April - June 2024

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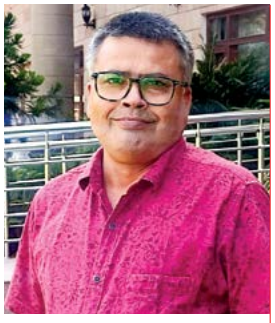


Ajit Kumar Thakur
Editor & Business Director

INDIA'S STRATEGIC SURGE IN EARLY 2024

The first quarter of 2024 was quite fast-paced and engaging for India on multiple fronts. Positioning technology at the core, efforts are on to develop indigenous technology to achieve self-reliance (Aatmanirbharta) in defence and retain meaningful strategic autonomy in a fragmented, polarised, and geopolitically charged world today.

The current global reality is clouded and loaded with an unending string of rhetoric. Closely watching the dynamic flux in geopolitics, India's strategic positioning over the last decade has altered significantly. New confluences in India's changing strategic geography now span regions, from island states and territories in the South Pacific to those along the African coast and in Europe. In the backdrop of the unending wars in Gaza and Ukraine, self-assured Indian foreign policy lexicon has brought 'Vishwamitra' at the centre stage globally, aligned to the nation's rising power stature. Shedding its past defensive stance and expressing itself with more clarity and confidence, India has strengthened its standing on the global arena as a consensus-building and unifying power. Instead of being trapped by mere narratives and rhetoric, India's pragmatic demand for executing the right action plan to come out of the current imbroglio has resonated well with wider acceptance.

> "Shedding its past defensive stance and expressing itself with more clarity and confidence, India has strengthened its standing on the global arena as a consensus-building and unifying power."

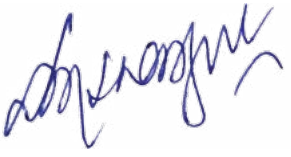
The Indian Army is strategically moving towards modernisation and enhancing defence capabilities. Having declared 2024 as the year of technology absorption, the Indian Army is all set to harness cutting-edge innovations. The restructuring of the Army Design Bureau to establish specialised cells at various command headquarters will streamline the incorporation of niche technology for capability development. Similarly, the Indian Air Force and Indian Navy have initiated multiple structured plans focused on technology absorption. The approval for the design and development of India's fifth-generation fighter jet, Advanced Medium Combat Aircraft (AMCA), was another highlight of the quarter. At the same time, joining the world's top nuclear powers, India mastered the ability to put multiple warheads atop a single intercontinental ballistic missile with the successful test of Multiple Independently Targetable Re-entry Vehicle (MITRV) technology on the indigenously developed Agni-V ICBM.

The government has set a target of over Rs 3 trillion of capital acquisition by 2028-29, offering a significant opportunity for domestic companies with 509 platforms and 4,666 components reserved exclusively for domestic production. The ongoing transformation in the defence industrial complex has set the stage for multiple stakeholders to rally and promote domestic technological innovation. Recognising the importance of research and development (R&D), assembly, scaling, and testing capabilities, the government with key institutional and policy changes is providing funding support as well. Moreover, with domestic demand providing a robust base for growth, the export potential of Indian defence equipment is expected to reach Rs 25,000-30,000 crore by 2026, positioning India among the top 20 defence exporters globally.

Amid the worldwide gloom, India's remarkable growth story has caught global attention and admiration for its economic robustness. According to reports, the resilient Indian growth story should continue in the long term.

While presenting the April-June 2024 edition, special care has been taken to provide our esteemed readers with a balanced and comprehensive coverage of wide-ranging, relevant, and contemporary topics. The key attractions of the edition are in-depth special coverage on India's Unmanned Aircraft Systems – Aatmanirbharta Roadmap 2030 and a special report on India's Maintenance, Repair, and Overhaul (MRO) sector along with regular columns, features, news, and views.

Happy Reading! Jai Hind!



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CONTE

SPECIAL FEATURE

Charting Unmanned Skies

Since the implementation of Unmanned Aircraft System (UAS) Rules in 2021 and subsequent strategic initiatives, India has aimed to position itself as a global drone hub by 2030

ANALYSIS

Expanding Frontiers of War

LEAD STORY

Prospects for Indian Defence Manufacturers in the Evolving Middle East Market

NTS

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RESPONSE

'Raksha Anirveda' editorial team looks forward to receiving comments and views from the readers on the content of the magazine.

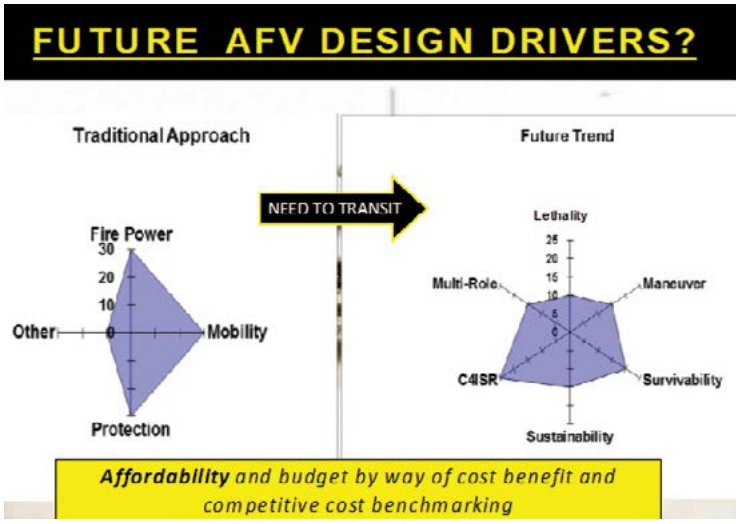
INSIGHT

THE CHANGING ART OF SURVIVABILITY

As the character of war changes and multidomain threats evolve, there is need for a paradigm shift from protection mindset to a systemic perspective of survivability. Embracing integrated and balanced survivability, combat forces can optimise the right blend of technology, training, and tactics to ensure the adaptability and resilience of combat platforms. Survivability in future battlespace is the key as "There Is No Invulnerability, Only Preparedness!"

By **LT GEN ASHOK BHIM SHIVANE**

Twenty-first century wars have seen a dramatic shift in their character. The reasons for conflict, the rules, the players, and the tools are constantly evolving. This makes warfare more complicated and contested. The multi-domain kinetic and non-kinetic threats along with the proliferation of unmanned systems pose a new challenge. The need is to make future forces more survivable and operational under such a canvas of multi-domain threats. It calls for thinking beyond protection to an all-encompassing concept of integrated balanced survivability.



As we view combat system design parameters, it is imperative to shift from the legacy Iron Triangle of Firepower, Protection and Mobility to a more relevant and holistic model of Lethality, Survivability, Manoeuvrability, Sustainability, Connectivity, Multi-role Adaptability and Affordability based on the commonality of base platform and technology convergence. Their balanced integration would lead to a more survivable and operationally viable combat system.

The Nagorno-Karabakh, Russia-Ukraine and Israel-Hamas conflict have certainly brought forth the larger canvas of survivability and the need to redefine its multiple yet integrated facets for its potency. The human elements of training, leadership, and tactics, adaptable to specific operational conditions and terrain add to the survivability canvas.

CURRENT APPROACH TO PROTECTION

The current approach to protection revolves around passive, reactive and active armour solutions. These are certainly inadequate to meet today's battlespace challenges.

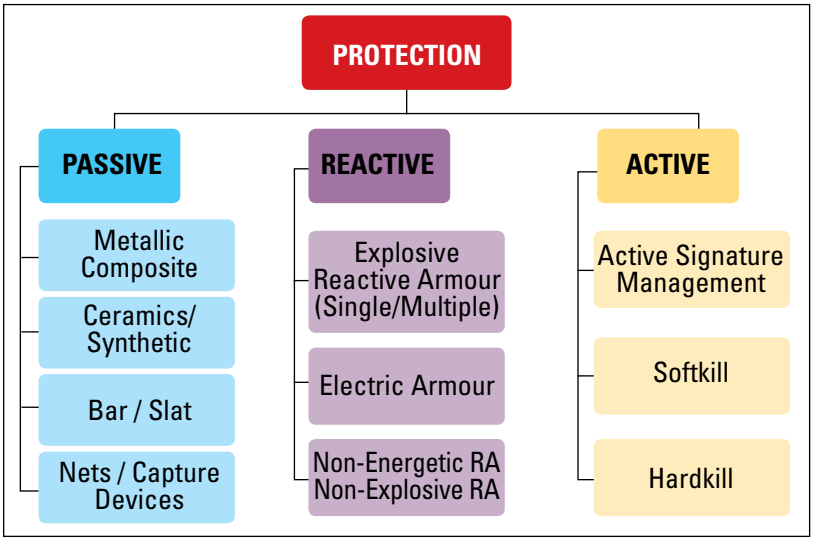
The threats faced by military forces have evolved into a complex and multifaceted challenge in a multidomain battlespace. Adversaries now employ a diverse array of weapons and tactics, ranging from conventional

The threats faced by military forces have evolved into a complex and multifaceted challenge in a multidomain battlespace. Adversaries now employ a diverse array of weapons and tactics, ranging from conventional warfare strategies to asymmetric approaches and even inciting public disorder

warfare strategies to asymmetric approaches and even inciting public disorder. The kinetic and non-kinetic threats have fused seamlessly across all domains. Urban combat operations and long-range precision warfare have added to the vulnerability of combat platforms.

