerial photography and military reconnaissance.

Space Tech: Space technology in Israel involves the design, development, and operation of advanced devices and systems for space travel and exploration, including sophisticated satellites for communication and surveillance, scientific instruments for advanced research, and spacecraft for exploration. Advances in spacecraft design, control systems, power generation, and communication systems are addressing critical industry challenges such as reusability, cost-effectiveness, and accessibility, ensuring Israel's strategic advantage in space-based technologies.

Unmanned Systems and Robotics: Unmanned systems and robotics in Israel encompass a wide range of autonomous and remotely controlled technologies, including unmanned aerial vehicles (UAVs) for reconnaissance and combat, unmanned ground vehicles (UGVs) for hazardous missions, unmanned surface vehicles (USVs) for maritime surveillance, and advanced robotics for diverse military applications. These systems leverage satellite and spacecraft technologies for data transmission, signal processing, precise location determination, surveillance, and movement control.

Sources within the defence industry, speaking with *Raksha Anirveda*, emphasise the unique advantage held by Israeli defence startups. "The young entrepreneurs who establish and run these startups are often reservists

ISRAEL DIARY

ISRAELI DEFENCE TECH INNOVATORS

TriEye: Revolutionising SWIR (Short-Wave Infrared) sensing for mass-market applications, TriEye's technology delivers mission-critical imaging and ranging in all weather and lighting conditions. They enable the implementation of SWIR sensors at scale.

X-TEND: Empowering remote operators with AI-assisted tactical robotics, X-TEND's systems enhance combat effectiveness in complex environments, including GPS and communication-denied zones, offering a range of dynamic battlefield solutions. According to the company working in the toughest environments on earth, such as GPS & COMMS denied situations, its multi-platform solutions enable a broad range of dynamic modern battlefield solutions designed for combat agility, effectiveness, and superiority.

AIROBOTICS: Delivering end-to-end, fully automated UAV systems for on-demand 24/7 aerial data operations, AIROBOTICS' platform provides comprehensive hardware and software solutions for efficient data capture, distribution, and analytics. The platform includes all hardware and software components required for safe and efficient data capture, distribution, and analytics, and can be implemented in any On-Prem or cloud-based configurations.

KELA: Offering a modular platform that enables militaries to seamlessly integrate new technologies, KELA's solutions enhance operational capabilities and adapt to evolving combat conditions. The company aims to expand its platform's deployment to US security agencies and other Western forces. Its platform, which is based on an open and modular architecture, allows militaries to safely and flexibly integrate new technologies without having to make significant changes to their current systems.

AXON VISION: Providing real-time, AI-based decision-making solutions, AXON VISION's systems enhance situational awareness for commanders operating with closed hatches, reducing cognitive load and maximising vehicle lethality and survivability. The product is a modular system contains AI clusters (Day/Night Camera, GPU and AI algorithm) and central unit.

HIGH LANDER: Developing the Vega UTM, a fully autonomous software solution for real-time airspace awareness, HIGH LANDER coordinates crewed and uncrewed aerial activity, providing a consolidated view of the sky and enabling tactical deconfliction. It coordinates disparate drone fleets and traditional air traffic at any scale, providing a real-time view of everything airborne.

in the Israel Defense Forces (IDF)," one source explained. ''They transition seamlessly - one day they serve in elite units that use the type of systems they develop and the next day, they are in the lab understanding exactly what the forces in combat need. The results are phenomenal and the upgrades are also based on the combat experience of the developers," the source added.

The Israeli Ministry of Defense (IMOD) plays a pivotal role in supporting these startups. An IMOD official told *Raksha Anirveda* that collaboration between the ministry and the defense startup ecosystem has significantly increased, particularly during the "Swords of Iron" conflict. "The Directorate of Defence Research & Development (DDR&D) has spearheaded a strategic initiative to integrate open innovation, accelerating the adoption of cutting-edge technologies within combat forces," the official stated. "Before the war, the ministry worked with approximately 200 startups. Since then, that number has grown by over 50 per cent, with more than 300 active startups and over 100 providing operational solutions on the battlefield."

Initiatives such as the Innofense and Innotal acceleration programs, the "Green Track" for rapid startup collaboration, and extensive partnerships with the private sector and venture capital funds are further accelerating this growth. The integration of artificial intelligence, autonomous systems, and advanced sensors has yielded dramatic real-time improvements, showcasing Israel's unique ability to innovate, develop, and deploy critical technological solutions under combat conditions.

–The writer is an Israel-based freelance journalist. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

INDIAN ARMY SOLDIER DESIGNS MISSION-READY COMBAT DRONE

Hawaldar Varinder Singh has been awarded the Vishisht Seva Medal for developing a versatile 35 kg Octacopter drone that can fight and fire, conduct surveillance, and deliver payloads to forward locations

RA EDITORIAL DESK

Hawaldar Varinder Singh of the 22 Sikh Regiment has developed a highly versatile 35 kg Octacopter drone that can fight and fire, conduct surveillance and monitoring, and deliver payloads to forward and difficult locations. This drone is equipped with real-time video capability that is displayed on a remote screen and shareable with command centres.

Moreover, the drone has been equipped with a platform for firing weapons, like AK-47, or dropping grenades onto enemy targets with pinpoint accuracy. According to Hawaldar Singh, with the help of a four-hand grenade MMG (medium machine gun) rifle, the enemy can be killed with pinpoint accuracy, which will prove to be a boon for the Indian Army.

With an operational range of 8-10 km in plains and high-altitude areas, the Octacopter is proving to be a versatile platform as it can be used for transporting weapons, ammunition, medicines, or mission-critical supplies to forward and difficult locations.

The Octacopter now comes equipped with GPS, night-enabled zooming cameras for surveillance, and autonomous flight capabilities via mission-planning software. It is compatible with Defence Series Maps and open-source mapping systems, further enhancing its deployment flexibility.

Hawaldar Varinder Singh began with a little tinkering around with a humble hexacopter prototype in 2023, which has become a versatile mission-ready military drone now, with its operational credibility already being proved during Operation Teesta after the Glacial Lake Outburst Flood in Sikkim in October 2023 and in war games like Bharat Shakti.

This remarkable achievement of Hawaldar Singh has earned him the Vishisht Seva Medal (VSM), awarded by President Droupadi Murmu. The award is presented to Indian armed forces personnel to acknowledge their 'distinguished service of a high order'.

While India is investing $3.5 billion in procuring 31 MQ-9B Remotely Piloted Aircraft Systems from the United States, Hawaldar Singh has done his part by designing a mission-ready combat drone that offers a multi-role platform for surveillance, combat, and logistics.

FUTURE AIR-MOBILITY

HIGH HOPES FOR LOW-ALTITUDE ECONOMY IN INDIA

The global aviation industry is witnessing an inflection point with the rise of eVTOLs — aircraft that integrate the vertical take-off functionality of helicopters with the operational efficiencies of electric propulsion. With traffic congestion costing the Indian economy nearly $22 billion annually, eVTOLs present a cleaner and sustainable alternative for short-distance air travel

"The future belongs to those who embrace innovation today."

– Prime Minister Narendra Modi

CDR RAHUL VERMA

India is at a turning point in urban transportation, with eVTOL (electric vertical take-off and landing) aircraft poised to redefine mobility. According to a Morgan Stanley report, the global urban air mobility market is projected to reach $1 trillion by 2040, with India playing a pivotal role. With traffic congestion costing the Indian economy nearly $22 billion annually and urban populations set to grow exponentially, a paradigm shift in transportation is not just desirable, it is essential.

India's urbanisation is not limited to metro cities alone. Tier-II and Tier-III cities are witnessing rapid growth, with over 400 million people expected to reside in these urban centres by 2030. A hub-and-spoke model integrating eVTOLs with existing transportation networks could provide a viable solution to inter-city and last-mile connectivity challenges, reducing travel time and increasing accessibility in underdeveloped regions.

As metropolises struggle with gridlocked streets and environmental concerns, eVTOL technology offers a revolutionary alternative — blending efficiency, sustainability, and advanced

aerodynamics to redefine urban air mobility (UAM). A growing number of Indian startups are pioneering this transformation, striving to position the nation as a formidable player in the global low-altitude economy.

The Emergence of eVTOLs: Transforming Urban Mobility

Globally, the aviation industry is witnessing an inflection point with the rise of eVTOLs — aircraft that integrate the vertical take-off functionality of helicopters with the operational efficiencies of electric propulsion. By significantly reducing carbon emissions and noise pollution, eVTOLs present a cleaner and more sustainable alternative for short-distance air travel. In India, where rapid urbanisation is exacerbating congestion in major cities, the case for these next-generation aerial vehicles has never been stronger.

India's eVTOL Vanguard: Startups Shaping the Future

Several Indian startups have recognised the immense potential of eVTOLs and are making remarkable strides in research, development, and deployment:

Sarla Aviation. Headquartered in Bengaluru, Sarla Aviation is leading India's push towards urban air mobility. By developing the country's first indigenous eVTOL aircraft, the company aims to revolutionise city travel across Mumbai, Bengaluru, Delhi, and Pune. Their vision is to offer aerial ride-sharing at cost parity with premium ground transportation, democratising access to on-demand air travel.

The ePlane Company. Incubated at IIT Madras, The ePlane Company has secured $14 million in funding to advance the development of eVTOL aircraft tailored for intra-city operations. With a keen focus on optimising battery efficiency, aerodynamics, and safety, the company is preparing for flight testing by mid-2025. Their approach leverages hybrid electric propulsion to maximise range and minimise operational costs, positioning them as a frontrunner in the nascent Indian eVTOL sector.

Bluj Aerospace is an emerging player in the Indian eVTOL sector dedicated to revolutionising urban air mobility. The company focuses on developing cutting-edge eVTOL aircraft that promise to enhance urban transportation by offering efficient, sustainable, and advanced aerodynamics solutions. Bluj Aerospace aims to address the growing challenges of urban congestion and environmental concerns by providing a cleaner and more sustainable alternative for short-distance air travel. With a commitment to innovation and excellence, Bluj Aerospace is poised to play a significant role in shaping the future of urban air mobility in India.

The Global Paradigm: Lessons from China and Beyond

India's aspirations for a robust low-altitude economy can draw significant insights from international advancements in eVTOL technology. China, for instance, has aggressively invested in advanced air mobility (AAM), establishing dedicated regulatory frameworks, urban vertiport networks, and state-backed funding programmes to accelerate development. Companies like EHang have successfully tested autonomous passenger drones in key cities, proving the feasibility of self-flying vehicles for short-haul urban transport.

Beyond China, the United States and Europe have also pioneered crucial aspects of AAM. The Federal Aviation Administration (FAA) and the European Union Aviation Safety Agency (EASA) have set safety and certification benchmarks, offering structured roadmaps for integrating eVTOLs into commercial operations. Collaborations between aerospace giants like Airbus, Boeing, and startups such as Joby Aviation highlight the importance of ecosystem-wide synergy, a model that India can adopt by encouraging public-private partnerships and streamlined regulatory pathways.

Additionally, Japan and South Korea are pushing ahead with ambitious urban air mobility (UAM) initiatives, integrating smart city planning with AAM infrastructure. Their policies emphasise controlled airspace corridors, air traffic management innovations, and public awareness programmes to enhance adoption. India must align its strategies with these global benchmarks while ensuring indigenous adaptations that cater to local infrastructure constraints and policy frameworks.

The Challenges and Road Ahead

Despite its promising potential, the Indian eVTOL ecosystem faces several hurdles:

Regulatory Framework. Establishing comprehensive policies to govern low-altitude air mobility remains a work in progress. Coordination between the Directorate General of Civil Aviation (DGCA) and other regulatory bodies will be crucial.

Recommendation: A dedicated eVTOL task force should be established to draft clear certification guidelines, streamline approvals, and ensure

Sarla Aviation is leading India's push towards urban air mobility. It developed the country's first indigenous eVTOL aircraft. Another leading player in the nascent Indian eVTOL sector is The ePlane Company. Also, Bluj Aerospace is poised to play a key role in shaping the future of urban air mobility in India

FUTURE AIR-MOBILITY

India must establish comprehensive policies to govern low-altitude air mobility. The success of eVTOLs depends on the availability of vertiports, charging stations, and dedicated flight corridors

synergy between aviation and urban development authorities.

Infrastructure Development. The success of eVTOLs depends on the availability of vertiports, charging stations, and dedicated flight corridors.

Recommendation: Public-private partnerships should be encouraged to fund and develop vertiport infrastructure in major metropolitan areas, with incentives for real estate developers to integrate vertiports into future urban planning.