Moreover, existing protection is primarily directional, leaving combat vehicles vulnerable to attacks from the bottom, rear, and top. Compounding these issues is the threat of multidirectional, multiple-domain simultaneous attacks on a single combat system, exploiting vulnerabilities of the conventional protection outlook. Furthermore, as adversaries move beyond manned platforms and traditional explosives-based attacks, there is a pressing need for survivability strategies to evolve accordingly to tackle non-kinetic threats. The proliferation of drones and unmanned combat vehicles has also added a new dimension to the top attack threats and survivability of combat vehicles. This necessitates an agile and adaptable survivability focus with technology-aided solutions to proactively counter future threats.

In the face of such challenges, military strategists will need to develop a new paradigm outlook to warfare from the legacy notion of protection to integrated survivability, to confront escalatory multidomain threats. This mandates an inclusive approach integrating disruptive technologies, innovative tactics, quality leadership, and advanced training to ensure adaptability and survivability in the future battlespace.



INSIGHT

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SURVIVABILITY AND COUNTERMEASURES

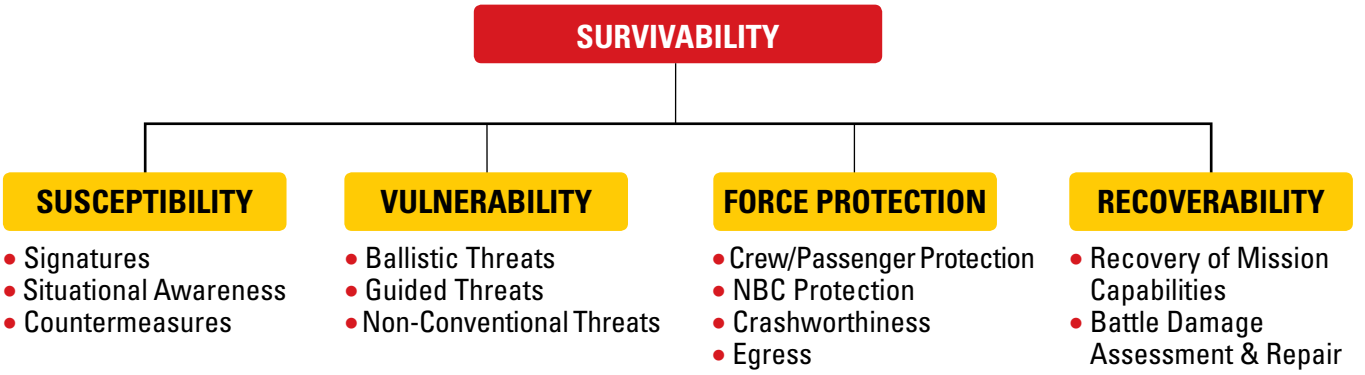
The concept of survivability and countermeasures (S&C) entails a comprehensive approach that integrates various elements, including vehicle silhouette profile, stealth technology, crew configuration, active protection systems (APS), and lightweight, configurable armour arrays. Further and most importantly, the non-tangible aspects of training, tactics, and leadership. Tanks are as good as the tankman and the tankman is as good as the operational doctrine, technology enablement and tactical skills. By employing a multi-layered kit, AFVs can enhance survivability while maintaining affordability and adaptability to evolving threats.

The survivability of a vehicle is not the sum of the various protection systems available, but more the smart integration of all those components to use the quintessence of their characteristics. While the layered protection concept remains valid in terms of sequence, survivability brings in other elements that are not necessarily linked to the vehicle, such as networked situational awareness, leadership, tactics, and training impacting survivability.

INTEGRATED SURVIVABILITY CONCEPT

Survivability of a combat system is generally assessed under three district aspects: susceptibility (detectable and being targeted), vulnerability (type of casualty if hit – mobility or destroyed), force protection (strategies or features aimed at safeguarding occupants), and recoverability. These are illustrated facing page:-

The concept of integrated survivability of combat systems is more holistic and comprehensive. It entails the right blend of technology, training, and tactics to ensure the survivability and resilience of combat platforms against myriad threats. From integrated networks, advanced sensors and adaptive armour solutions to futuristic autonomous mechanisms, advanced combat platforms are designed to detect, pre-empt, counter, and defeat a variety of threats both in the kinetic and non-kinetic domain. Thus, they are hard to see, hard to hit and hard to kill. Further by integrating proactive offensive capabilities with resilient defensive capabilities, integrated survivability enhances operational success in a contested and complex battlespace. Thus, integrated survivability is a holistic approach to warfare, where technology, training, leadership, tactics, adaptability, and resilience are integrated to attain combat superiority.



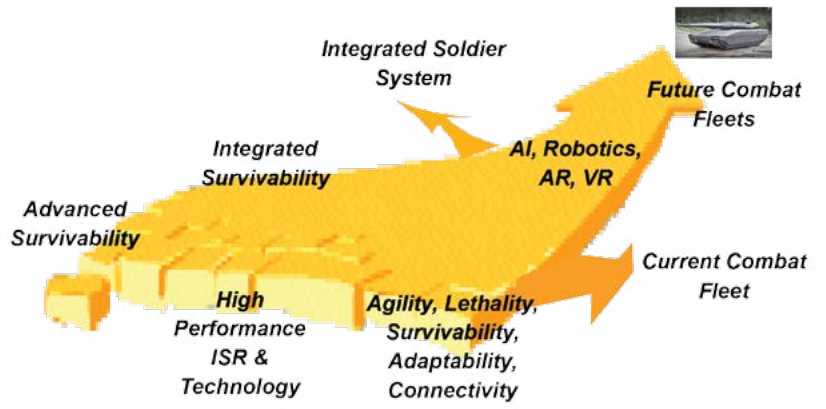
BALANCED SURVIVABILITY FOR FUTURE

Balanced survivability entails seamless integration of ISR superiority, stealth technology, threat avoidance, hit avoidance, penetration evasion and redundancy for cumulative combat superiority. While the traditional concept of "survivability bulbs" provides a structured sequence of actions from the attacker's perspective – from observation to destruction – the broader framework of intelligence, surveillance, and tactics add to enhance overall resilience and effectiveness. Thus, balanced survivability acknowledges the interconnectedness of diverse elements and emphasises the strategic fusion of factors such as situational awareness, strategic planning, and adaptability, all of which contribute significantly to a combat system's ability to withstand and overcome threats in dynamic and challenging environments.

FUTURE SURVIVABILITY ROADMAP

Future survivability focus must seamlessly integrate advanced technologies such as artificial intelligence, machine cognition, robotics, cyber resilience, and network-centric operations capabilities. It would also entail a healthy mix of manned and unmanned systems.

The networked approach to combine armed forces with interoperability between different platforms and units will enhance their resilience, agility, and adaptability contributing to mission accomplishment. will enhance their resilience, agility, and adaptability contributing to mission accomplishment. This integrated approach with all facets fused can ensure combat overmatch while mitigating risks and maximising success.



SUMMING UP

Twenty-first century battlespace and the complexity of threats therein demand a transformative shift in the concept of combat survivability. The need is to transition from myopic system-oriented, passive protection to a holistic process-driven, proactive, pre-emptive, and integrated survivability capability. The future roadmap for survivability must fuse both offensive and defensive capabilities seamlessly integrated and interoperable across all combat systems. Integrated survivability also has an important human element of leadership, decision superiority based on information dominance, doctrines and adaptable tactics, combined arms, and manoeuvre warfare doctrines, besides leveraging advanced technologies. This approach to integrated and balanced survivability will result in force agility, resilience, and mission accomplishment in future battlespace.

Integrated survivability is a holistic approach to warfare, where technology, training, leadership, tactics, adaptability, and resilience are integrated to attain combat superiority

–The author, a PVSM, AVSM, VSM has had an illustrious career spanning nearly four decades with the Indian Army. A distinguished Armoured Corps officer, he has served in various prestigious staff and command appointments including Commander Independent Armoured Brigade, ADG PP, GOC Armoured Division and GOC Strike 1. As DG Mechanised Forces, he was the architect to initiate process for reintroduction of Light Tank and Chairman on the study on C5ISR for the Indian Army. Subsequently he was Consultant MoD/OFB from 2018 to 2020. He is a reputed defence analyst, a motivational speaker and prolific writer on matters of military, defence technology and national security.The views expressed are of the writer and do not necessarily reflect the views of ***Raksha Anirveda***

ANALYSIS

EXPANDING FRONTIERS

Hybrid warfare challenges traditional notions of warfare, blurring the lines between state and non-state actors, and ushering in a new era of strategic complexity. In the Red Sea region, tensions between state and non-state actors have escalated, highlighting the intricate interplay of geopolitical interests and regional dynamics

By **NIRANJAN MARJANI**

The concept of warfare is continuously evolving and becoming broader and more complex, encompassing various elements beyond the traditional state-versus-state conflicts. War is no longer solely defined as conventional warfare between states; it now also includes conflicts between state actors, non-state actors, and criminal or proxy groups, termed as unconventional warfare.

Hybrid warfare is a military concept that has gained traction since the end of the Cold War among strategists, policymakers, and observers in the defence and security domain worldwide. Hybrid warfare could be defined as a combination of conventional and non-conventional warfare, where the involved entities employ cyber warfare, disinformation campaigns, and economic pressures in addition to military operations.

The Israel-Hamas war that began on October 7, 2023, is increasingly spilling over into a wider geographic expanse. This conflict has spread to the Indian Ocean Region and has taken on the form of a global conflict as several regional and extra-regional powers are now involved.

OF WAR

In addition to the conventional military conflict, elements of hybrid warfare are also becoming a part of this conflict.

THE HYBRID NATURE OF THE CONFLICT IN THE RED SEA

The conflict in the Middle East, of which the conflict in the Red Sea is a subset, has several elements of hybrid warfare. Firstly, the war between Israel and Hamas is a war between a state and a non-state actor. Hamas governs Gaza, which is not a recognised state. Additionally, Hamas is designated as a terrorist organisation by the United States and the European Union.

Secondly, alongside the involvement of Hamas, Lebanon-based Hezbollah is also engaged in conflict with Israel. The Yemen-based Houthis, in a show of support for Hamas, have targeted commercial ships passing through the Red Sea, particularly those transiting to or from Israel. All three of these organisations are supported by Iran. Through these organisations, Iran is engaged in a proxy war with its adversaries like Israel and the Gulf States in different parts of the Middle East, including Syria, Lebanon, and Yemen.

Third, at the operational level, the tactics employed by the Houthis are also part of hybrid warfare. Attacks on merchant ships through drones have been a prominent feature of the Houthis' military strategy. Further, in the first week of March, several subsea internet cables were found damaged in the Red Sea. These attacks have only added to the complexities of the ongoing Israel-Hamas war.

Fourth, in addition to the attacks, the disinformation component of the hybrid war has gained prominence due to the attacks on the subsea internet cables. It was not immediately clear who had caused damage to these cables. Conflicting reports about this incident also obscure obtaining exact information about who could have caused this damage.

The Yemeni government indicated that the Houthis may have attacked these internet cables. Israel has also concurred with the Yemeni government and has blamed the Houthis. For their part, the Houthis have denied any responsibility in this incident. Meanwhile, a German internet firm, DE-CIX, has hinted that the damage to the cables was caused by an anchor from a ship that was attacked by the Houthis.

As mentioned previously, the theatre of this war is constantly expanding and has implications for India as well.

IMPLICATIONS FOR INDIA

Before discussing the implications of the conflict in the Red Sea for India, it is pertinent to establish how India fits into the matrix of this conflict. While India is not a direct party involved in either the Israel-Hamas war or the conflict in the Red Sea, the spillover effects of this conflict stand to affect India. The absence of direct involvement implies that the conflicts in the Middle East are not directed against India, nor is India targeting any country or group as a part of this conflict. However, since hybrid warfare blurs the boundaries of conventional war, India, as a stakeholder in the Middle East, is vulnerable to these conflicts.

For its part, India has taken a multi-pronged approach since the start of this conflict to address the challenges arising from it. At the diplomatic level, while condemning the terror attack by Hamas and supporting Israel, India has also sent humanitarian aid to Gaza.

India is also involved in the development of the India-Middle East-Europe Economic Corridor (IMEC) along with Gulf States like the UAE and Saudi Arabia. However, the Israel-Hamas war has delayed the development of this route

ANALYSIS

The Israel-Hamas war has destabilised the Middle East, thereby putting temporary brakes on, if not totally derailing, the peace efforts between the Arab States and Israel for the past few years. However, hybrid warfare, which also includes grey zone warfare carried out during the ambiguous time period between war and peace, is likely to continue

At the strategic level, the Indian Navy has been involved in protecting commercial vessels passing through the Red Sea. Since November 2023, several commercial ships have been subjected to attacks by the Houthis. The attacks have included direct confrontations, hijackings of ships, and attacks through drones. By engaging with the attackers and thwarting the attacks, India has positioned itself as a net security provider in the Western Indian Ocean.

Regarding the implications, India faces two principal perspectives:

First, this conflict has compelled India to reroute its trade with Europe. The Suez Canal route serves as the primary transit route for India's trade with Europe. With the conflict in the Red Sea, India, along with several other countries, is forced to take a longer route through the Cape of Good Hope. This not only extends the delivery time by 15-20 days but also increases transit costs due to increased freight rates and insurance premiums. India is also involved in the development of the India-Middle East-Europe Economic Corridor (IMEC) along with Gulf States like the UAE and Saudi Arabia. However, the Israel-Hamas war has delayed the development of this route. For India, which concluded a free trade agreement with the UAE in 2022 and is in talks with the Gulf Cooperation Council and the European Union for similar agreements, the current conflict in the Red Sea could further delay the materialisation of these economic engagements.

Second, the damage to the subsea internet cables, part of the cyber warfare, could have multi-dimensional impacts on India. These cables are conduits for data transmission and global communication, including internet traffic, telephone calls, and data exchanges. India is among the major hubs for subsea cables worldwide, with Mumbai having about 20 cables and Chennai having nine. As a hub, India connects various regions like the Middle East, Southeast Asia, East Asia, and Europe through these subsea cables. As one of the largest and fastest-growing economies in the world, India depends on high-speed connectivity for its economic activity and digital services. With digital public infrastructure becoming a backbone of the Indian economy, it is imperative for India to be nimble-footed to counter these threats.

This war has destabilised the Middle East, thereby putting temporary brakes on, if not totally derailing, the peace efforts between the Arab States and Israel for the past few years. The immediate trigger may be the Israel-Hamas war. However, hybrid warfare, which also includes grey zone warfare carried out during the ambiguous time period between war and peace, is likely to continue. Overall, global wars are increasingly becoming complicated, making it difficult to distinguish them as conventional or unconventional. The geopolitics of the Middle East is also defined by states involved in unconventional conflicts with their adversaries through employing proxy groups or non-state actors.

For India, which is not directly pitched against any of the conflicting sides in the Middle East, diplomacy remains a primary mechanism to secure its interests. Simultaneously, India also needs to strengthen its own capabilities to counter the direct or indirect impact of hybrid warfare, particularly in the cyber domain, as it remains a crucial component across economic and strategic domains. Only through continuous upgrades in its hybrid warfare capabilities can India meet the challenges posed by the emerging complex theatres of war.

--The writer is an Independent Political Analyst and Researcher based in Vadodara. Follow him on Twitter: @NiranjanMarjani. The views expressed are of the writer and do not necessarily reflect the views of ***Raksha Anirveda***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ANALYSIS

THE INDIC: HELLENISTIC TANGO

The visit of the Greek Prime Minister to India formalised the cementing of ties that date back a millennium; it, however, is just the tip of the iceberg

By **PRANAY K. SHOME**

Prime Minister Narendra Modi with Greek Premier Kyriakos Mitsotakis

With the fifth largest economy in the world, India's diplomatic and political clout has been increasing on an exponential scale. However, in keeping with longstanding traditions, India, that is, Bharat has been keeping her feet on the ground and down to earth. In light of such assertion, it becomes necessary to understand the trajectory of the India-Greece story.

Greece, the cradle of Western civilisation and the birthplace of Western democracy, is the bastion of intellectual thought. It has gifted the world the likes of Plato, Aristotle, and Socrates. It has institutionalised the principles of liberty, equality and human dignity. For more than a millennia, Greece has been the torchbearer of Western civilisation.

On the other hand, we find Bharat, which is the world's oldest living civilisation. Infused with a bewildering array of cultures, languages, religions and opinionated populace, she is the birthplace of global democracy. With the largest population in the world, Bharat is the world's largest democracy and is a civilisation-state.

India-Greece ties date back more than a millennium, starting with the Greek invasion of Bactria (Northern Afghanistan) in 206 BC. Popularly known as Indo-Greeks, their rule laid the groundwork for an enduring exchange of people-to-people ties. India and Greece have a lot in common - shared democratic values, strong belief in freedom of speech and expression, protection of human rights and a strong need to protect the internal and external sovereignty of their respective countries and emphasis on strategic autonomy.

In light of that, the incumbent Greek Premier Kyriakos Mitsotakis visited New Delhi in February 2024. The visit proved to be consequential for both the countries.

PARTNERSHIP SOLIDIFIED

The partnership was elevated to the level of strategic partnership during the Greek Prime Minister's visit, even as the visiting head of the state participated in the flagship conclave of the Indian Government-Raisina Dialogue organised jointly by the Ministry of External Affairs and Observer Research Foundation.

Agreements on mobility, migration and defence cooperation were signed. A key outcome of the visit was the invitation of

India to Greece to join the Indo-Pacific Oceans Initiative as a part of a larger grand plan to counter the assertive claims of China in the strategic Indian Ocean region in general & Indo-Pacific region in particular.

Bharat has a select group of relationships with countries and groupings that have been elevated to the level of strategic partnerships. This signals how much importance Bharat attaches to the Hellenistic republic, a testament to the changing sands of global geopolitics and times.