Public Acceptance and Safety. For widespread adoption, confidence in eVTOL safety, reliability, and affordability must be fostered.

Recommendation: Awareness campaigns, pilot programmes, and safety demonstrations should be conducted in collaboration with regulatory bodies to build trust among consumers and stakeholders.

A Skyward Future

"The future belongs to those who prepare for it today." – Malcolm X. The advent of eVTOL technology marks a significant leap towards sustainable and efficient urban transportation. While the road ahead is fraught with challenges, history has shown that bold innovation and strategic policymaking can transform the seemingly impossible into reality.

Prime Minister Narendra Modi once said, "The world is looking at India with great hope and optimism." As India leads the charge in urban air mobility, these words ring truer than ever. With vision, commitment, and unwavering resolve, India can emerge as a global powerhouse in the low-altitude economy. The PM has emphasised that "reform, perform, and transform" is the way forward. By embracing policy advancements, fostering innovation, and investing in cutting-edge infrastructure, India can set a global benchmark in eVTOL development.

India has an unparalleled opportunity to lead the global low-altitude economy. With forward-thinking startups, regulatory foresight, and robust infrastructure, the nation can redefine urban mobility for the 21st century. John F Kennedy once said, "We choose to go to the moon... not because it is easy, but because it is hard." The future is difficult but bright, and if this can be done anywhere, it has to be done here in India.

As the nation propels itself into this new frontier, the sky is not the limit, it is just the beginning.

–The writer is a Navy veteran having diverse aircraft experience as a Naval Aviator. He is an emerging technology and prioritisation scout for a leading Indian multinational corporation, focusing on advancing force modernisation through innovative technological applications and operational concepts. He aims to leverage his domain knowledge to propel unmanned and autonomous systems, and create value for Aatmanirbhar Bharat and the Indian Aviation industry through his writing. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

THREE NEW AIRLINES TO FLY IN THE INDIAN SKY IN 2025

The Indian aviation sector may witness further growth in 2025 with the launch of three new airlines in India - Shankh Air, Air Kerala and Al Hind Air slated to start operations soon

Though India has 12 functioning passenger airlines, yet the market concentration remains high with just two top carriers serving over 90% of passengers. The growing number of airports and increasing air travel preferences create substantial opportunities for new contenders in this expanding market.

Reportedly, three new airlines will soon join the ever-expanding Indian civil aviation sector. Of these, Shankh Air will operate from Noida's new Jewar International Airport (DXN). Kerala will host two new airlines - Air Kerala and Al Hind Air. Both will compete to become the state's first scheduled carrier while focusing on regional connectivity in southern states and future expansion to Gulf countries.

All three carriers received their no-objection certificates (NOCs) from the Ministry of Civil Aviation (MoCA) in 2024. They await final air operator certificates (AOC) from the Director General of Civil Aviation (DGCA).

SHANKH AIR

Shankh Air will operate from the upcoming Noida Jewar International Airport as Uttar Pradesh's first scheduled full-service airline. Initial routes will connect Lucknow (LKO), Varanasi (VNS), Gorakhpur (GOP), and major metros including Delhi (DEL), Mumbai (BOM), and Bengaluru (BLR).

The carrier plans to lease its first narrow-body aircraft by March-end, starting operations with two aircraft and expanding to five within a year. International expansion is targeted for 2027. Chairman Shravan Kumar Vishwakarma has committed $50 million in initial funding, while parent company Shankh Trading Pvt. Ltd. pledged $200 million for launch and expansion of the new airline.

AIR KERALA

Air Kerala aims to become India's first ultra-low-cost carrier, launching domestic operations in 2025 and international flights in 2026. Initially conceptualized by the state government in 2005, this private initiative will operate under Zettfly Aviation Pvt. Ltd., founded by UAE-based entrepreneurs Afi Ahmed and Ayub Kallada.

Shankh Air will operate from the upcoming Noida Jewar International Airport as Uttar Pradesh's first scheduled full-service airline. Initial routes will connect Lucknow, Varanasi, Gorakhpur, and major metros including Delhi, Mumbai, and Bengaluru

The airline will operate three ATR 72-600 aircraft from Cochin International Airport (COK), focusing on connecting Kerala's Tier-2 and Tier-3 cities with major hubs while serving the Malayali expatriate community in the Middle East.

AL HIND AIR

Calicut-based Al Hind Group will transition from a tour and travel agency to launch Al Hind Air as a regional commuter airline.

Starting with two ATR 72-600 aircraft operating from Cochin International Airport (COK), the carrier plans to expand to seven aircraft within a year and launch international routes to Gulf countries within two years of operations.

The launch of these three new airlines in India in 2025 marks a historic year for Indian aviation, promising improved regional connectivity, enhanced service quality, and competitive pricing. Final launch dates remain pending as the airlines await regulatory approval from the DGCA.

SUSTAINTABILITY

BOEING DEMONSTRATES CASCADE TOOL AT AERO INDIA 2025: MAPPING AVIATION'S PATH TO NET ZERO

The Cascade Climate Impact Model will continue to serve as a valuable tool in enabling decisions that shape sustainable future for global aviation

RA EDITORIAL DESK

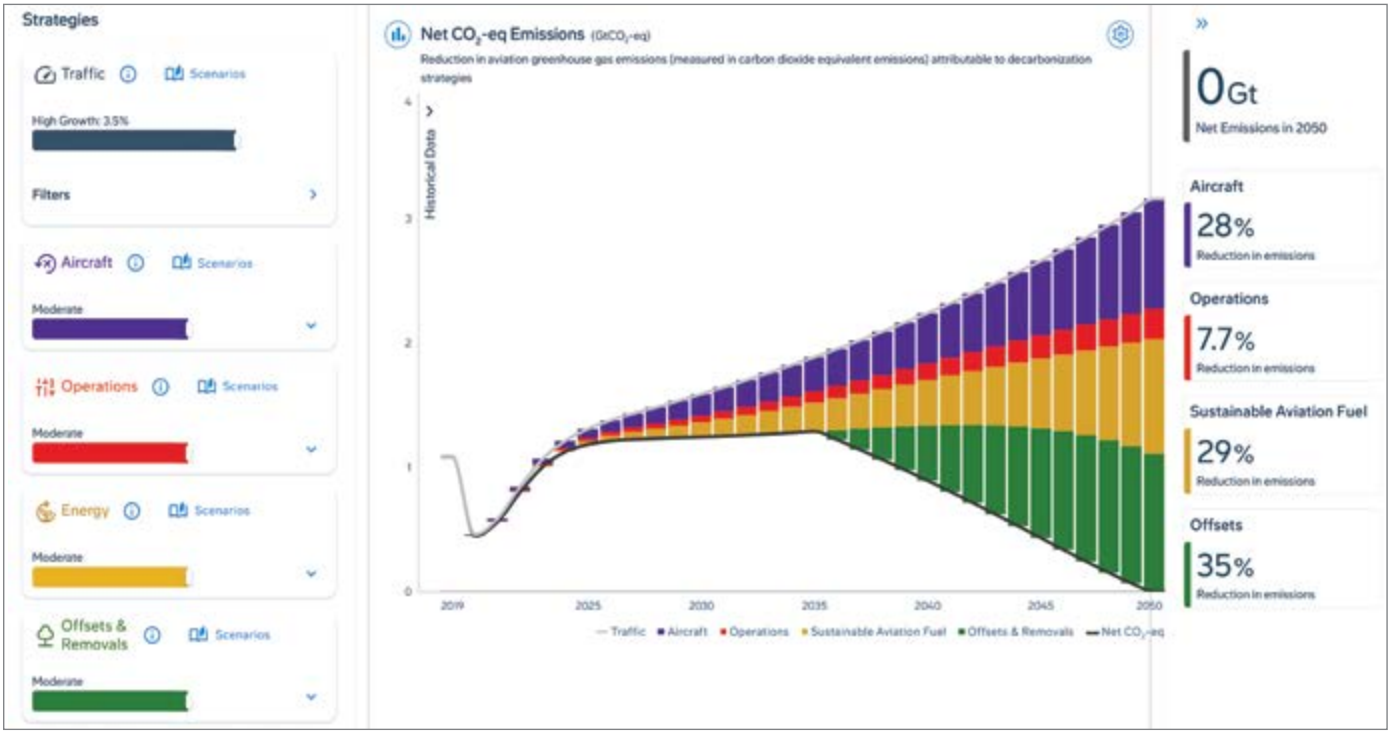
As climate change and aviation sustainability take centre stage, industry leaders are working to develop real solutions for a greener future. Aviation is responsible for 2-2.5% of global emissions but remains a vital economic driver, contributing 4.3% of GDP and supporting over 86 million jobs. Achieving the delicate balance between reducing emissions and fostering growth is one of the sector's most pressing challenges.

At Aero India 2025, Boeing showcased its Cascade Climate Impact Model, showing how the aviation industry can achieve net-zero CO2 emissions by 2050. Developed in collaboration with MIT, the Whittle Lab at Cambridge, NASA, and IATA, Cascade is a robust and data-driven tool designed to help policymakers, airlines, and industry leaders evaluate different decarbonisation strategies.

Cascade is a dynamic modeling tool that allows you to analyse strategies and scenarios to reduce aviation's emissions through 2050. It considers a comprehensive view of renewable energy sources' entire lifecycle, from production and distribution to their use in aviation as alternative energy carriers like electricity, hydrogen, and SAF (Sustainable Aviation Fuel). The model also assesses the impact of various strategies, including fleet renewal, operational efficiency, renewable energy adoption, and future aircraft technologies.

THE ROLE OF SUSTAINABLE AVIATION FUEL

Boeing's Chief Sustainability Officer Brian Moran led the Cascade demonstration in Bangalore. He emphasised the importance of Sustainable Aviation Fuel and shared that while SAF production is scaling up, more significant efforts are required to accelerate its widespread adoption. The model offers actionable insights, enabling industry stakeholders to make informed decisions that balance environmental goals



with economic realities.

With India projected to require 2,500 new aircraft over the next two decades, updating the nation's fleet will help reduce its aviation carbon footprint.

Sustainable Aviation Fuel (SAF) is critical to achieving aviation's net-zero goals. Boeing has been a leader in advocating for SAF since 2008, supporting multiple production pathways, including municipal solid waste and used cooking oil.

SAF can reduce lifecycle emissions by up to 80% compared to conventional jet fuel. Notably, India has the potential to produce 22 million tons of SAF annually—exceeding its domestic demand. However, production challenges and the cost disparity between SAF and traditional jet fuel remain barriers that need policy intervention and industry collaboration.

Boeing has partnered with leading Indian organisations, including HPCL, to support the development of SAF. In collaboration with partners, Boeing has also developed country-specific roadmaps that provide a strategic foundation for scaling SAF production and adoption globally.

REGULATORY & POLICY SUPPORT FOR NET-ZERO GOALS

Regulatory frameworks such as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) play a critical role in the short term. As cleaner technologies continue to scale, airlines can help bridge the gap by supporting carbon offset projects.

Sustainable Aviation Fuel (SAF) is critical to achieving aviation's net-zero goals. Boeing has been a leader in advocating for SAF since 2008, supporting multiple production pathways, including municipal solid waste and used cooking oil

Transitioning to sustainable aviation requires a coordinated effort from aircraft manufacturers, fuel producers, policymakers, and airlines. While fleet modernisation, SAF adoption, and operational efficiency are key, long-term success will depend on robust regulatory support, financial incentives, and cross-industry collaboration.

INDIA'S ROLE IN SUSTAINABLE AVIATION

With India's aviation sector poised for rapid expansion, early investments in sustainable technologies and infrastructure will ensure the country remains a leader in the journey toward net-zero aviation. Boeing's Cascade Climate Impact Model will continue to serve as a valuable tool in enabling decisions that shape sustainable future for global aviation.