TURKEY - THE ELEPHANT IN THE ROOM

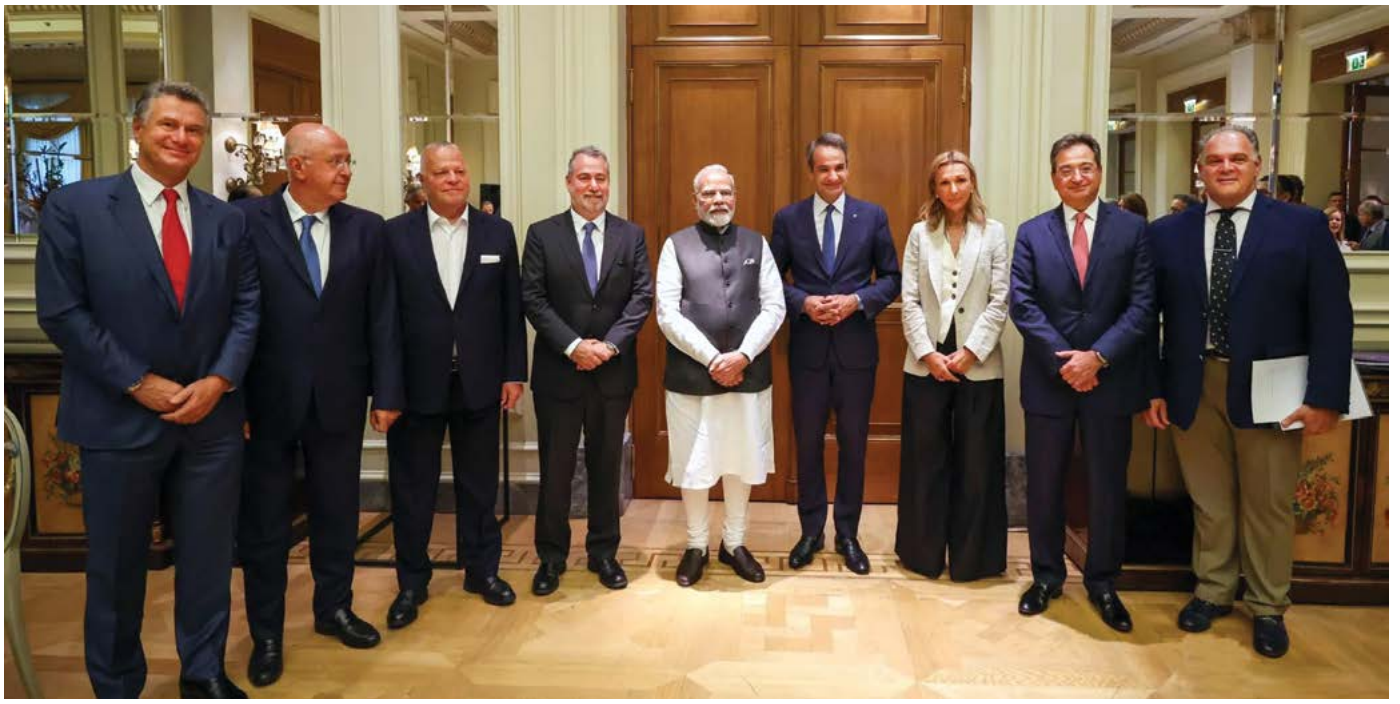
Nothing in international politics happens by chance, every circumstance and situation where nation-states act is carefully crafted to suit their interests. India's intention behind improving ties with Greece is not without India's national interests. This pertains to dealing with the elephant in the room - Turkey.

Turkey and Bharat have had a frosty relationship ever since the inauguration of the second tenure of Prime Minister Narendra Modi. Turkey has not only been virulently anti-India but has supported Bharat's arch nemesis Pakistan on various issues, particularly on Kashmir. To make matters worse, Turkey expressed concern & condemned India's move to abolish Article 370 and downgrade the status of Jammu & Kashmir from a state to a union territory. Further, Turkey has been actively sponsoring Islamist elements in Bharat to balkanise India.

India and Greece have a lot in common - shared democratic values, strong belief in freedom of speech and expression, protection of human rights and a strong need to protect the internal and external sovereignty of their respective countries and emphasis on strategic autonomy

Turkey's religiously driven devious

ANALYSIS



Prime Minister Modi in attendance at the business lunch hosted by Greek Prime Minister Kyriakos Mitsotakis in Athens

India's decision to forge a stronger relationship with Greece is aimed at countering the China-Pakistan-Turkey axis which threatens to trigger a two-and-a-half front war against Bharat with the aid of the Taliban rulers in Afghanistan

geopolitical agenda is not limited to India, Greece is also bearing the brunt of the Erdogan regime's diabolical plans. Turkey and Greece have a history of confrontational relationships. Greece was formerly a vassal state of the Ottoman Empire, it was only from the early 19th century onwards that Turkey began unravelling, leading them to be dubbed the "Sick Man of Europe".

In the recent past, Greece and Turkey have seen the souring of ties, especially with the Greek War of Independence in the years 1919-1922 which still evokes painful memories of the egregious atrocities committed by the Ottoman forces.

In addition, the discovery of massive oil and gas reserves in the Mediterranean Sea led to the locking of horns among Cyprus, Greece and Turkey over competing claims. As usual, Turkey claimed the entire region as its own, just like China did in the case of the South China Sea region.

Just like it, Turkey and Greece have competing claims in the Aegean Sea which sometimes have threatened to spiral out of control.

India's decision to forge a stronger relationship with Greece is aimed at countering the China-Pakistan-Turkey axis which threatens to trigger a two-and-a-half front war against Bharat with the aid of the Taliban rulers in Afghanistan.

Turkey's routine interference in the internal affairs of India is part of a broader pattern. The pattern is aimed destabilising the internal polity of countries that do not share the same worldview with it.

India's decision to participate with Greece in different multilateral military exercises is part of a broader plan to militarily back Greece should the need ever arise to stare the Turkish regime in the face.

With Bharat slowly but steadily increasing its weight in global economics and geopolitics, the India-Greece partnership will serve as a beacon of hope for countries looking for reliable partners to counter the hegemony, imperialism and new-age colonialism backed by a missionary worldview.

– 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 the views of ***Raksha Anirveda***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ANALYSIS

FROM SYMBOLISM TO SUBSTANCE

President Macron's India visit during the Republic Day celebrations underscored a broader narrative of collaboration between the two nations. Their relationship encompasses diverse domains such as defence, economics, cultural exchanges, and shared geopolitical objectives in the Indo-Pacific region

By **NATALIA FREYTON**

On Friday, January 26, President Emmanuel Macron was the honoured guest of Prime Minister Narendra Modi at India's prestigious annual military parade, marking Indian Republic Day. The state visit emphasised the strengthening of bilateral relations between the two nations, offering an opportunity to reaffirm longstanding and valuable mutual commitments.

The visit of the French President serves to underscore the deepening strategic ties between the two nations, a relationship further strengthened by Prime Minister Narendra Modi's participation in last year's Bastille Day celebrations. For both countries, this partnership represents a tangible manifestation of their shared vision of multipolar international relations and their commitment to national independence. France sees India as playing a crucial role in expanding its influence in the Asia-Pacific region, where India is hoped to serve as an economic and military counterbalance to China. Additionally, for India, joint projects represent not only a means of rebalancing vis-à-vis Chinese expansion but also a practical application of the Make in India strategy.

THE ORIGINS OF AN ENDURING RELATIONSHIP

The modern India- France relationship traces its roots back to the period following India's independence in 1947, characterised by robust military cooperation that initially began in the defence procurement sector. Over the years, this partnership has remained steadfast, witnessing fluctuations in intensity. From the acquisition of 71 Ouragan fighters in 1953 to the diverse Mirage models during the 1980s and 1990s, particularly in the realm of airborne capabilities, the collaboration continues to stand as a testament to time-tested ties.

President Emmanuel Macron shaking hands with Prime Minister Narendra Modi

NOTABLE DIPLOMATIC ENGAGEMENTS

In 1976, Jacques Chirac, serving as Prime Minister of France, made a notable impact by embarking on his inaugural visit to India during the Indira Gandhi era. This historic visit occurred during a period when India was often overlooked by much of the Anglo-Saxon world. This marked the beginning of a strategic partnership between France and India, now commemorating its 26th anniversary, which commenced on January 26, 1998, during French President Jacques Chirac's visit to India as the chief guest for the Republic Day celebrations (Jacques Chirac served as Prime Minister of France from 1974 to 1976 and again from 1986 to 1988. He then served as President from 1995 to 2007).

A ROBUST AND MULTI-DOMAIN PARTNERSHIP

The India- France strategic partnership boasts deep roots spanning several decades, characterised by extensive collaboration across diverse domains, including defence, economics, and culture. India perceives France as a strong and strategic ally in its foreign relations. Similarly, France regards India as an important partner in the Asian region, sharing fundamental values such as democracy, human rights, and a commitment to multilateral cooperation. The India-France alliance is considered a cornerstone of France's broader foreign policy objectives in Asia.

SHARED VALUES AND GEOPOLITICS

As two of the world's oldest and largest democracies, France and India share several structural similarities that strengthen their bilateral relationship. These include robust democratic institutions, a diverse multi-party system, and the fundamental principle of universal suffrage.

They also share a vision for a multipolar world order based on principles of equality, justice, and mutual respect. Consequently, France has reaffirmed its strong endorsement for India's candidacy for permanent membership on the Security Council.

France's divergence from the United States' decision to invade Iraq in 2003, underscores its commitment to an autonomous foreign policy agenda. Additionally, French President Emmanuel Macron has openly criticised NATO, highlighting the importance of strategic autonomy for Europe and advocating for greater European defence cooperation

ANALYSIS

As a key member of the Western alliance, France demonstrates a nuanced stance in international politics, maintaining a distinct departure from the stringent influence of the United States.

This approach is exemplified by France's adherence to Gaullist principles, which prioritise national sovereignty and independence in foreign affairs. For instance, France's divergence from the United States' decision to invade Iraq in 2003, underscores its commitment to an autonomous foreign policy agenda. Additionally, French President Emmanuel Macron has openly criticised NATO, highlighting the importance of strategic autonomy for Europe and advocating for greater European defence cooperation. These instances exemplify France's assertive stance within the Western camp, characterised by a willingness to assert its own interests and principles while collaborating with its allies.

India's diplomacy also recognises national sovereignty and independence as two key principles of its existence. This position encompasses its historical role in the non-aligned movement and its dynamic relations with global powers such as Russia and the United States. Despite its membership in the Commonwealth, India maintains a deliberate distance, fostering closer ties with France as a result. This strategic shift underscores India's evolving foreign policy objectives, reflecting a nuanced approach to engagement with the international community. By cultivating stronger partnerships with nations like France, India seeks to assert its independent voice on the global stage while navigating complex geopolitical dynamics with dexterity and foresight.