BY INVITATION

REVOLUTIONISING AIRPORT OPERATIONS: EMERGING TECHNOLOGY ENHANCES PASSENGER EXPERIENCE, DRIVES SUSTAINABILITY

Biometric systems facilitate security checks, AI-driven customer service offers personalised assistance to passengers, and the Internet of Things, big data analytics, and cloud computing optimise airport operations. In addition, green practices, energy-efficient lighting and waste management reduce carbon footprints, contributing to a healthier environment

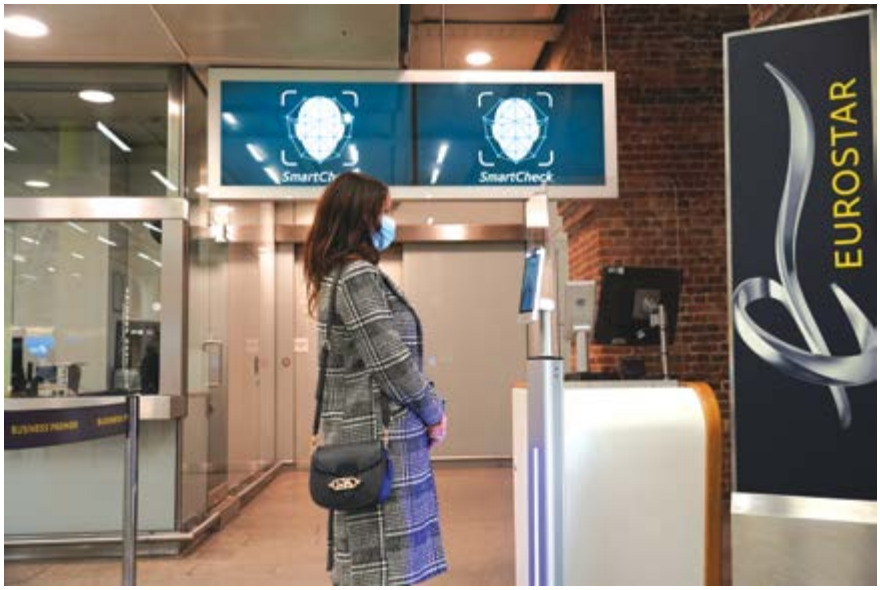
RISHI MEHTA

With global travel rapidly becoming a mainstream phenomenon, airports no longer serve as mere transit points but as complex ecosystems that require seamless coordination and efficiency. In this regard, the incorporation of cutting-edge technologies is redefining airport operations, elevating passenger experiences, and driving sustainability. This transformation is vital to address the soaring demands of modern travellers and the urgent need for environmental responsibility.

Today, travellers demand efficiency, convenience, and comfort, and technologies such as biometric systems, AI-driven customer service, and real-time information systems are at the forefront of this change. Biometric systems, for instance, facilitate security checks by utilising facial recognition. This substantially lowers wait times and enhances security, offering passengers a more seamless and stress-free experience.

AI-driven customer service is another gamechanger, with virtual assistants and chatbots backed by artificial intelligence offering personalised assistance to passengers. This includes providing real-time information and support, including the status of flights and gate changes, ensuring that passengers receive timely and precise information.

Moreover, technologies like the Internet of Things (IoT), big data analytics, and cloud computing play crucial roles in optimising airport operations. IoT-enabled devices gather extensive data from different touch points within the airport, such as baggage handling systems, security checkpoints, and passenger flow.



This data is then scrutinised by leveraging big data analytics to determine patterns and trends, offering critical insights for enhancing operational efficiency.

On the other hand, cloud computing enables the storage and processing of significant datasets, facilitating real-time data analysis and decision-making. This ensures that airport operations are more agile to changing conditions. For instance, real-time data analysis can help predict passenger flow and manage resources accordingly, reducing congestion and

improving the overall passenger experience.

Another important aspect of airport operations is enhancing the safety and security of passengers. Today, AI and machine learning are being used to boost security benchmarks. AI-powered surveillance systems can monitor and assess video feeds in realtime, pinpointing potential security threats and warning security personnel. Moreover, machine learning algorithms can consistently learn from data, improving their precision in detecting suspicious actions over time.

Upgrading technological infrastructure also benefits air traffic management systems with optimised flight schedules and air traffic, reducing delays. With a substantial evaluation of weather conditions, flight paths, and air traffic patterns, air traffic controllers can make informed decisions that improve operational efficiency.

A notable example of technological advancement in airport operations is the deployment of AEROWISE - a Digital Twin-Powered Integrated Airport Predictive Operations Centre - at Rajiv Gandhi International Airport in Hyderabad.

This avant-garde solution combines numerous modules and tracks multiple key performance indicators, providing a bird's eye view of the airport ecosystem. This marks a significant step towards the future of airport management, showcasing the endless potential of digital transformation in the aviation sector.

Cloud computing enables data storage and processing, facilitating decision-making and ensuring airport operations are more agile to changing conditions

Another critical focus of the global aviation sector is sustainability, and airports are increasingly adopting green technologies and practices to reduce their environmental footprint. Energyefficient lighting, waste management processes, and sustainable building materials are becoming standard in modern airports. These initiatives reduce energy consumption and contribute to a healthier environment.

Moreover, conventional ground support vehicles that run on fossil fuels are replaced with electric alternatives. This lowers greenhouse gas emissions and the airport's overall carbon footprint.

The journey towards a digital and sustainable aviation industry is ongoing, and the advantages are evident. As technology continues to advance, airports will be able to deliver even more innovative and intuitive experiences, further elevating the standard of air travel across the globe. The future of airport operations is promising, and technology is leading this transformation.

-The writer is CEO of WAISL. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

URBAN AIR MOBILITY IN INDIA: VJAITRA AIR MOBILITY PLAYS KEY ROLE IN UAM EVOLUTION

With rapid urbanisation, increasing congestion in megacities, and a strong push towards zero-emission mobility solutions, India presents a unique landscape to adopt electric and hydrogen-powered vertical takeoff and landing (VTOL) aircraft. At the forefront of this revolution is VJAITRA Air Mobility

RATANDEEP TRIPATHI

Urban Air Mobility (UAM) is emerging as the next frontier in sustainable transportation, promising to revolutionise how people and cargo move across cities. While the global UAM market has seen rapid developments in North America, Europe and the Middle East, India is now stepping up as a major player in this transformative sector. With rapid urbanisation, increasing congestion in megacities, and a strong push towards zero-emission mobility solutions, India presents a unique landscape to adopt electric and hydrogen-powered vertical takeoff and landing (VTOL) aircraft. At the forefront of this revolution is VJAITRA Air Mobility, India's pioneering aerospace startup, which has developed cutting-edge full-VTOL air taxis and has secured two patents in this domain. Vjaitra Air Mobility is supported by India' top - tier institute IIML-EIC for incubation and GOI approval.

COMPARING INDIA'S UAM MARKET WITH THE GLOBAL LANDSCAPE

The urban air mobility sector globally has witnessed significant advancements, with leading players such as Joby Aviation, Archer Aviation, Volocopter, and Lilium spearheading electric air taxi development. These companies have secured regulatory approvals, conducted test flights, and entered strategic partnerships for commercialisation. In the Middle East, Dubai has announced plans to deploy electric air taxis by 2026, while Europe is fostering collaborations for urban air corridors.

India, despite being a late entrant, is accelerating rapidly. The country's unique challenge of high urban congestion, coupled with increasing investments in green aviation technologies, creates a fertile ground for UAM adoption. Unlike its Western counterparts, where infrastructure development is relatively seamless, India requires a hybrid approach, integrating UAM with existing metro networks, railway stations, and airports. Recognising this, VJAITRA Air Mobility has strategically positioned itself to bridge this gap with affordable, zero-carbon, and zero-noise VTOL air taxis.

VJAITRA AIR MOBILITY: INDIA'S UAM PIONEER

VJAITRA Air Mobility is leading India's push into the sustainable air mobility sector with a clear vision: zero carbon emissions, zero noise, and one-third the affordability of traditional air travel and helicopter

Ratandeep Tripathi, CEO and Managing Director of Vjaitra Air Mobility

services. The company has introduced multiple aircraft models catering to diverse urban and regional mobility needs:

V-600x Hydrogen-Powered VTOL: The world's first hydrogen-powered air taxi in India, boasting an extended range of 600 km, making it suitable for regional connectivity.

VJ-220 Electric Model: With range upto 220 km, it is focused on intercity travel, filling the gap between metro cities and upcoming regional hubs.

A testament to VJAITRA's leadership in this space is its two recently registered patents on full-VTOL air taxis, reinforcing its technological edge and commitment to innovation.

STRATEGIC PARTNERSHIPS: EXPANDING INDIA'S UAM ECOSYSTEM

To drive adoption and commercialisation, VJAITRA has actively forged partnerships with multiple stakeholders in India's aviation ecosystem. Some of the notable collaborations include:

BookMyJet: A strategic partnership that enables seamless booking and scheduling of VJAITRA's air taxis through an established luxury air charter aggregator.

Mewar Helicopter Services Pvt Ltd: A collaboration aimed at integrating VJAITRA's VTOL solutions with existing helicopter networks in Rajasthan for improved last-mile connectivity.

UtripO Aviation: An LOI was signed for leasing V600x hydrogen VTOLs, with UtripO planning to procure 25 units worth $312.5 million post-certification.

Star Air & Air Kerala (Collaboration Talks Underway): Discussions are in progress to integrate VJAITRA's VTOL air taxis into regional air connectivity initiatives, bridging the gap between Tier-2 and Tier-3 cities with metro hubs.

These partnerships highlight the growing industry confidence in VJAITRA's vision and product lineup.

AFFORDABILITY: DISRUPTING THE COST MODEL OF AIR TRAVEL

One of the most compelling aspects of VJAITRA's UAM strategy is its affordability. Traditional air travel and helicopter services remain inaccessible to a vast majority of Indians due to high ticket prices. VJAITRA aims to change this by offering air taxi services at just one-third of the cost of a normal flight ticket or helicopter budget. This pricing model has the potential to make UAM a mainstream mode of transport, rather than a luxury segment.

By leveraging advanced electric propulsion and hydrogen fuel cells, operational costs are significantly reduced, making VTOL travel not just cleaner but also economically viable for the masses. With the government's push for green energy and sustainable aviation, VJAITRA's cost-effective model aligns with national policies on reducing carbon footprints in transportation.

CHALLENGES AND POLICY ROADMAP FOR UAM IN INDIA

Despite the promising outlook, India's urban air mobility sector must overcome several challenges to achieve large-scale deployment:

One of the most compelling aspects of VJAITRA's Urban Air Mobility strategy is its affordability. The company aims to offer air taxi services at just one-third of the cost of a traditional flight ticket. This pricing model is expected to make UAM a mainstream mode of transport in India, rather than a luxury segment

UAM LANDSCAPE

India's urban air mobility sector must overcome several challenges to achieve large-scale deployment. The DGCA is still drafting comprehensive guidelines for eVTOL operations. Unlike developed markets, India lacks the necessary vertiports

Regulatory Framework: India's Directorate General of Civil Aviation (DGCA) is still drafting comprehensive guidelines for eVTOL operations. Clearances for air routes, air traffic management, and vertiport infrastructure are crucial for commercial rollout.

Infrastructure Development: Unlike developed markets, India lacks the necessary vertiports — specialised hubs for VTOL aircraft operations. Government and private sector collaboration is needed to develop these at strategic locations.

Public Awareness and Adoption: Indian consumers are still unfamiliar with air taxis. Educational campaigns and pilot projects in metro cities will be essential in gaining user trust and acceptance.

Battery and Hydrogen Fuel Supply Chain: The availability of sustainable Hydrogen production and high-density battery technology remains a challenge. Investments in indigenous fuel cell technology and battery manufacturing are key to scaling operations.

FUTURE PROSPECTS: INDIA'S PATH TO BECOMING A GLOBAL UAM LEADER

India's UAM sector is poised for exponential growth, with projections estimating the market to be worth $10 billion by 2030. VJAITRA Air Mobility is at the forefront of this shift, driving innovation in clean aviation and air taxi services. With regulatory support, infrastructure investments, and strategic industry partnerships, India has the potential to not only match global players but also emerge as a leader in sustainable urban air mobility.

The government's focus on the National Green Aviation Policy, Hydrogen adoption, and Make-in-India initiatives provides a strong foundation for startups like VJAITRA to thrive. Additionally, the push for Regional Air Connectivity through UAM solutions aligns well with India's long-term transportation strategy.

As urban congestion worsens and the demand for faster, cleaner, and more affordable transportation grows, VJAITRA Air Mobility is uniquely positioned to redefine India's air mobility landscape. By pioneering zero-emission VTOL solutions, securing vital partnerships, and advocating affordability, the company is leading India into the next era of sustainable air transportation.

With India rapidly catching up with global counterparts, the time is ripe for government bodies, investors, and industry players to join forces and accelerate the adoption of UAM in India. The coming years will be crucial in determining whether India can transition from a follower to a global leader in urban air mobility—and VJAITRA Air Mobility is at the heart of this revolution.

–The writer is CEO and Managing Director of Vjaitra Air Mobility, Country Head Liaison – Advanced Air Mobility Institute, USA and Mobility Member – Sky Alliance of Autonomous Air Mobility, Austria. The views expressed are of the writer and do not necessarily reflect that of ***Raksha Anirveda***

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FLYING CARS

GUNTUR STARTUP MAGNUM WINGS SUCCESSFULLY TESTS PILOT-LESS EVTOL PROTOTYPE

The V2 eVTOL can travel up to 40 kilometres at a speed of 100 kmph and reach an altitude of 2,000 feet. It can be operated remotely or piloted manually

Developed by Magnum Wings, a startup that began research in 2017, a compact, pilot-less capsule-style electric Vertical Take-off and Landing (eVTOL) aircraft was recently unveiled in Guntur. Capable of carrying two passengers, the aircraft can travel up to 40 kilometres at a speed of 100 kmph and reach an altitude of 2,000 feet. According to company officials, it can be operated remotely or piloted manually.

Magnum Wings recently conducted a successful test flight of the prototype, which is intended for use as an air car. The initial test run was conducted without passengers or a pilot, with the aircraft controlled remotely from the ground. It can also navigate using a pre-set travel programme. The eVTOL aircraft is a workable model but requires regulatory approvals before commercial deployment.

According to founder CEO of Magnum Wings, Abhiram Chava, the V2 Vehicle (Version 1) has been finalised and it recently completed a successful test run without a human onboard. He stated that for passenger travel, the aircraft requires clearance and approval from the Directorate General of Civil Aviation (DGCA), the statutory body regulating civil aviation in India.

Magnum Wings' V2 aircraft is designed to carry two passengers with a payload capacity of 220 kg and requires a landing space of approximately 3.5 to 4 metres. Another version is in development that will accommodate three people, including a pilot. The aircraft can be operated similarly to a personal vehicle. However, a basic pilot certification will be necessary, which can be completed in about a week. Magnum Wings plans to provide this certification after obtaining the necessary DGCA approvals. As manufacturer, the company can offer training directly or through third-party providers.

The V2 version is equipped with eight batteries, eight propellers, eight motors and flight controllers, said Abhiram and added that even if two or more motors or propellers fail mid-flight, the aircraft can continue operating safely. In emergencies, it is designed to deploy a parachute for a secure landing. He emphasised that the vehicle is extremely safe and will be priced similarly to a premium car.

Before takeoff, the aircraft will require route clearance. Air traffic management will be handled by the Civil Aviation Department of the government of India. Since it is an electric vehicle, it can be recharged anywhere, making it a convenient mode of transport that saves travel time.

Abhiram Chava also revealed that the company is developing two additional versions capable of carrying four and eight passengers, respectively. Unlike the V2, these models will require a pilot for operation.

He explained that the Bharat Vertical Take-off and Landing (B-VTOL) Aircraft policy is currently under review by the Civil Aviation Department of the Government of India. "Once implemented, these vertical landing vehicles can be introduced in the market. The certification criteria applies to piloted VTOL aircraft with a maximum takeoff weight between 150 kg and 5,000 kg, intended for use in Advanced Air Mobility," he said.

BOC AVIATION ORDERS 50 BOEING 737 MAX JETS TO SUPPORT GLOBAL AIRLINES

Boeing and BOC Aviation have announced a new, firm order for 50 737-8 jets, expanding the lessor's 737 MAX portfolio to 215 737-8s and 737-9s.

BOC Aviation will increase its Boeing order book to 139 unfilled orders. BOC Aviation currently has 69 737 MAX airplanes on operating leases to more than 15 airlines worldwide.

"Our strong partnership with Boeing has led to this 50-aircraft order for the fuel-efficient Boeing 737-8 aircraft. With this transaction, we have commitments to purchase over 140 of these aircraft, which is the largest Boeing orderbook position in our history," said Steven Townend, Chief Executive Officer and Managing Director, BOC Aviation. "This order will enable us to continue providing our airline customers with technologically advanced aircraft for their future fleet growth."

With single-aisle jets projected to account for 75% of global deliveries over the next 20 years, lessors are looking to build their order books to

support airlines' fleet growth plans and replace less-efficient older jets. To date, lessors have ordered more than 1,200 737 MAX jets as they seek to replace up to 300 Next-Generation 737s per year that are set to retire from passenger operations by the end of the decade.

"BOC Aviation's latest investment in the 737-8 demonstrates the confidence lessors have in this airplane to meet continued air travel demand and improve fuel efficiency," said Brad McMullen, Boeing senior vice president of Commercial Sales and Marketing. "The 737-8 is much sought after by airlines due to its unmatched versatility, generating significant operational savings because of lower fuel consumption."

The 737-8, seating 162 to 210 passengers depending on configuration and with a range of up to 3,500 nautical miles (6,480 km), is the market's most versatile single-aisle airplane, capable of operating profitably on short- and medium-haul routes.

A leading global aerospace company and top US exporter, Boeing develops, manufactures and services commercial airplanes, defense products and space systems for customers in more than 150 countries. Our US and global workforce and supplier base drive innovation, economic opportunity, sustainability and community impact. Boeing is committed to fostering a culture based on our core values of safety, quality and integrity.

AIRBUS AWARDS 'MAKE IN INDIA' H130 HELICOPTER FUSELAGE CONTRACT TO MAHINDRA AEROSTRUCTURES

Dr Anish Shah, Group CEO and Managing Director of the Mahindra Group, Kinjarapu Rammohan Naidu, Civil Aviation Minister, Vumlunmang Vualnam, Secretary, Civil Aviation Minister, and Rémi Maillard, President and Managing Director of Airbus in India and South Asia, during the contract signing ceremony

Pursuing its strategic commitments to 'Make in India' and to promote the helicopter ecosystem in the country, Airbus Helicopters has awarded a contract for the manufacturing of the main fuselage assembly of the H130 helicopter to Mahindra Aerostructures Pvt. Ltd. in India.

The contract was signed in the presence of Kinjarapu Rammohan Naidu, Minister of Civil Aviation, Government of India, Vumlunmang Vualnam, Secretary, Ministry of Civil Aviation, Rémi Maillard, President and Managing Director of Airbus in India and South Asia, and Dr Anish Shah, Group CEO and Managing Director of the Mahindra Group.

Mahindra will produce the H130's main fuselage assembly, which will then be shipped to Airbus Helicopters' facilities in Europe. Industrialisation will commence immediately, with the first cabin assembly scheduled for delivery by March 2027.

"We have a strategic plan for India and we are implementing it to develop a holistic aerospace ecosystem across all dimensions: assembly, manufacturing, engineering, innovation, digital and training," said Rémi Maillard, President and Managing Director Airbus India and South Asia. "The H130 fuselage manufacturing contract underscores Airbus' confidence in the growing industrial excellence of the Indian supply chain, which offers the right mix of competencies and competitiveness. We are glad to extend this bond with India through our latest association with our partner Mahindra Aerostructures," Maillard added.

Mahindra already supplies a variety of parts and sub-assemblies for Airbus' commercial aircraft programmes. The latest contract marks a significant milestone for Mahindra as it continues to expand its portfolio of capabilities from parts and sub-assemblies to larger and more complex aerostructures.

For Airbus, India is both a major market and a strategic resource hub. Today, every Airbus commercial aircraft has components and technologies made in India. Currently, Airbus' annual procurement of components and services from India stands at $1.4 billion. Airbus' efforts to mature the wider Indian aerospace ecosystem also includes the building of two Final Assembly Lines: one for the C295 military aircraft and the other for the H125 helicopter.

The H130 is an intermediate single-engine helicopter tailored for passenger transport, tourism and private and business aviation, as well as medical airlift and surveillance missions. It has a wide, unobstructed cabin, which accommodates the pilot and up to seven passengers, providing outstanding visibility through a large wrap-around windscreen and wide windows. Its state-of-the-art technologies, materials, systems and avionics make it a quiet and powerful helicopter.

BY INVITATION

FROM IMPORTER TO GLOBAL POWERHOUSE: INDIA'S ROADMAP FOR AEROSPACE MANUFACTURING EXCELLENCE

India positions itself as a key player in aerospace manufacturing but remains heavily dependent on imports. It should aim for at least a 10% share of the global aerospace market by 2033. We must develop a robust supply chain ecosystem to enhance domestic design and manufacturing capabilities

KAUSHAL JADIA

The global aerospace industry is experiencing remarkable growth, driven by increasing demand for air travel and advancements in defence technologies. In 2024, nearly 5 billion passengers flew worldwide, supporting a commercial aerospace manufacturing sector valued at $373.61 billion, projected to reach $791.78 billion by 2034 at a CAGR of 7.8%.

Similarly, the global defence aerospace market, encompassing military aircraft, missile defence, and naval and land systems, stood at $1.45 trillion in 2024 and is expected to grow to $2.41 trillion by 2033, at a CAGR of 5.83%.

Despite this global expansion, India remains heavily dependent on imports, particularly in defence and commercial aerospace. However, with progressive policy initiatives and a strong focus on innovation, India is positioning itself as a key player in aerospace manufacturing by leveraging technology integration, supply chain localisation, and cost optimisation.

INDIA'S AEROSPACE ECOSYSTEM AND CHALLENGES

India has some aerospace design and manufacturing capabilities, nurtured through government investments and initiatives by research bodies and public sector companies. In recent years, participation of the private sector has increased. Many foreign OEMs are increasingly looking at India as a sourcing hub for engineering manufacturing, supported by a large talent pool, policy support from the government, and improved infrastructure. While the change is in the right direction, it is still far from the rightful contribution that a large nation like India should make to the global aerospace and defence market.

Indian imports are estimated to be $15 billion annually for commercial and military aviation, while exports are around $2 billion. India's contribution to global commercial aviation is likely less than 2% of the overall market. Several key challenges persist:

Raw Material Constraints: Most raw materials such as electronics and semiconductors, are imported. The certifiability of metals remains a constraint.

Certification: The certification ecosystem needs significant development. India also lacks strong bilateral agreements with recognised regulators like the FAA

and EASA, which places an extra burden on developing certifiable products in India.

Limited Product Design: While manufacturing and engineering services have grown in recent years, the ability to develop complete products with local IP is still lacking.

Skills: Skill development across engineering and manufacturing still needs improvement.

Quality & Processes: Awareness of aerospace processes and adherence to world-class quality standards have gaps.

THE PATH TO TRANSFORMATION

Each of the gaps listed above will need focused attention. The government can play a significant role in strengthening regulatory frameworks, skill development, and policies to incentivise investment in the sector. The industry also needs to take greater ownership in the segment in terms of design ownership and developing a manufacturing eco-system aligned with the needs of the aerospace sector.

ELECTRONICS IN AEROSPACE

Electronics and software are increasingly required in modern aircraft, and may account for about a third of the aerospace market. It also represents parts requiring higher sophistication. Avionics, sensors like radars, cameras, flight control and management software, and communication systems are critical for safety and efficiency. This has been of particular focus of Cyient DLM. Its facilities were one of the first in the country to achieve AS9100 and NADCAP certifications. Cyient DLM undertakes the manufacturing of electronics for multiple OEMs in the commercial and defence aerospace sector. Cyient DLM is also doing pioneering work in India for the design and certification of complex electronics for commercial aviation.

The semiconductor mission for the country should make semiconductor components readily available in due course. This will enable greater value add from India. Design and creation of IP, along with certification eco-system for aerospace electronics, is an area that should be a priority sector alongside manufacturing.

VISION 2033: INDIA'S AEROSPACE ROADMAP

India should aim for at least a 10% share of the global aerospace market by 2033. India must develop a robust supply chain ecosystem to reduce import dependence and enhance domestic design and manufacturing capabilities. Strengthening private sector participation in R&D and innovation will be crucial in advancing cutting-edge aerospace technologies.

Additionally, improving certification capabilities to meet global aviation standards will help Indian manufacturers integrate seamlessly into international supply chains. Finally, fostering strong public-private partnerships will accelerate industry growth, drive investment, and position India as a leading player in the global aerospace sector. With the right strategy and collaboration between industry stakeholders, policymakers, and global partners, India's journey from an aerospace importer to a global manufacturing leader is well within reach.

The future of aerospace is being written today — India has the opportunity to lead this story.