India's concern over China's expanding influence in the Indian Ocean is magnified by the implementation of China's Go strategy, which involves establishing multiple support bases to monitor and potentially manipulate major maritime communication routes. In response, France's Indo-Pacific strategy, outlined by President Emmanuel Macron in May 2018, positions India as a crucial ally in countering Chinese expansion. Furthermore, the shared challenges of stability along the Indian Ocean shores, coupled with the presence of significant Indian diasporas, have prompted collaborative efforts between India and France, including joint maritime missions and a mutual interest in strategic areas like the Mozambique Channel, aimed at addressing security concerns heightened by transit vulnerabilities in the Red Sea.

GROWING COLLABORATION

In mutually beneficial collaboration, France and India maintain a multifaceted relationship in various sectors, from agriculture and infrastructure to global decarbonisation, nuclear energy, and cybersecurity. Just last year, they announced a new cooperation program focused on small modular reactors (SMRs) and large modular reactors (LMRs) in nuclear energy. A joint statement following talks at the Élysée Palace on July 14 emphasised the importance of increasing the share of clean energy sources to achieve the Paris Agreement objectives.

However, the real area of increased collaboration in recent times is defence. Talks between Macron

Dassault Rafale aircraft engine

Airbus H125 helicopter

and Modi at the beginning of the year resulted in the confirmation of a defence industrial roadmap, aiming to support joint development and production of military equipment and systems. This initiative underscores their commitment to enhancing collaboration in key areas such as defence, innovation, and sustainable development.

In terms of defence, several industrial initiatives are already underway, most of which represent major advances in the Make it India initiative, giving substance to the key strategic projects of the current Indian government. A maintenance, repair, and overhaul workshop for Leading Edge Aviation Propulsion (LEAP) and Rafale engines in India, established by the French company Safran, is currently in progress. Indian Foreign Minister Vinay Kwatra announced that the Indian conglomerate Tata Group and France's Airbus signed an agreement to jointly manufacture civil helicopters. Furthermore, Airbus and the Tata Group have entered into an agreement to assemble H125 Ecureuil helicopters in India by 2026.

But the most emblematic project remains the construction of the Scorpene submarines by the Mazagon Dock Ltd Shipyard in Mumbai. While the INS Vagsheer, the 6th in a series, will shortly enter service, the prospect of three other examples equipped with Indian Air independent propulsion technology is still on the cards. The extreme technical complexity of this kind of programme seems to illustrate the spirit of this cooperation, according to Macron, who underlined how there would be "no limits" to sharing technology with India.

PERSPECTIVES ON THE CHALLENGE OF MULTIPOLARITY

In examining the challenge of multipolarity, it's evident that this strategic partnership is advancing, with numerous projects proposed, though not all implemented, with a focus on mutual benefit. Despite the inherent risks at this ambitious level, the ties are likely to strengthen in the future, making them harder to question. Both parties stand to gain significantly from their collaborative actions on the global stage.

However, the realisation of this positive vision depends on maintaining a consensus, particularly on the concept of multipolarity. Key unpredictable elements include the future stance of the US, which may adopt a less interventionist approach under different leadership scenarios, such as a potential victory for Trump. Macron's aspiration to lead the Western world in the absence of strong US leadership poses another consideration, potentially conflicting with France's traditional role as a balancing power. Additionally, the ability of BRICS nations to propose a genuine alternative multipolar world without confrontation with the Western camp is crucial. India's role as a bridge between North and South remains essential in navigating these complexities.

–The writer is a defence and security industry consultant having varied experience working with medium and large companies majorly in European market. The views expressed are of the writer and do not necessarily reflect the views of ***Raksha Anirveda***

France's Indo-Pacific strategy, outlined by President Emmanuel Macron in May 2018, positions India as a crucial ally in countering Chinese expansion. Furthermore, the shared challenges of stability along the Indian Ocean shores, coupled with the presence of significant Indian diasporas, have prompted collaborative efforts between India and France

EMERGING TECHNOLOGIES TO BOLSTER INDIA-S KOREA TIES

Last week, India's External Affairs Minister S Jaishankar travelled to South Korea and Japan in a move aimed at further strengthening ties with the two East Asian nations. In South Korea, the EAM focussed on enhancing the bilateral partnership in new areas including emerging technologies, semiconductors and green hydrogen

By **ASAD MIRZA**

The External Affairs Minister S Jaishankar travelled to South Korea from March 5-6 where he co-chaired the 10th India-Republic of Korea Joint Commission Meeting (JCM) with his counterpart Cho Tae-yul.

At the JCM, S Jaishankar expressed India's desire to expand its strategic partnership with South Korea into new areas such as critical and emerging technologies, semiconductors, and green hydrogen. The JCM covered a wide range of topics, including cooperation in defence, science and technology, trade, people-to-people exchange, and cultural cooperation. The two sides also discussed advancing trilateral cooperation and exchanged views on developments in the Indo-Pacific region, as well as regional and global issues of mutual interest.

Jaishankar also stated that during Prime Minister Narendra Modi's 2015 visit to South Korea, the two countries' relations were upgraded to a special strategic partnership. He mentioned that in 2023, the two nations celebrated their diplomatic ties' 50th anniversary.

Stressing the expansion of cooperation between India and South Korea into new sectors, Jaishankar emphasised that while maintaining momentum in traditional areas of cooperation is important, there is a keen interest in broadening collaboration into new domains to modernise mutual ties.

This statement summarised the new vision, which India has for increasing its bilateral ties with South Korea

INDIA-S KOREA BILATERAL TRADE

The EAM further called for a quick conclusion to the review of India's trade agreement with South Korea, adding that the two countries must work together to find more 'meeting points' and increase their engagement to realise their potential.

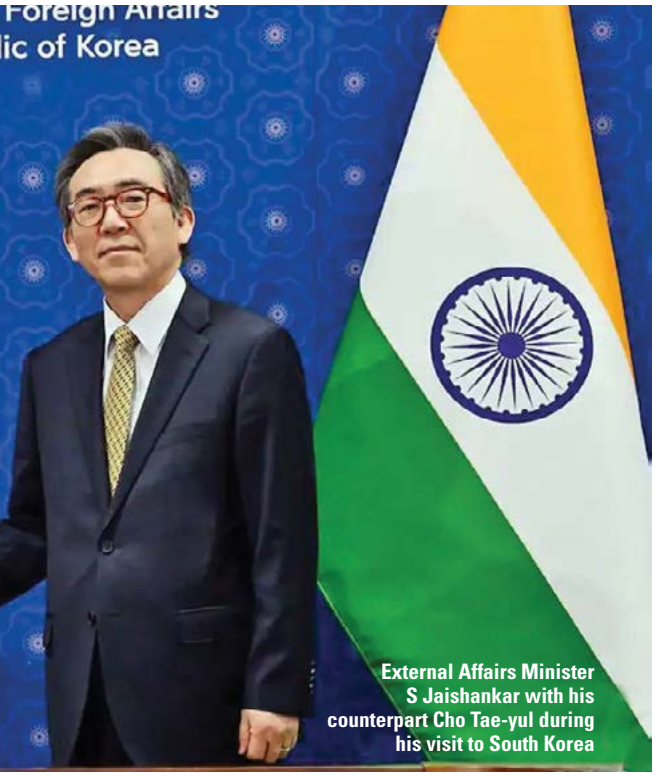
Pointing to the long-pending review of CEPA (Comprehensive Economic Partnership Agreement) between India and South Korea, the EAM urged for its upgradation to embrace new and emerging sectors, for which he urged to identify more intersections and meeting points that work for both.

The Comprehensive Economic Partnership Agreement, or CEPA, between India and South Korea came into force in 2010. However, India has said the pact should be more balanced and equitable. Reports say India wants greater access to the South Korean market for certain goods such as steel, rice, and shrimp while Korea is said to want greater access to India in sectors such as auto components and chemicals.

Negotiations to 'upgrade' the CEPA are currently on going, with South Korea's Ambassador to India Chang Jae-bok saying that the two countries are hopeful of completing the talks in 2024. Officials from India and

South Korea had met in January for the 10th round of official negotiations to upgrade the CEPA.

India's bilateral trade with South Korea grew 9 percent in 2022-23 to $27.88 billion, with India having a significant trade deficit. While India's exports contracted by 18 percent to $6.65 billion, imports from South Korea jumped 21 percent to $21.23 billion.



External Affairs Minister S Jaishankar with his counterpart Cho Tae-yul during his visit to South Korea

In the first nine months of 2023-24, the total bilateral trade stood at $20.92 billion, with India's exports down 7 percent year-on-year at $4.76 billion and imports from South Korea up 1 percent at $16.16 billion.

EXPANDING COMPREHENSIVE COOPERATION

There were fruitful discussions between the two sides on comprehensive cooperation in the fields of defence, science and technology and trade. It is believed that this deal between India and South Korea will cause great tension to N Korea's Kim Jong Un. In his address at the Korea National Diplomatic Academy Jaishankar also said that trade apart, India and South Korea must recognise the strengths they both brought to the table.

"Today, we are all contemplating the prospect of a re-globalisation that would be very much shaped by emerging technologies. That gives our two nations the opening to progress ourselves while contributing to a better world," the minister said.

Responding to a question related to India's production-linked incentive scheme for semiconductor manufacturing, Jaishankar said it is part of increasing domestic capabilities. While this is in India's interests, Jaishankar said it is also part of de-risking the world economy. He said that both countries have seen increasing similarity of views on international forums. He said, "It is important to focus on the Indo-Pacific region." The reference here was obviously to India's increasing role in Quad.

Jaishankar, in this regard, highlighted the Fusion Centre, hosted by India and built as a result of a number of White Shipping agreements with different partners with a common operative picture across the entire Indian Ocean.

"Similarly, RoK's participation in initiatives like the Indo-Pacific Oceans Initiative, which looks at a range of oceanic issues from ecology and environment to transport and science technology, would, I think, be a very valuable addition," he said.

India's top diplomat was referring to the Information Fusion Centre-Indian Ocean Region (IFC-IOR), which is hosted by the Indian Navy and headquartered in Gurugram. It has 25 partner countries, including the US, Japan, Australia, and Bangladesh. Jaishankar also suggested cooperation through the International Solar Alliance and the Coalition for Disaster Resilient Infrastructure, both of which are led by India.

Aside from the converging strategic outlooks of both countries – with India's focus extending eastward toward the Korean Peninsula, and South Korea's moving westward toward the Indian Ocean – Jaishankar outlined the economic logic for the partnership. Stronger cooperation, he said, is "therefore, impelled by both national interests and global de-risking."

CULTURAL TIES

During his visit to Seoul, Indian External Affairs minister also met with Gimhae City Mayor Hong Tae-yong and discussed greater cultural and educational cooperation with Gimhae City. He highlighted the Gimhae-Ayodhya connect as a testament to the shared cultural heritage and longstanding people-to-people relations between the two nations, referring to the legendary story of Queen Heo Hwang-ok (Princess Suriratna) from Ayodhya who married King Kim Suro in Korea some 2,000 years ago.

Overall, given the areas highlighted by the EAM during his visit, it seems that India is trying to revive the previous effort to set up an India-Japan-South Korea trilateral. However, in the current scenario around IOR countries, this trilateral forum, apart from boosting ties between the three nations, will also aim to synergise with the Quad's focus areas in the region. Ostensibly, defence will be paramount in this effort.

India-S Korea JCM covered a wide range of topics, including cooperation in defence, science and technology, trade, people-to-people exchange, and cultural cooperation

FOCUS EAST ASIA - II

External Affairs Minister S Jaishankar and Defence Minister Rajnath Singh with Japanese Prime Minister Fumio Kishida

GREEN TECH AND SECURITY TALKS TAKE CENTRE STAGE

In addition to technological collaboration, S Jaishankar also batted for increased defence cooperation between India and Japan, besides working together for reforms of international bodies like the United Nations, during his recent visit to Japan

By **ASAD MIRZA**

On the second leg of his East Asian tour, EAM Jaishankar travelled to Japan. Besides focussing on the bilateral ties, the visit was also aimed at further enhancing India-Japan cooperation in emerging fields like green technology, and digital transformation and also review the security dialogue between the two countries, besides discussing measures to counter the common adversary i.e. China.

On March 7, addressing the first Raisina Roundtable in Tokyo, S Jaishankar, citing the turbulence in India's relationship with China amid the continuing border standoff, said that it is a cause of concern if a country doesn't observe written agreements with its neighbours and also raises a question on the said country's intentions.

EAM also said that when big power shifts take place in the Indo-Pacific region, there are accompanying and strategic consequences, although countries intend to keep relationships stable despite changing dynamics but that has not been the case with China.

INDO-JAPANESE DEFENCE TIES

Promoting India's recent accomplishments and advances in various fields, Jaishankar said that whether it is the ease of doing business, infrastructure development, ease of living, digital delivery, startup, and innovation culture... India is clearly a very different country today. This is important for the Japanese to recognise, adding that India is increasingly turning

to like-minded partners who gather together for a particular purpose. Agreeing that the most universal expression of the global order is still the United Nations, Dr Jaishankar said that its reform is of paramount importance, and India and Japan seek to make the UN structures more contemporary.

The minister also called for Japanese cooperation concerning the development assistance in the Global South. He added that as a leading voice of the Global South, and being "particularly conscious of this responsibility", India's development efforts today span 78 nations across different continents.

Japan's Foreign Minister Yoshimasa Hayashi said there was "an increasing need" for India and Japan to step-up security cooperation as the two countries held talks to further strengthen military ties amid growing tension from China and Russia in the region. She also said they agreed to look for possibilities to extend their cooperation to new areas of space and cyber security.

India-Japan Special Strategic and Global Partnership has further deepened in the last decade in areas such as defence and digital technologies, semiconductor supply chains, clean energy, high speed rail, industrial competitiveness and connectivity.

DEFENCE TIES

The meetings between the Japanese Foreign Minister Yoshimasa Hayashi and Defence Minister Yasukazu Hamada with their Indian counterparts, S Jaishankar and Rajnath Singh, in Tokyo, comes at a sensitive time as Russia holds a major multinational military exercise in its far east, with China and India part

Stating that the world is now more volatile, uncertain, unpredictable, and open-ended, Jaishankar said that it is a "prospect that India and Japan have to confront, both from the national perspectives as well as from the point of view of their own relationship".

He noted Russia's war on Ukraine, China's increasingly assertive and coercive actions, including escalating tension near Taiwan, as well as North Korea's missile and nuclear threats. Hamada, who held defence talks with Indian MoD Rajnath Singh on March 7, said that bilateral and multinational joint exercises and other defence cooperation have expanded in recent years and will be raised to 'new highs'. He said their first joint fighter jet training is being planned.

Japanese Foreign Ministry officials said on March 6, that Japan wants to step up joint military drills and cooperation in the development and transfer of military equipment and technology with India.

Japan hopes to expand military equipment transfers to back up its feeble defence industry as the country tries to bolster its military capability and spending as deterrence against growing threats from China, Russia and North Korea. Noting rapidly changing strategic relations and a worsening security environment on the global stage where divisions and contention are deepening, Kamikawa said Japan wants to work with India in resolving common issues through dialogue and cooperation.

Japan and India are discussing joint development of unmanned ground vehicle technology, Japanese officials said. Japan's earlier plan to sell sea-landing planes to India has been held up, partly by the costs.

QUAD'S DIRECTION

Japan and India, members of the Quad grouping that also includes the United States and Australia, have rapidly intensified bilateral ties amid shared concern about China's increasingly assertive economic and military activities in the region. Japan also wants to reaffirm India's support in promoting a "free and open Indo-Pacific vision" that Japan promotes with the United States as part of the Quad framework that also includes Australia as a counter to China's assertiveness in the region, Japanese foreign ministry officials said.

External Affairs Minister S Jaishankar on March 8, speaking at Nikkei Forum on the India-Japan Special Strategic Partnership, said that solutions for India and Japan nationally, as well as regionally and globally, lie there. He further emphasised that India-Japan ties will both draw strength from larger activities together, especially from the Quad.

"My argument is that India-Japan ties will both draw strength from our larger activities together, especially from the Quad, but also contribute to its effectiveness and its breadth," he said.

The two ministers welcomed expanding joint military exercises. Jaishankar said their countries would work together to enhance economic security and supply chain resilience, and discussed cooperation in areas such as semiconductor, green technology, and digital transformation.

India's East Asian outreach comes at a time when the Indo-Pacific region is facing increasing Chinese belligerence in the region. India wants to hedge its bets with two leading players in East Asia, i.e. S Korea and Japan through defence ties but paramount to it is ensuring the access to the semiconductor industry and other key strategic areas, all of which were highlighted by the EAM in both the countries. Further with Japan, India needs to be seen as an equal partner in Quad, to gain the American confidence, as so far it has not been able to achieve the goals, for which it had joined the Quad.

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S Jaishankar, citing China amid the continuing border standoff, said that it is a cause of concern if a country doesn't observe written agreements with its neighbours and also raises a question on the said country's intentions

LEAD STORY

PROSPECTS FOR INDIAN DEFENCE MANUFACTURERS IN THE EVOLVING MIDDLE EAST MARKET

The trade and cultural links between India and various Middle Eastern nations are centuries old. However, in the current global scenario, the opportunity in the fast expanding Middle Eastern countries for self-reliance in the defence-manufacturing sector could be used by the Indian defence manufacturers for mutual benefit

By **DR MD. MUDDASSIR QUAMAR**

The Middle East is one of the most dynamic defence markets in the world. Violent conflicts, external and internal security threats and tensions among regional states generate strong demands for defence procurement. The region has remained unstable for over a century, and for long the regional countries have spent a substantive proportion of their annual budget on defence. The Middle Eastern and Gulf countries have traditionally depended on external supplies to meet their defence and security demands. However, with the global geopolitical and geoeconomic shifts, reduced US inclination to meet their needs and transitions in the energy market, the regional countries have expedited their efforts to reduce dependence on external defence procurement.

While Israel and Türkiye are the leaders in this regard, the UAE, Saudi Arabia, and Qatar too have been working towards consolidating their defence industry sector. In addition, Egypt and Iran too have put greater emphasis on meeting their security and defence requirements indigenously. These developments underline the shifts in the regional defence market, with the Middle Eastern and Gulf countries looking beyond the traditional industry leaders to forge futuristic partnerships. From an Indian point of view, with greater emphasis on developing the defence industry, this generates an extraordinary prospect for cooperation and collaboration with the defence industry in the Middle Eastern and Gulf markets.

MIDDLE EAST DEFENCE MARKET

According to the Stockholm International Peace Research Institute (SIPRI), during 2019-23, the Middle East accounted for 30 per cent of all arms imports globally, second only to Asia and Oceania, which accounted for 37 per cent. During the same period, three regional countries, Saudi Arabia, Qatar and Egypt, were among the top ten global arms importers, ranked second, third and seventh, respectively. Notably, four of the Gulf Cooperation Council (GCC) countries, Kuwait (12) and UAE (14), in addition to Saudi Arabia and Qatar, are among the top 15 global arms importers.