*–The writer is Senior Vice President and Chief Technology Officer at Cyient DLM. The views expressed are of the writer and do not necessarily reflect that of **Raksha Anirveda***

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SPOTLIGHT

GARUDA AEROSPACE AND ZUPPA's STRATEGIC PARTNERSHIP MARKS THE BEGINNING OF A NEW ERA OF COOPERATIVE GROWTH AMONG KEY INDIAN DRONE COMPANIES

Garuda Aerospace and Zuppa partnership will bolster the Make in India drone ecosystem, drive innovation, expand market reach, and position India as a global leader in secure drone technology

Zuppa, the company leading the nations push towards Indigenous drones has entered into a strategic partnership that involves both an undisclosed investment as well as orders for its products with Garuda Aerospace, a well known leading player in India's Agri and Defence drone ecosystem.

Sai Pattabiram, Founder & MD, Zuppa

Agnishwar Jayprakash, Founder and CEO, Garuda

This unique partnership between two leading players from the Indian drone ecosystem is among the first aimed at advancing secure drone technology and strengthening India's position in the global drone ecosystem. Zuppa is India's only deep-tech company specialising in designing, developing, and manufacturing cyber-secure drones and drone autopilots. At the core of its innovation is the Indigenous Cyber Physical Stack, comprising autopilot hardware, firmware, command control protocols, and UI software, built on its patented Disseminated Parallel Control Computing in Real Time (DPCC) architecture.

Unlike many drone manufacturers reliant on imported components, Zuppa designs its own autopilot systems, allowing it to choose non-Chinese origin components for its PCBs. This significantly reduces cybersecurity risks associated with embedded malware, making Zuppa's technology a trusted and resilient alternative in the global drone market.

Through this investment, Garuda Aerospace and Zuppa have joined forces to accelerate next-generation drone solutions, expand market reach, and position India as a global leader in secure drone technology. As the only Indian company among a select seven globally with proprietary deep-tech in secure autopilot systems for unmanned aerial systems (UAS), Zuppa brings unmatched expertise in cyber-secure autopilot advancements, while

Garuda Aerospace leverages its strengths in financing, operations, and customer acquisition to scale adoption especially in large value procurements .

Zuppa's standardised drone platforms offer modular adaptability across various categories, similar to the roll-out chassis concept in the automotive industry or standardised designs in computing devices like laptops and mobile phones. This innovation enables partners to cater to diverse customer needs with minimal development time and cost, making Zuppa a deep-tech leader in this rapidly evolving sector.

Agnishwar Jayprakash, Founder and CEO, Garuda Aerospace said, "At Garuda Aerospace, we are committed to driving innovation and self-reliance in the Indian drone ecosystem. Our strategic investment in Zuppa marks a significant step towards advancing secure and indigenous drone technologies.

Aerospace

Venkatesh Sai, Co-Founder & Technical Director, Zuppa

By combining Zuppa's deep-tech expertise in cyber-secure autopilot systems with our strengths in operations and market expansion, we aim to position India as a global leader in next-generation drone solutions. This partnership is a testament to our shared vision of fostering an Aatmanirbhar Bharat in aerospace and defence."

Sai Pattabiram, Founder & MD at Zuppa, said "India has the potential to emerge as a Global Hub for Secure Drones by 2030. To achieve this, the Indian drone industry must transition from a commoditised assembly model of imported components to a tiered cooperative ecosystem, similar to mature sectors like Automotive and Aerospace. Our partnership with Garuda Aerospace is a pioneering step in this direction."

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Sai Pattabiram, Founder & MD, Zuppa

Venkatesh Sai, Co-Founder & Technical Director at Zuppa, highlighted the synergy between the two companies, "Our partnership with Garuda Aerospace is a win-win collaboration, allowing us to focus on our core technological expertise and building a network to distribute and service our products across India while Garuda Aerospace expands our products and technologies across applications and geographies. This alliance sets a precedent for more symbiotic partnerships in the Indian drone ecosystem."

With the government's push for Aatmanirbhar Bharat and increasing strategic defence partnerships, this collaboration marks a transformative shift in India's drone industry. By leveraging each other's strengths, Zuppa and Garuda Aerospace are paving the way for indigenous, cyber-secure drone solutions that will redefine defence, commercial, and industrial applications on a global scale while setting the tone for collaborative initiatives between other players within the Indian Drone Ecosystem .

Garuda Aerospace is among India's top Drone companies with a strong Brand presence and reach across the country's Agricultural drone community. Recognising the Country's immediate need for Secure drones from a national security perspective Garuda is on a mission to strengthen India's Indigenous drone Ecosystem starting with ZUPPA, a core Deep Tech player in the sector with more to follow.

ZUPPA Geo Navigation Technologies India's fully home grown Deep Tech company leading the nations indigenous secure drones drive with its patented DPCC computing architecture has developed a range of affordable, aatmanirbhar, user friendly secure drone platforms that can be used by developers and service providers to build Applications with minimal efforts and time, there by shortening their getting to Revenue Cycle.

AATMANIRBHARTA STRIDES

PM MODI INAUGURATES LOITERING MUNITION TEST RANGE AT NAGPUR

On his recent visit to Nagpur, Maharashtra, PM Modi on March 31 inaugurated the Loitering Munition Test Range at Solar Defence & Aerospace Ltd (SDAL), a subsidiary of Nagpur-based Solar Industries Ltd. Maharashtra Chief Minister Devendra Fadnavis, Chairman of the company Satyanarayan Nuwal, and its Chief Executive Officer and Managing Director of the company were also present on the occasion

RA EDITORIAL DESK

Prime Minister Narendra Modi unveiled the plaque to mark the inauguration of the new runway facility for development and testing of unmanned aerial systems. Located at a distance of about 35 km from the Nagpur city, the newly constructed airstrip and testing range represent a leap forward in India's capabilities for UAV development and munitions testing.

The 1.27 km runway, tailored specifically for UAVs, will support the take-off, landing, and operational testing of unmanned systems, including Medium Altitude Long Endurance (MALE) platforms. The accompanying live munition and warhead testing facility will enable rigorous evaluation of advanced weaponry, such as loitering munitions and other precision-guided munitions.

Spread over 1,080 acres, the test range has a dedicated command and control centre, unmanned aerial vehicle (UAV) take off area, endurance and communication range check facility, parachute recovery area, static and moving target engagement, target hit and CEP measurement, warhead lethality test facility, and many more.

Apart from this, PM Modi also visited the product gallery wherein SDAL showcased its products like Pinaka rocket system, air-bombs, mines, grenade, military explosives, ATGM, *Nagastra* 1 & 2 loiter munitions, and many more.

"I visited the Solar Defence and Aerospace Limited facility in Nagpur and inaugurated the Loitering Munition Test Range. This will significantly boost self-reliance in the defence sector," PM Modi said in a post on X.

Solar Industries India Ltd in January announced that its wholly-owned subsidiary Economic Explosives Limited (EEL) has signed a memorandum of understanding (MoU) with the Maharashtra government to establish a mega defence and aerospace project in Nagpur.

The agreement, formalised during the World Economic Forum in Davos, envisages a project, with an investment of approximately Rs 12,700 crore, and will focus on expanding production capabilities in critical defence products such as drones, unmanned aerial vehicles (UAVs), counter-drone systems, energetic materials, and next-generation explosives.

The Prime Minister also witnessed the state-of-the-art indigenously developed systems viz. Loiter Munition - *Nagastra* 3, *Bhargavastra* - Micro-Missile based Counter Drone System and Bhaumastra - Mine Detection & Disposal System. Many Indian companies have entered into drone related technologies and systems mostly focused on surveillance and logistics applications.

The Solar Group's defence subsidiary has contributed several cutting-edge weapons to the Indian armed forces. In June last year, the Indian Army received from EEL the first batch of Nagastra-1 or 'suicide drones' which can strike enemy training camps and launch pads in border areas with precision and save soldiers' lives.

The Army placed an order of 480 such drones, and at least 120 of them have reportedly been delivered, so far. Nagastra-1 is a type of "loitering munition", where the aerial weapon is designed with an in-built warhead, designed to loiter around an area until a target is located and then crash into it.

These indigenously developed drones offer more selective targeting as the attack can be changed mid-flight or even aborted. In a 'kamikaze mode', the drone can neutralise any threat with a GPS-enabled precision strike with an accuracy of 2 metres.

In February this year, the Ministry of Defence (MoD) signed contracts worth a total of Rs 10,147 crore with the EEL, as well as Munitions India Ltd (MIL), and Bharat Electronics Ltd (BEL) to enhance the Indian Army's firepower with advanced rockets for the Pinaka Multiple Launch Rocket System (MLRS). This is a big step towards a major milestone in the modernisation of India's artillery forces.

Under the contracts, the EEL will supply the Area Denial Munition (ADM) Type-1 (DPICM), and the MIL will provide the High Explosive Pre-Fragmented (HEPF) Mk-1 (Enhanced) rockets.

Many Indian industries and start-ups have entered drone related technologies and systems mostly focused on surveillance and logistics applications. Use of drones and UAVs for combat applications requires critical competency and infrastructure. Keeping in view the futuristic requirements of this emerging technology.

SIDAL has taken the initiative to develop *Nagastra* series of Loiter Munitions with flying ranges from 15 km to more than 100 km and explosive payload carrying capability from 1 kg to 10 kg. *Nagastra* 3 is a Vehicle Launched Loiter Munition System of endurance 3 hours, range 100 km and can carry 8.5 kg warhead. It is being developed under Make 2 project from Arty of Indian Army. In case a target is not detected or if the mission is aborted, the suicide drones can be called back and make a soft landing with a parachute recovery mechanism, enabling them to be reused multiple times.

Bhargavastra is an indigenously designed and developed Counter Drone System meant for quick interception of drones for an assured hard kill using tiny, guided missiles with swarm engagement capability. This solution offers mobile protection against drone attacks with near simultaneous engagement of multiple drones. With a long range of detection (up to 6 km) and long range of neutralization (up to 2.5 km), it ensures safety of vulnerable assets/battlefield formations.

Bhaumastra, a drone-based system under development by SDAL, would be the first of its kind in any developed nation to provide a drone-based solution to the global problem of demining land mines. The mine-detection system, Bhaumastra, has a drone that can detect mines flying at a very low height. Using AI, it can point out land mines, excluding other material buried in the soil. The mines are then blown up from a remote place. This technology indeed is a ground breaking technology to defuse land mines, without losing any human lives.

SDAL has taken an initiative to address the global menace of land mines detection and disposal. As per some estimates there are more than 11 million buried mines world over which remain uncleared and are causing casualties or maiming of both soldiers and civilians in peace time.

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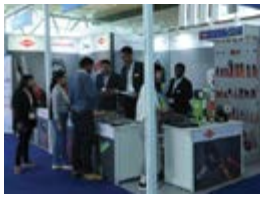
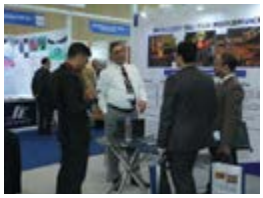






PARTNERS 2025

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TECHNOLOGY

OVERLAND AI TURNS MILITARY VEHICLES INTO ROBOT TRUCKS

The US company's comprehensive system, SPARK, transforms a ground vehicle into a fully autonomous platform and is compatible with most vehicle types. It can function without relying on detailed maps, and ensures that the vehicle travel at speeds suitable for different operations or terrains. Its perception system uses LiDAR and stereo cameras to see through darkness, dust, and storms

RA EDITORIAL DESK

Washington-based company Overland AI has unveiled a comprehensive system named SPARK that transforms a ground vehicle into a fully autonomous platform. This groundbreaking technology can revolutionise military logistics.

This system, once accepted by the armed forces, can revolutionise logistics delivery on battlefields for the US. Moreover, it can also give the military an added 'fire-and-forget' type of advantage in battle zones, which could even be used to deliver an explosive payload to the intended target site.

IMMEDIATE PATH TO AUTONOMY

Overland AI says the system's modular, drive-by-wire design allows for rapid installation with minimal modifications to the host vehicle, preserving manual control capabilities when needed. The autonomous ground platform is designed for rapid deployment across existing US military fleets.

The company says the SPARK system provides an immediate path to autonomy without the extended procurement timelines typically associated with new autonomous systems.

The company's co-founder and CEO Byron Boots said, "By integrating SPARK, the DOD and other government departments can transform their existing fleets into autonomous ground vehicles rapidly. This capability provides tactical advantages in a military theater that is changing minute over minute."

"Autonomous vehicles are force multipliers that allow a single operator to control multiple vehicles, all while out of harm's way," chief operating officer Greg Okopal said. "Our troops deserve access to this technology in a matter of days, not years."

MODULE FITS IN MOST VEHICLES

The company says its proprietary ground vehicle autonomy stack – called OverDrive – is purpose-built for complex, natural, and contested environments. The system can function without relying on detailed maps, and make the vehicle travel at speeds that are fit for operations.