A Forecast International report notes that in 2022, the Middle East defence market comprised 6.7 per cent of the total global spending on arms purchases, amounting to US$ 127 billion, with Saudi Arabia, Israel, UAE, Iran and Oman, respectively, being the biggest spenders. Additionally, other regional countries, including Iraq, Kuwait, Egypt, Qatar, Jordan, Lebanon and Bahrain, have a strong defence budget with near total dependence on external procurements to meet military and security equipment requirements.

The biggest suppliers to the Middle East market, according to SIPRI, are the US (52 per cent), France (12 per cent), Italy (10 per cent) and Germany (7.1 per cent). Among others, Russia, Spain, Türkiye, China and South Korea have emerged as prominent suppliers of arms and military equipment to the Middle Eastern countries. Among the international defence manufacturers, Boeing, Lockheed Martin and BAE Systems are the top three market leaders in the region, with Saudi

Prime Minister Narendra Modi with UAE President Mohamed bin Zayed

Arabian Military Industries (SAMI) and Israel Aerospace Industries among the regional market leaders. Military vehicles, weapons and ammunition, communication systems, and personnel training and protection are the leading segments in demand and will lead the compound annual growth rate in the next five years.

Another important regional trend is the consolidation of defence manufacturing with emphasis on localisation through international collaboration, technology transfer, strengthening of domestic manufacturing through partnership with global market leaders, and expanding exports to reduce the cost of defence expenditure, as well as focus on the need for economic diversification. Hence, countries such as Türkiye, Saudi Arabia and the UAE, have worked towards strengthening their defence manufacturing companies and industries. Israel has a traditionally strong manufacturing industry and export network among the regional exporters. Nonetheless, Türkiye has quickly emerged as one of the strongest exporters, ranked 11th in the world during the 2019-23 period, while UAE and Iran have also consolidated their positions, ranked 20th and 25th respectively.

Besides Israeli and Turkish manufacturers, Saudi Arabia's SAMI and UAE's EDGE have been spending heavily on developing their manufacturing and research and development (R&D) capabilities. The UAE established EDGE Group in 2019 by bringing together the country's defence companies to create a mega-conglomerate with 25 subsidiaries. In 2023, in the fourth year of its formation, the company announced a 400 per cent increase in orders since inception, with US$ 5 billion worth of orders in 2023 alone. The company focuses on autonomous systems, smart weapons, and electronic and communication systems. Similarly, Saudi Arabia established SAMI in 2017 to reduce its external dependence to 50 per cent by 2030 as per Vision 2030 plan, and although this is an ambitious target, the company has moved fast to create infrastructure and capacity to meet the target mainly through joint ventures and incorporating local manufacturing terms in new agreements such as with Türkiye's Baykar, a global leader in drone manufacturing, to locally produce its Akinci twin-turboprop medium-altitude, long-endurance uncrewed aircraft system (UAS).

INDIAN DEFENCE INDUSTRY

India is the global leader in defence expenditure. The defence requirements are highly diverse and complex due to its vast and complex geography and varied security threats. In 2019-23, India's share in global arms imports was 9.8 per cent higher than any other country. High dependence and expenditure on defence imports have prompted the Government of India (GoI) to nudge the domestic defence industry towards creating local capabilities, increase R&D investment, encourage localisation through joint ventures and develop a defence manufacturing ecosystem in the country to

From an Indian point of view, with greater emphasis on developing the defence industry, this generates an extra-ordinary prospect for cooperation and collaboration with the defence industry in the Middle Eastern and Gulf markets

LEAD STORY

Theunis Botha, CEO of AL TARIQ and S. Krishna Kumar, Executive Director of HAL at Aero India 2023

The growing security and defence cooperation between India and the Middle Eastern countries, with a focus on military-to-military and defence industries' cooperation, has opened up space for Indian and Gulf and Middle Eastern defence companies and start-ups to seek partnership and collaborate in defence sector

reduce external dependence. Consequently, there has been a significant increase in the defence industry's value, which stood at US$ 1.068 trillion in 2022-23, with US$ 160 billion in defence exports.

In its 2022-23 defence budget, 25 per cent of the R&D budget was earmarked for private industry and start-ups. Notably, as of 2023, 606 new industrial licences were issued to 369 companies operating in the defence sector. Under the Aatmanirbhar Bharat initiative, the GoI has issued four positive indigenisation lists with 411 products to be manufactured domestically. The MoD plans to have a US$ 26 billion turnover in aerospace and defence manufacturing by 2025 with a US$ 5 billion export target. The GoI has also set an ambitious target of US$ 15 billion in defence exports by 2026 and has been encouraging state governments to support local defence industries to set up bases.

The Indian defence industry is a mix of public and private sector companies. Major public sector defence manufacturing and R&D companies are Hindustan Aeronautics Limited (HAL), Bharat Dynamics, Bharat Electronics, Bharat Earth Movers Limited (BEML), Defence Research and Research Organisation (DRDO), MTAR Technologies Limited and Indian Ordnance Factories. Among the private sector companies, Tata Advance Systems, Larsen & Toubro Defence, Bharat Forge (Kalyani Group), Adani Group, Mahindra Defence Systems, Reliance Industries and Ashok Leyland, with proven track records, have stepped up their defence arms and subsidiaries. Some of these, including Tata Defence, L&T Defence, Bharat Dynamics Ltd, HAL, DRDO and Kalyani etc. are industry leaders and have forged partnerships with international manufacturers for capacity building and local manufacturing.

PROSPECTS FOR COLLABORATION

The emphasis on strengthening local defence industries in India and the Middle Eastern countries, especially in the GCC states, has created a strong prospect for collaboration at multiple levels, including joint R&D projects, joint ventures in manufacturing and growth in defence supplies. In February 2023, during the International Defence Exhibition and Conference (IDEX) in Abu Dhabi, EDGE and HAL signed a memorandum of understanding (MoU) to explore areas of cooperation, including the joint design and development of missile systems and drones. Another Indian defence company, ICOMM, signed a technology transfer agreement with UAE's CARACAL (an EDGE subsidiary) to manufacture the latter's complete line of small arms for the Indian market. Many other such partnerships, joint ventures in design and manufacturing and collaboration agreements have also been signed or are under consideration with defence manufacturers based in Israel, Saudi Arabia and Egypt.

Among the most important areas where Indian companies can explore cooperation are electronics and communications technology, radar systems, precision equipment, small arms, military vehicles and personnel protection and training equipment. Among strategic areas with prospects for collaboration and cooperation are space exploration, missile and drone systems, aircraft and engine design and manufacturing and surveillance systems. There is also scope for collaboration among start-ups, especially in technological innovation that has the potential to attract investments, including from Gulf-based defence-tech giants.

The growing security and defence cooperation between India and the Middle Eastern countries, especially with the GCC States, with a focus on military-to-military and defence industries' cooperation, has opened up space for Indian and Gulf and Middle Eastern defence companies and start-ups to seek partnership and collaborate in defence R&D and manufacturing sector. Among the leading countries where the prospects for cooperation are high so far as the Indian industries are concerned are Israel, UAE, Saudi Arabia, Egypt, Bahrain, Oman and Jordan.

India's growing political, diplomatic and strategic relations with the Gulf and Middle East have opened up newer avenues for cooperation in various sectors. One of the key sectors where there is a greater prospect for collaboration is the defence industry, which is at a nascent stage of growth in India and the region. Indian defence industry leaders and start-ups can, and should, explore the possibilities of forging partnerships in defence R&D and manufacturing with their counterparts in the Gulf and Middle East, especially in the UAE, Saudi Arabia and Egypt, as their strategic goals align with India's, opening up durable and lucrative prospects.

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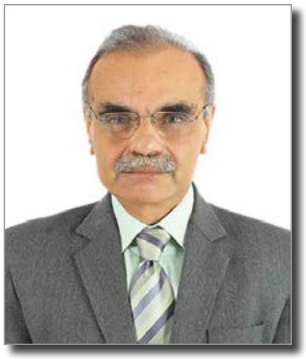

AMIT COWSHISH

SELF-RELIANCE IN DEFENCE PRODUCTION: NEED FOR REDEFINITION

India has come a long way in designing and developing military equipment. Still, the Stockholm International Peace Research Institute's latest report has again adjudged India as the largest importer of weapons, adversely affecting India's profile as a country with rapidly growing self-reliance in defence production. The main reason behind it is the way self-reliance is defined and measured. This needs to change

It was a proud moment for India when the first production series of Tejas Light Combat Aircraft (LCA) Mk1A - an advanced version of the LCA Mk1 - completed an 18-minute sortie successfully. It paved the way for the delivery of 83 Mk-1A fighters to commence shortly, for which the Indian Air Force (IAF) placed an order in February 2021.

This feat came close on the heels of Made-in-India weapon systems rolling down Kartavya Path in central Delhi during the Republic Day parade on January 26, 2024. These systems included the Prachanda Light Combat Helicopter (LCH), Nag anti-tank missile, Pinaka multi-barrel rocket, Swathi Weapon Locating Radar, Sarvatra Mobile Bridging systems, Bhishma T-90 Main Battle Tanks, drone jammer system, advanced radio frequency systems, et al.

India has come a long way in designing and developing military equipment and manufacturing equipment under licence from foreign original equipment manufacturers (FOEMs). This is creditable, but it is also a fact that most of the major defence systems manufactured in India - including indigenously designed and developed systems - incorporate to varying extents, imported sub-systems and components that are critical to their operational exploitation.