SPARK runs OverDrive

technology on an ultra-compact compute module that fits in most vehicles. Its perception system uses LiDAR and stereo cameras to see through darkness, dust, and storms, while tracking movement via integrated GPS, IMU, and speed encoders.

Additionally, the modern battlefield demands vehicles that can operate in degraded environments where GPS may be denied and communication compromised. SPARK's communications system maintains connectivity via Starlink, tactical mesh, LTE, and WiFi when possible, ensuring mission continuity even in the harshest conditions.

HAZARDOUS MISSIONS NEED RELIABLE TECHNOLOGY

Established in 2022 and headquartered in Seattle, Washington, Overland AI is powering ground operations for modern defence. The company leverages over a decade of advanced research in robotics and machine learning, as well as a field-test forward ethos, to deliver advanced autonomy for unit commanders. Hazardous missions in austere and electronically denied environments demand that this technology is reliable and resilient.

Overland AI's SPARK autonomy upfit and OverDrive stack enable ground vehicles to navigate off-road while its OverWatch C2 provides commanders with precisely coordinated capabilities that are vital for complex missions to succeed. Overland AI is developing these capabilities and putting them into the hands of tactical operators today.

The modern battlefield demands vehicles that can operate in degraded environments where GPS may be denied and communication compromised. SPARK's communications system maintains connectivity via Starlink, tactical mesh, LTE, and WiFi when possible, ensuring mission continuity even in the harshest conditions

NEWS ROUND UP

INDIA IN NEGOTIATIONS FOR ADDITIONAL 10 AIRBUS C-295 MILITARY TRANSPORT AIRCRAFT

India is currently in negotiations to purchase an additional 10 Airbus C-295 military transport aircraft, expanding its original order of 71. This move is part of a broader effort to revamp the country's ageing fleet, particularly the legacy Avro HS-748 aircraft that have been in service since 1961. The discussions are seen as a boost to Airbus' partnership with the TATA Group, following the establishment of a C-295 assembly line in Gujarat last year. In 2021, India signed a $2.52 billion deal for 56 C-295s for the Air Force, and later approved an initial order for 15 more for the navy and coast guard. The additional aircraft are reportedly intended for the Indian Air Force, which has significant transport capability requirements.

The potential expanded order for 25 C-295s could be valued at approximately $1.1 billion, based on the pricing of the initial 56 aircraft purchase. The C-295 is a versatile multi-role transport aircraft capable of carrying up to 70 troops or eight tonnes of cargo, and can perform missions such as airborne warning, surveillance, and reconnaissance. Airbus has noted that the Indian Air Force will soon become the largest operator of the C-295, with all structural components being manufactured locally in India.

The Indian government is also considering further orders for the C-295, with some sources indicating a desire for up to 75 additional aircraft beyond the initial 56. The first 16 C-295s from the original order are being assembled in Spain, while the remainder will be produced at the Airbus-TATA facility in India by 2031. If faster delivery is required, some of the new aircraft might still be sourced from Spain.

This initiative aligns with India's broader strategy to enhance domestic production and self-reliance in defence manufacturing, particularly in response to China's growing military capabilities.

POTENTIAL ACQUISITION OF RUSSIAN MID-AIR REFUELERS TO STRENGTHEN IAF'S CAPABILITIES

The Indian Air Force (IAF) is set to bolster its mid-air refueling capabilities with the potential acquisition of Russian mid-air refuelers, specifically the Il-78M-90A (Il-476). This enhancement is significant given India's long-standing familiarity with Russian defence equipment, which includes a substantial fleet of Russian-origin fighter jets like the Su-30MKI.

The IAF currently operates six IL-78MKI tankers, which have been reliable but are ageing and require modernisation or replacement to maintain operational effectiveness. The need for expanded mid-air refueling capabilities is driven by the IAF's requirement to conduct long-range missions, particularly in strategic regions such as the Arabian Sea, the Malacca Strait, and the Red Sea. The IAF aims to increase its fleet of mid-air refuelers to at least a dozen, with plans to potentially double this number to 18, as part of its broader strategy to enhance the operational range and flexibility of its fighter jets. For example, India's air surveillance aircraft Netra, besides fighter jets like Su-30MKI, Mirage, Rafale, and MiG-29, require air-to-air refueling when deployed at distances beyond 1000 kilometres. That's why mid-air refueling is essential to IAF's dominance of the air space over the Indian Ocean Region (IOR). Russia's offer to provide the Il-78M-90A, along with potential technology transfer and local production, aligns with India's "Aatmanirbhar Bharat" vision, which emphasises self-reliance in defence manufacturing. This could transform India into a manufacturing hub for air-to-air refuelers, similar to its experience with the Su-30MKI, potentially opening up export opportunities.

In addition to Russian options, the IAF is also considering other international contenders, including Airbus's A330 MRTT, Boeing's KC-46 Pegasus, and a partnership between Hindustan Aeronautics Limited (HAL) and Israel Aerospace Industries (IAI) to convert Boeing 737 aircraft into refuelers. The choice will depend on factors such as cost-effectiveness, capability, and the potential for technology transfer.

SOLAR INDUSTRIES SECURES ORDER WORTH ₹239 CRORE FROM MoD

Solar Industries India Limited, through its wholly-owned subsidiary Solar Defence and Aerospace Limited, has secured a significant contract worth Rs 239 crore from the Ministry of Defence. This contract involves the supply of multi-mode hand grenades, which are to be delivered over a period of one year. The deal reinforces Solar Industries' strong position in the defence manufacturing sector, contributing to India's self-reliance in defence production and enhancing national security capabilities. This order highlights Solar Defence capabilities in delivering high-quality defence products and strengthens its partnership with the Ministry of Defence. The company's role in India's defence sector is further solidified by this contract, which is part of its broader strategy to support domestic defence manufacturing.

SCHIEBEL CAMCOPTER® S-100 UAS SELECTED BY EUROPEAN DEFENCE AGENCY FOR CROSS-DOMAIN LOGISTICS PROGRAMME

Under the Hub for European Defence Innovation (HEDI), European Defence Agency (EDA) has established the "Autonomous Systems for Cross-Domain Logistics (Air and Land)" programme and selected Schiebel's CAMCOPTER® S-100 for the heavy-lift Vertical Takeoff and Landing (VTOL) Unmanned Air System category.

The large-scale initiative, hosted by the Italian Army, will focus on collaborative experimentation of UAS and Unmanned Ground Systems (UGS). In June and July 2025, several simulated missions, e.g. last-mile resupply in hostile environments, will be demonstrated. The CAMCOPTER® S-100 was selected for the above 50kg payload category, and will conduct the trials together with two smaller UAS and three UGS.

The role of autonomous systems in today's military is increasingly requiring interoperability, particularly for cross-domain operations and logistical support, significantly enhancing efficiency and effectiveness in challenging environments.

HEDI aims at accelerating and streamlining the integration of emerging technologies into military applications through immersive operational and technical field testing in a collaborative and agile environment.

"This programme, which is the first of its kind by EDA, closely follows three other tenders won by Schiebel in the European Union, including a new contract for the European Maritime Safety Agency, as well as the European Defence Fund's SEACURE and OPTIMAS consortiums. With its unrivalled experience, maturity and proven performance, the S-100 is the logical choice and we're looking forward to showcase our capabilities at the upcoming experimentation," said Hans Georg Schiebel, Chairman of the Schiebel Group.

NAVANTIA CUTS FIRST STEEL FOR THE 2ND CORVETTE FOR SAUDI ARABIA AT THE SAN FERNANDO SHIPYARD

Navantia San Fernando shipyard hosted on March 14, the first steel cutting ceremony for the second corvette for the Royal Saudi Naval Force (RSNF), within the new contract signed at the end of last year, which involves the construction of three more ships to be added to the five previously delivered to the RSNF . The start of construction of this second unit, just three months after the first one, was held at Navantia San Fernando shipyard and was presided over by the Business Managing Director, Alberto Cervantes, along with the RSNF project manager officer in San Fernando, Commodore Eng. Alharbi, Fareed Mohammed.

The last of these three ships is expected to be delivered in 2028. Navantia will be responsible for delivering the first unit, while the second and third will be completed in Saudi Arabia with the installation, integration, and testing of the combat system, as was done in the previous contract.

The order includes the supply of an integrated logistics support package and crew training, along

with an operational evaluation period of the ships by the Spanish Navy at the Rota Naval Base, where Navantia will provide support services. Additionally, Navantia will be responsible for the training of 100 Saudi engineers.

This contract represents about four million hours of work for the Cádiz Bay, generating an impact of up to 2,000 jobs (direct, indirect, and induced employment).

This second series of three corvettes for Saudi Arabia will be identical to the first series, with a design based on the AVANTE 2200 model from NAVANTIA, a versatile ship specially designed for missions of maritime traffic surveillance and control, search and rescue missions, and assistance to other ships, among others.

Additionally, the ships will have significant capabilities for the defense of strategic assets, intelligence, and anti-submarine, anti-air, anti-surface, and electronic warfare capabilities.

The corvette design is state-of-the-art, maximising Navantia's participation, incorporating proprietary products such as the HAZEM combat system, through the SAMINavantia joint venture, the HERMESYS integrated communications system, the DORNA fire control system, the Integrated Platform Control System, the MINERVA integrated bridge, propulsion engines under MTU license, diesel generator sets, and reduction gearboxes under Schelde license. Finally, Navantia Shiprepairs unit will also participate in the program with the work to be carried out during the corvette dockings in San Fernando.

NEWS ROUND UP

FRANCE MAY OPEN A NEW ASSEMBLY LINE INDIA, ANTICIPATING LARGE ORDERS FOR RAFALE

France is considering opening a new assembly line for the Rafale fighter jet in India to manage anticipated large orders from the country. Dassault Aviation, the manufacturer of the Rafale, is assessing this possibility as part of its strategy to increase production capacity. CEO Éric Trappier stated that India is preparing major orders, and establishing a final assembly line there would help absorb the new workload.

The move is driven by India's expected procurement of additional Rafale-M carrier-based fighters and potential follow-up orders from the Indian Air Force. Dassault is currently ramping up its Rafale production rate from two to three aircraft per month, with plans to reach four or even five depending on future orders.

The company delivered 36 Rafales to India under a previous contract and is now exploring further collaborations, including the production of the new Rafale F5 variant. This advanced variant will feature more powerful engines, enhanced survivability, and improved data links, along with the capability to deploy a large unmanned combat aerial vehicle (UCAV).

Establishing an assembly line in India aligns with New Delhi's "Make in India" initiative, which aims to boost domestic manufacturing. It would also provide economic benefits by leveraging India's lower labour costs and potentially circumventing European supply chain bottlenecks.

The setting up of a Rafale assembly line in India offers several key benefits for both Dassault Aviation and India. For India, this partnership promises jobs, technology transfer, and a stronger indigenous defence ecosystem, which is crucial as the Indian Air Force seeks to modernise its fleet.

Contract negotiations are underway for the acquisition of Rafale Marine fighters by the Indian Navy, which could further solidify Dassault's presence in India.

The potential collaboration between Dassault and India marks a significant step in bolstering India's defence capabilities and positioning the country as a major player in global defence manufacturing.

JOHN COCKERILL DEFENSE AND ELECTRO PNEUMATICS & HYDRAULICS ANNOUNCE JOINT VENTURE TO STRENGTHEN INDIA'S DEFENCE CAPABILITIES

John Cockerill Defense, a global leader in advanced defence systems and industrial engineering, and Electro Pneumatics & Hydraulics Pvt Ltd, a renowned Indian defence technology company, have entered into a Joint Venture (JV) Agreement for combining their technological, manufacturing and innovation capabilities to strengthen India's defence ecosystem. This partnership is aligned with the 'Make in India' initiative and enables a greater degree of self-reliance for the country in defence manufacturing. The JV will focus on manufacturing, assembling, and commissioning turrets for the Indian Army's Indian Light Tank (I.L.T) program, a critical initiative aimed at enhancing India's defence capabilities in extreme and challenging terrains. The joint venture will harness John Cockerill's global expertise in advanced weapon systems and Electro Pneumatics & Hydraulics' extensive local knowledge to provide world-class defence solutions tailored to the specific needs of the Indian armed forces. The JV gives a significant boost to India's domestic defence production capabilities and strengthens India's position as a key player in global defence technology development and manufacturing.

This partnership marks a significant milestone in India's journey toward self-reliance in defence technology and manufacturing. With a shared vision for enhancing technological excellence, innovation, and national security, John Cockerill Defense and Electro Pneumatics & Hydraulics Pvt Ltd will work together to develop next-generation defence solutions for the Indian armed forces while also elevating the country's credentials as a global defence manufacturing hub.

ZEN TECHNOLOGIES BAGS THIRD PATENT FOR T-90 TANK SIMULATOR

Zen Technologies, a Hyderabad-based defence company, has been granted its third patent for the T-90 Tank Simulator, specifically for the Containerised Driving Simulator System (T-90-DS). This cutting-edge simulator is designed to enhance the training of Indian Army tank operators by providing an immersive and realistic experience.

The T-90-DS is a portable, high-fidelity training solution that replicates the tank driver's station with full controls and a six-degree-of-freedom (6-DOF) motion platform, accurately simulating the movements of a T-90 tank across diverse terrains.

The simulator integrates artificial intelligence-driven, scenario-based training modules, enabling personnel to prepare for various combat environments such as urban warfare, desert operations, and night manoeuvres.

It also incorporates virtual reality (VR) and augmented reality (AR) technologies to enhance situational awareness and provide real-time battlefield scenarios, supporting crew coordination and multi-unit training.

This latest patent adds to Zen Technologies' previous patents for the Basic Gunnery Simulator (BGS) and Crew Gunnery Simulator (CGS) for the T-90 tank, as well as three patents for T-72 and BMP-II tank simulator variants.

The T-90-DS is designed as a containerised, plug-and-play system, allowing it to be easily transported and set up at military bases, thereby reducing logistical challenges associated with live tank training. The patent, filed on March 24, 2022, is valid until March 24, 2042, and marks Zen Technologies' fourth patent in 2025 and its 14th in the fiscal year 2024-25.

INDIA-US STRATEGIC PARTNERSHIP: MQ-9B PREDATOR DRONES TO BE ASSEMBLED LOCALLY IN INDIA

India is set to significantly enhance its military capabilities by finalising a deal with the United States for the acquisition of 31 MQ-9B Predator drones, valued at approximately $3.9 billion.

This agreement, which is expected to be signed soon, includes the establishment of a local assembly facility for 21 of these drones, marking a pivotal step in India's defence modernisation efforts. The deal has been described as a transformative moment in the strategic partnership between India and the US, particularly in light of growing regional security challenges posed by China and Pakistan.

Vivek Lall, Chief Executive of General Atomics, emphasised that this acquisition will not only bolster India's intelligence, surveillance, and reconnaissance (ISR) capabilities but also contribute to the development of India's domestic defence industry through technology transfer and local assembly.

The MQ-9B drones are designed for high-altitude, long-endurance missions and can perform various roles, including precision strikes and anti-submarine warfare. They will be equipped with advanced weaponry, including Hellfire missiles and precision-guided bombs.

The Indian Navy will receive 15 Sea Guardian variants, while the Army and Air Force will each get eight Sky Guardian drones.

This strategic move aligns with India's broader vision of becoming self-sufficient in defence manufacturing and aims to create job opportunities within the sector. The drones are expected to be operational within two to three years, enhancing India's surveillance capabilities across critical regions such as the Indian Ocean and along its land borders with China.

KALYANI POWERTRAIN PARTNERS WITH TAIWAN'S COMPAL ELECTRONICS TO MANUFACTURE SERVERS IN INDIA

Kalyani Powertrain, a wholly-owned subsidiary of Bharat Forge, entered into a Technology licensing agreement with Compal Electronics, Inc. for manufacturing of X86 platform Servers in India. The two parties have signed a memorandum of understanding (MoU) to develop server business using locally manufactured solution in India, echoing the Indian government's "Make in India" policy. Compal will provide KPTL with technological support related to servers, including overseeing local production, assembly, testing activities, and final sales. Additionally, the electronics division of Kalyani Powertrain announced the launch of Made in India servers from their state of art manufacturing facility at Pune, Maharashtra in February 2025. "The factory is poised to stimulate local businesses, attract and contribute significantly to the region's manufacturing potential," said the company in a filing with the exchanges. This collaboration plays a crucial role in bolstering India's Make in India initiative by fostering local manufacturing and reducing dependency on imports. The collaboration will empower enterprises, cloud providers, hyperscalers, and government organisations with high-performance, cost-efficient server solutions tailored for AI workloads, cloud computing, and large-scale data processing.

EDGE GROUP'S POWERTECH SECURES FIRST P145I ENGINE ORDER FOR ADASI UAVS

EDGE Group entity, POWERTECH, has secured its first order for the P145i combustion engine from ADASI, marking a significant milestone in its strategy to become a globally competitive original equipment manufacturer (OEM) of high-performance propulsion systems for defence and civil aerospace applications.

Under the agreement, POWERTECH will supply ADASI with its advanced six-cylinder fuel-injection engine, designed to enhance the efficiency and performance of unmanned aerial vehicles (UAVs) and light aircraft.

Engineered for superior reliability, fuel efficiency, and seamless integration with advanced aerial platforms, the P145i performs across diverse environmental conditions. Meanwhile, its lightweight design ensures greater operational flexibility, making it ideal for autonomous aerial platforms.

This agreement marks a pivotal step in POWERTECH's long-term vision to establish its position as a global leader in reliable, purpose-built propulsion systems and solutions, designed to address the growing demand for advanced aero engines and support the accelerated advancement across the UAV and aerospace propulsion sectors.

NEWS ROUND UP

EDGE TO CONTINUE EXPANSION OF ITS NAVAL CAPABILITIES THROUGH MULTI-BILLION EURO JOINT VENTURE WITH CMN NAVAL

EDGE, one of the world's leading advanced technology and defence groups, and CMN NAVAL, a world-renowned naval shipbuilding group specialising in the design, engineering, and construction of superior naval and commercial vessels, and mega yachts, have formally agreed to create a new Abu Dhabi-based shipbuilding joint venture (JV) named AD NAVAL (ADN). Leveraging an existing order pipeline worth approximately EUR 7 billion, the JV will bring together both companies under an exclusivity agreement on the segment of high value small to mid-size naval vessels including Corvettes, Offshore Patrol Vehicles (OPVs), High-speed Interceptors, Trimarans, and Landing Craft. The move will see EDGE significantly expand the scope of its capabilities in the naval domain.

EDGE, holding a 51% stake in the new company, will collaborate with CMN NAVAL on sales, commercial activities, and engineering. It will also establish a design bureau which will assume intellectual property rights for all future designs. The JV will grant EDGE access to CMN NAVAL's global supply chain and its advanced Integrated Logistics Support (ILS) system and software, enhancing cost efficiency and operational performance through predictive and preventative maintenance, as well as the provision and management of all spare parts.

The scope of the JV will also explore Combat Systems Integration (CSI) of EDGE's advanced autonomous air and sea, and smart weapons solutions onto vessels built by the new company.

The JV will create valuable direct employment opportunities for skilled personnel in the UAE, as well as related third-party opportunities across its global supply chain.

LIQUID ROBOTICS AND SAGAR DEFENCE ENGINEERING SIGN MOU TO STRENGTHEN MARITIME SECURITY

Liquid Robotics, a Boeing company, has signed a memorandum of understanding (MoU) with Sagar Defence Engineering Pvt. Ltd, a leading Indian unmanned systems startup, to co-develop and co-produce Autonomous Surface Vessels (ASV). The agreement builds on the joint US-India Roadmap for Defence Industrial Cooperation.

This partnership aims to enhance undersea domain awareness through manufacturing, system interoperability, ocean testing, and the establishment of a maintenance, repair, and overhaul (MRO) capacity for the Wave Glider ASV platform. The MoU supports the ASIA aimed at expanding industry partnerships and strengthening production capabilities across the Indo-Pacific region.

"The US-India relationship continues to strengthen, and we see immense potential in deepening our collaboration," said Salil Gupte, president, Boeing India and South Asia. "This partnership with Sagar Defence Engineering underscores our commitment to co-developing and co-producing critical systems in India, fully aligning with the collaborative vision of both the US and Indian governments outlined in the US – India Joint Leaders Statement last month."

"The Wave Glider is a key platform for US-India collaboration, strengthening tactical readiness in the Indo-Pacific. Partnering with Sagar Defence advances bilateral defense cooperation and supports the ASIA initiative to expand industry partnerships and production across the region," said Shane Goodenough, CEO of Liquid Robotics.

"This strategic partnership brings together the best of US and Indian defence capabilities by co-developing advanced technologies like the Wave Glider, strengthening our aim to contribute towards fostering innovation within India's defence ecosystem strengthens. This collaboration reinforces our shared vision of providing solutions for complex maritime challenges to enhance global maritime security." Capt Nikunj Parashar, Founder, Sagar Defence Engineering Pvt. Ltd.

As the first such project by a US company in partnership with an Indian startup, this collaboration marks a milestone in US-India defence industrial cooperation, with undersea domain awareness as a key focus. It reinforces India's potential to be developed as a hub for MRO and sustainment of such platforms, with export potential across the region. Additionally, advancing autonomous underwater capabilities will accelerate ecosystem growth and drive innovation in next-generation defence technologies.

EDGE UNVEILS DISCOVERY-CIM, A NEXT-GENERATION CRITICAL INFRASTRUCTURE MONITORING PLATFORM

EDGE, one of the world's leading advanced technology and defence groups, has launched DISCOVERY-CIM, a next-generation Critical Infrastructure Monitoring (CIM) platform designed to help organisations safeguard and monitor their vital assets. Jointly developed by EDGE entities ORYXLABS, a global provider of advanced digital security solutions that help enterprises monitor, secure and optimise their critical assets and networked environments, and BEACON RED, a leading system integrator specialising in training solutions, advanced technologies, and national security capability development, DISCOVERY-CIM delivers real-time protection, enhanced situational awareness, and predictive analytics for critical infrastructure protection and pipeline monitoring. The platform marks the latest addition to the DISCOVERY product family, expanding ORYXLABS' External Attack Surface Management (EASM) portfolio into critical Operational Technology (OT) environments. It is specifically designed to monitor external pipeline integrity and environmental protection systems in real time. BEACON RED, serving as the end-to-end system integrator, will oversee the platform's seamless integration, deployment, and operational efficiency. Leveraging advanced technologies to prevent environmental risks along pipelines and sensor fusion technology managed by BEACON RED, DISCOVERY-CIM enables users to proactively detect and respond to threats such as leaks, unauthorised access, and environmental hazards. Additionally, the platform integrates state-of-the-art fibre-optic monitoring and security solutions to enhance infrastructure security and operational resilience. With real-time threat detection, intelligent analytics, and cutting-edge monitoring capabilities, DISCOVERY-CIM sets a new benchmark for critical infrastructure monitoring and security.

EDGE GROUP STRENGTHENS PARTNERSHIP WITH CENSIPAM

EDGE, one of the world's leading advanced technology and defence groups, has signed a new agreement with the Management and Operational Centre of the Amazon Protection System (Centro Gestor e Operacional do Sistema de Proteção da Amazônia: CENSIPAM), an agency of the Brazilian Ministry of Defence dedicated to the management and protection of the Legal Amazon and Blue Amazon.

This agreement reaffirms EDGE and CENSIPAM's commitment to continue working together. Last year, during the Mostra BID Exhibition in Brasília, CENSIPAM and SIATT, a Brazilian specialist in smart weapons and advanced defence systems, in which EDGE holds a 50 percent stake, signed a Letter of Intent for the acquisition of an ultra-secure communications system. The customised system, designed by EDGE, integrates EDGE's KATIM X3M ultra-secure smartphone and encrypted gateways 9001R Model devices, SIATT's SATCOM link and command and control software, and radios from the Brazilian Military Material Industry (IMBEL). With this new combined solution, EDGE will offer significant advantages for customers in Brazil and Latin America, providing reliable and highly secure communication in challenging and remote operational environments.

GODREJ ENTERPRISES GROUP COLLABORATES WITH EOS TO ADVANCE 3D PRINTING CAPABILITIES FOR AEROSPACE MANUFACTURING IN INDIA

The Aerospace business of Godrej Enterprises Group, is strengthening its commitment to India's self-reliance vision through signing of a significant memorandum of understanding (MoU) with the EOS, a global leader in industrial 3D printing solutions, to develop a state-of-the-art Additive Manufacturing (AM)-based manufacturing ecosystem focused on the Indian aviation and space industries. This collaboration represents a critical step in India's technological evolution, enabling the transformation of complex manufacturing processes and positioning the country as a global leader in aerospace innovation.

The partnership aims to transform the aviation and space industry in India through AM-driven design and delivery of functionally enhanced products. With EOS possessing the largest AM global install-base in the space technology industry, the collaboration brings together a powerful combination of technological expertise and manufacturing capabilities. Together, Godrej Enterprises Group and EOS will build the technical capabilities and production capacities required to establish a robust AM-based aviation and space supply chain to serve both Indian and global Original Equipment Manufacturers (OEMs).

This partnership is particularly significant given India's remarkable progress in space technology. Since its first launch in 1963, India has achieved ground-breaking milestones, including reaching Mars' orbit on the first attempt, being the first to soft land on the Moon's south-pole, and recently completing its 100th launch. Godrej has been at the forefront of advancing India's aerospace ambitions, executing critical assembly processes for cryo-engine assemblies and satellite thrusters that have powered all of India's space projects.

NEWS ROUND UP

HANWHA AEROSPACE ANNOUNCES INDIA CONTRACT WORTH $253 MILLION FOR ADDITIONAL K9 VAJRA-T SELF-PROPELLED HOWITZER

South Korea's Hanwha Aerospace announced a $253 million contract with India for a second round of 100 K9 Vajra-T self-propelled howitzers.

"This follow-up order reflects the deepening defence partnership between Korea and India," Jae-il Son, CEO and president of Hanwha Aerospace, said in a statement. "We will continue to be a trusted, reliable partner for India's defence capabilities in the years ahead, supporting India's vision for defence manufacturing self-reliance."

The 155mm howitzers will be built in India by Larsen & Toubro, as part of the country's vigorous effort to increase the amount and value of weapons built in India. The contract was signed at the South Korean embassy in New Delhi. An initial order of 100 of the same self-propelled howitzers was placed in 2017. The first K9 Vajra-T order used more than 50 percent local materials and parts, according to Hanwha release. The new contract plans to hit 60 percent.

Defence cooperation between Korea and India "has expanded significantly in recent years, encompassing various domains including land systems, aerospace, and maritime technologies," the Hanwha release said mentioning "air defence systems and advanced military technologies." That's likely a reference to a Hanwha product called Hybrid BiHo, reportedly still under consideration for acquisition by New Delhi.

The release by Hanwha Aerospace stated that it "remains committed to expanding its partnership with India beyond the K9 Vajra program."

In 2018, Prime Minister Modi noted his country's "strong momentum in our cooperation with Republic of Korea" at the Shangri La Dialogue in Singapore. The two countries elevated their cooperation to that of a "Special Strategic Partnership" in 2015 and have reinvigorated it since.

GA-EMS AND RAFAEL TO JOINTLY DEVELOP LONG-RANGE, PRECISION-GUIDED STRIKE MISSILE 'BULLSEYE', MoU SIGNED

General Atomics Electromagnetic Systems (GA-EMS) has signed a memorandum of understanding (MOU) with Israeli company Rafael to jointly develop a long-range, precision-guided strike missile.

The GA-EMS' Bullseye missile will meet US military specifications and will provide multi-platform launch capabilities from air, ground and sea for strike mass at an affordable price point.

Representatives from GA-EMS and Rafael made the announcement at the Navy League of the United States, Sea-Air-Space Conference in National Harbor, MD.

"We are excited to work with Rafael to introduce Bullseye, a highly effective deep-strike missile. Bullseye will be built in the US for delivery to US military customers to support a variety of critical Department of Defence and coalition partners' precision-fires missions," said Scott Forney, president of GA-EMS.

"As a company that has spent decades pushing the boundaries of precision-strike technology, we are proud to partner with GA-EMS on the Bullseye program," said Yuval Miller, executive vice president and head of Rafael's Air & C4ISR Systems Division.

"By combining Rafael's combat-proven innovative 5th Generation missile technologies with GA-EMS's advanced manufacturing, assembly, integration and test expertise, Bullseye will deliver unprecedented accuracy, flexibility and affordability, giving warfighters a state-of-the-art missile system that hits its mark and adapts to evolving mission needs," stated Yuval Miller.

The missile's design is currently at Technology Readiness Level 8 (TRL 8). Rafael has successfully performed aerodynamics, engine, seeker, launch integration and testing. Additional testing is being scheduled for flight qualification and to prove operational readiness with missiles on order and scheduled for delivery starting late 2025 and onwards. The missile will be compliant with applicable US military standards and will be built and integrated at GA-EMS' manufacturing centre-of-excellence in Tupelo, MS.

PARAS DEFENCE SIGNS MoU WITH ISRAELI MICROCON VISION FOR ADVANCED DRONE CAMERA TECHNOLOGY

Paras Defence and Space Technologies, an Indian defence firm, has signed a memorandum of understanding (MoU) with MicroCon Vision, an Israeli company that is part of Controp and the Rafael Group. This collaboration aims to bring advanced drone camera technology to India at significantly reduced costs while enhancing indigenous production capabilities. Under the agreement, Paras Defence will become the exclusive supplier of MicroCon's drone cameras, including Intelligence, Surveillance, and Reconnaissance (ISR) payloads and Electro-Optical/Infrared (EO/IR) seekers, in India. MicroCon will serve as Paras Defence's exclusive supplier for these technologies. The partnership is expected to lower the cost of drone camera models by 50-60%, making them more affordable for defence forces and commercial applications. Imported models typically cost around Rs 20 lakh and Rs 40 lakh per unit.

The collaboration aligns with India's "Make in India" initiative by incorporating indigenous content into these technologies. It will enhance India's self-reliance in defence while improving operational efficiency in both defence and civilian sectors. Advanced features such as AI-powered analytics, high-resolution imaging, and thermal vision are expected to bolster surveillance capabilities. This partnership also reflects the growing demand for drones in India, with the market projected to grow by approximately 17% by 2029 due to increased applications in defence, homeland security, disaster management, and industrial sectors.

MITSUBISHI HEAVY INDUSTRIES CLINCHES DEAL TO DEVELOP NEW LONG-RANGE, PRECISION-GUIDED MISSILES FOR JAPAN SDF

Japan's Mitsubishi Heavy Industries (MHI) has clinched a deal to develop new long-range, precision-guided missiles in a 32 billion yen ($216 million) contract for the Japan Self-Defence Force. The Ministry of Defence indicated in a news release April 1 that the contract is part of plans to boost standoff missile capabilities as the Asian nation faces multiple regional threats.

The contract with MHI to develop new ground-to-ground and ground-to-ship precision-guided missiles will last until 2028. The ministry expects the new missiles to be completed in 2032. The missiles will be used to "prevent and eliminate invading troops," the Ministry of Defence said. The ministry has not released any additional information about the missiles but included in the press release a few diagrams showing its expected capabilities.

The long-range missiles could target vulnerable parts of ships and traverse Japan's mountainous terrains to hit land-based targets with "particularly high accuracy."

Since 2022, Japan has been beefing up its capabilities as part of its "three white papers," the National Security Strategy, the National Defence Strategy, and the Defence Buildup Plan. Japan has allocated approximately 939 billion yen for standoff defence capabilities. The budget includes allocations for Type 12 surface-to-ship missiles (16.8 billion yen, or $112.6 million); submarine-launched guided missiles (3 billion

yen, or $20.1 million); and high-velocity gliding missiles for island defence (29.3 billion yen, or $160.2 million).

The Asian nation also plans to acquire joint strike missiles to be installed on its F-35As and joint air-to-surface stand-off missile for its upgraded F-15 aircraft. Last year, Japan signed a deal to purchase 400 additional Tomahawk missiles from the United States and declared plans to deploy a year earlier than planned some Tomahawks and Type 12 surface-to-ship truck-mounted missiles this year. Earlier this week, the country's defence ministry also announced its latest missile co-production project with the US to develop AIM-120 advanced medium-range air-to-air missiles during US defence secretary Pete Hegseth's visit to Japan. During the visit, Hegseth called Japan "an indispensable partner in deterring Communist Chinese military aggression."

MAHINDRA AUTOMOTIVE TO SUPPLY SCORPIO PIK-UP TO INDIAN ARMED FORCES, SECURES ₹2,700 CRORE CONTRACT

Mahindra Automotive has finalised a significant deal worth Rs 2,700 crore with the Indian Armed Forces to supply 1,986 units of the Scorpio Pik-Up, marking a substantial expansion of Mahindra vehicles in military service. This latest contract increases Mahindra's total contribution to the military fleet to over 4,000 vehicles, including various models such as the Scorpio Classic, Scorpio-N, and Bolero Pik-Up 4WD. The Indian Army will now have more than 7,000 Mahindra Scorpio SUVs in its fleet, demonstrating the military's continued trust in the manufacturer's vehicles for defence operations.

Earlier in the month, it was announced that 2,978 units of Force Gurkha will be inducted into

the Indian Armed Forces fleet.

Mahindra has established a strong relationship with the Indian military over the years, consistently providing vehicles that meet the stringent requirements of armed forces operations. The company operates a specialised subsidiary called Mahindra Defence, which recently delivered the Armado ALSV to the Indian Army, notable for being the first vehicle of its kind designed, developed, and manufactured entirely in India. Prior to this latest contract, the Indian Army had already ordered 1,470 units of the Scorpio Classic under the 4×4 light utility vehicle – general services (LUV-GS) category, intended to replace the ageing Maruti Gypsy vehicles that were phased out when production ended in 2017. This established history reflects Mahindra's capability to deliver vehicles that can withstand the demanding conditions of military use across diverse terrains.

SPOTLIGHT: DEFENCE DRONES

SHAPING THE FUTURE OF WARFARE

With rapid technological advancements, Unmanned Aerial Systems (UAS), or drones, have become indispensable in modern combat. Indian innovators like Garuda Aerospace are making substantial contributions in terms of providing indigenous solutions in drone technology, thus enhancing self-reliance and strengthening national security

AGNISHWAR JAYAPRAKASH

The rise of Unmanned Aerial Systems (UAS), commonly known as drones, is transforming modern defence operations. Initially limited to surveillance, drones have become integral to military strategy, intelligence gathering, and combat. Their ability to operate in diverse environments makes them essential in warfare and security. Several factors drive the rapid adoption of drones in defence. They provide accurate Intelligence, Surveillance, and Reconnaissance (ISR), offering real-time data to improve decision-making. Armed drones enable precise strikes, reducing risks to soldiers. Beyond combat, drones support logistics, border security, infrastructure protection, search and rescue missions, disaster response, and humanitarian aid delivery in conflict zones. Their versatility in both offensive and defensive operations makes them indispensable in modern warfare.

Drones' applications extend beyond combat—supporting logistics, border security, and humanitarian missions. Enhanced by AI and 5G connectivity, drones now enable faster decision-making and seamless integration into defence networks

Technological advancements are enhancing drone capabilities. Artificial Intelligence (AI) enables drones to navigate, identify targets, and analyse data for quick responses. Improved communication technologies, such as 5G, strengthen connectivity and integration with defence networks. Swarm technology, where multiple drones operate collaboratively, is shaping future military strategies. Additionally, drones equipped with electronic warfare capabilities can jam enemy communications and disrupt adversary operations, making them critical in electronic warfare.

Indian companies like Garuda Aerospace are at the forefront of defence drone innovation. They develop drones for surveillance and logistics, providing high-resolution imagery and real-time intelligence essential for border security and military operations. Garuda Aerospace is also working on drone-based delivery systems for remote areas, reducing dependency on traditional transport. Furthermore, Indian defence firms are investing in indigenous drone manufacturing to enhance self-reliance and minimise dependence on foreign technology, aligning with the government's 'Make in India' initiative, which encourages domestic production and technological advancement.

The global defence drone industry is expanding rapidly, with countries investing in local technology to improve security and reduce reliance on foreign suppliers. Governments and defence agencies are partnering with private firms to accelerate drone development and deployment. The use of drone swarms for coordinated attacks, autonomous decision-making in combat scenarios, and the development of stealth drones with reduced radar signatures are emerging trends in the industry. Future advancements may include solar-powered drones for extended flight endurance, hybrid drones capable of land, sea, and air operations, and the integration of quantum computing for enhanced data processing.

The future of defence drones looks promising, with increasing automation, durability, and adaptability. As AI, machine learning, and advanced sensors evolve, drones will play an even more significant role in modern warfare. Companies like Garuda Aerospace are making substantial contributions, strengthening national security, and positioning India as a leader in drone technology. Continued investment in research and development, collaboration between defence and tech firms, and policy support from governments will further accelerate the evolution of drone capabilities, shaping the future of global military operations.

–The writer is Founder and CEO, Garuda Aerospace

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