For example, the indigenous content (IC) in Tejas LCA Mk1A is expected to be more than 70 per cent in the next few years, but the aircraft is powered by F404-GE-IN20 engines, supplied by the American multinational conglomerate, General Electric. Even Tejas LCA Mk2, which the DRDO plans to develop, will be powered by GE 414 Engine, though it will be manufactured in India with 80 per cent transfer of technology from GE Engines. Other locally manufactured aircraft like Su-30 MKI fighter jets and Hawk Trainer aircraft also have a high percentage of IC, but these too are powered by imported engines.

Many land-based and naval platforms also run on imported or foreign-origin engines. For example, the K-9 SP Howitzers, licence-built jointly by L&T and South Korea's Samsung Techwin at Hazira in Gujarat, are powered by X1,000 horsepower (750 kW) German MT881Ka-500 MTU Friedrichshafen engines and USA-designed Allison 1100-5A3 transmission systems, being licence-built at a facility in Tamil Nadu.

As for naval platforms, INS Vikrant, the indigenously designed front-line aircraft carrier is powered by four General Electric LM2500+ gas turbines on two shafts, generating over 80 megawatts (110,000 hp) of power, primarily because after decades of efforts, Defence Research and Development Organisation (DRDO) administered Gas Turbine Research Establishment (GTRE) at Bengaluru has not succeeded in developing aero gas-turbines for military aircraft, or the marine gas turbines, which was to be a spin-off of the main project.

Meanwhile, India has imported or is in the process of importing, major weapons systems and platforms such as Medium Multi-role Combat Aircraft Rafale, Lockheed Martin C-130J Super Hercules four-engine turboprop military transport aircraft, Boeing AH-64E Apache attack helicopters and CH-47 Chinook heavy-lift helicopters, Sig Sauer Assault Rifles, General Atomics MQ-9B SkyGuardian remotely piloted aircraft systems (RPAS), and so on.

The indigenous content in Tejas LCA Mk1A is expected to be more than 70 per cent in the next few years, but the aircraft is powered by F404-GE-IN20 engines, supplied by the American multinational conglomerate, General Electric. Other locally manufactured aircraft such as Su-30 MKI fighter jets and Hawk Trainer aircraft also are powered by imported engines

No wonder then that the latest March 2024 report of the Sweden-based Stockholm International Peace Research Institute has yet again adjudged India as the largest importer of arms during the period 2019-23, accounting for 9.8 per cent of the global trade, up from 9.1 per cent during the 2018-22 period. It hurts

Tejas Light Combat Aircraft (LCA)

India's profile as a country with rapidly growing self-reliance in defence production.

The MoD does not attach credence to these reports, arguing instead that the rising expenditure on the procurement of defence equipment from Indian companies - up from 58 per cent of the capital budget in 2021-22 to 75 per cent in 2023-24 - is a truer indicator of growing self-reliance. This notion needs to be discounted, however.

As a matter of policy, MoD prefers Indian companies as prime vendors under acquisition categories like Buy (Indian – Indian Designed, Developed and Manufactured), Buy (Indian), and Buy and Make (Indian). This allows them to tie up with foreign companies for the transfer of technology, obtaining specialist services or importing raw materials or some critical components, to varying degrees, to manufacture the equipment in India. This is also true of the equipment manufactured in India under other categories like Buy (Global – Manufacture in India) and 'Make'.

Since all payments to the Indian companies are made by MoD in INR, the expenditure on local procurement is rising every year, but this expenditure does not reflect the payments Indian companies make to the foreign vendors for obtaining raw materials, technology, knocked-down kits, components, and other specialist services.

This shows that expenditure in INR cannot be an index of self-reliance in defence production as long as the local manufacturers continue to depend on foreign sources for critical components, raw materials, and the like, without which the equipment manufactured in India, even with a very high IC percentage, cannot be operationally ready for use.

India needs to create an agency on the lines of the Defense Advanced Research Projects Agency (DARPA) of the United States (without necessarily dismantling DRDO) to focus exclusively on the development of critical and futuristic technologies. The Kelkar Committee had recommended the setting up of such an agency in 2005, but the government did not accept the recommendation

Just imagine the impact it would have on self-reliance if, because of geopolitical or other reasons, one of the FOEMs stops the export of aero-engines or their critical components, or terminates the arrangement for licensed production of engines in India. It will undoubtedly be a big blow to the production of aero-engines in India and, by implication, compromise India's military capabilities.

The real test of self-reliance is the capability to design, develop and produce critical technologies without which the equipment or platform cannot be operationally exploited. If the country has this capability, it will matter little if the IC in a particular equipment, weapon system or platform is low, provided the non-critical components are available from multiple local or foreign sources.

What is impacting India's march to self-reliance in the real sense of the term, defined as the capability to indigenously design, develop and manufacture all manner of defence equipment

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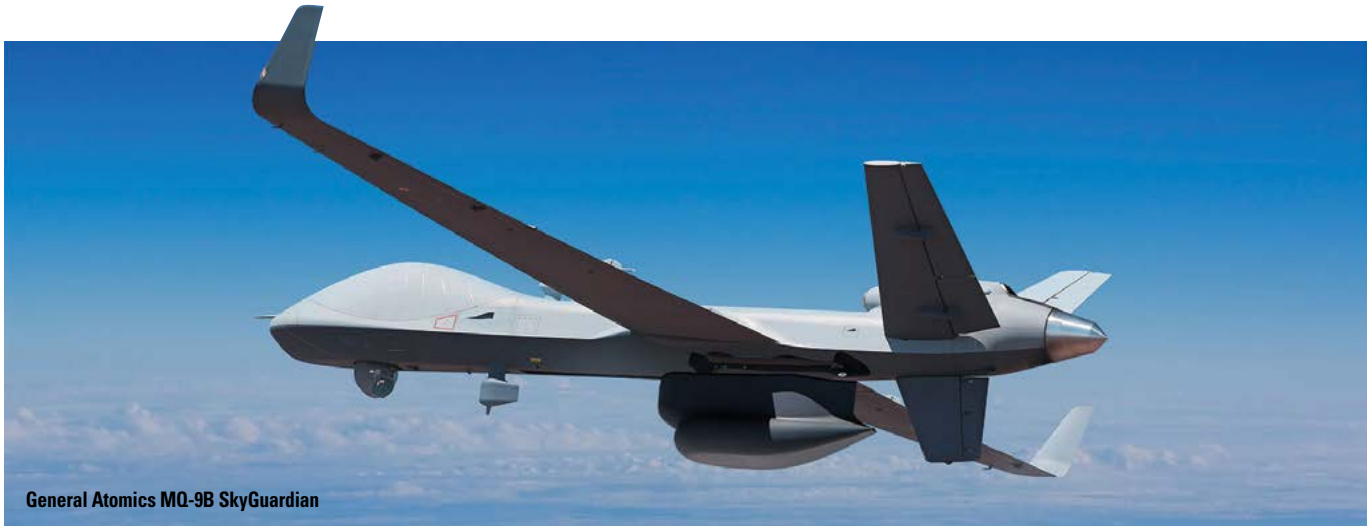

General Atomics MQ-9B SkyGuardian

required by its armed forces without having to rely on the import of critical technologies to make the equipment ready for operational exploitation?

The main reason, of course, is the way self-reliance is defined and measured. Self-reliance cannot be conflated with local manufacturing of equipment with a high IC percentage. A new approach needs to be developed to measure self-reliance in terms of decreasing dependence on FOEMs for critical technologies.

What is also missing is an appropriate structural and procedural framework. The existing framework is geared more towards acquiring than developing futuristic technologies and undertaking fundamental research.

In the USA, the responsibility for developing emerging technologies for the military is shouldered by the Defense Advanced Research Projects Agency (DARPA). It functions with a small complement of approximately 220 government employees. (However, DRDO has more than 30,000, including 5,000 scientists, in six technical offices, including nearly 100 program managers, who together oversee about 250 R&D projects.) Most of the heavy lifting is done by outside R&D agencies with the DARPA coordinating all those efforts.

This Agency was long seen as an ideal solution for promoting defence R&D in India and the Kelkar Committee had indeed recommended in 2005 the setting up of a Board of Research for Advanced Defence Sciences (BRADS) to function on the lines of DARPA, but inexplicably the recommendation was not accepted by the government.

The money spent on defence research and development (R&D) also poses a challenge. With a share of just about 6-7 per cent in the overall defence budget, DRDO cannot be expected to work wonders. Therefore, conditions need to be created for the private sector to play a major role in India's quest for self-reliance in the true sense of the term

Be that as it may, the private sector will have to play a greater role in developing critical technologies. Some creditable efforts are being made under the Technology Development Fund and the iDEX (Innovation for Defence Excellence) Scheme, but these disjointed efforts are not focused on major critical technologies like the development of an aero-engine.

The money spent on defence research and development (R&D) also poses a challenge. With a share of just about 6-7 per cent in the overall defence budget, DRDO cannot be expected to work wonders. Finance Minister Nirmala Sitharaman announced in her budget speech on February 1, 2022, that 25 per cent of MoD's annual R&D budget will be reserved for private companies and start-ups to break the monopoly of the public sector on developing cutting-edge military technology. Given the paltry R&D budget, the money that could be diverted to the private sector would have been insignificant. In any case, the scheme never got activated.

Increased private sector participation can also mitigate the inadequacy of budget outlays. In the USA, 75 per cent of the total R&D funding is by the business enterprises, with the academia, government and other sectors contributing 11, 9 and 5 per cent respectively. China, South Korea, Japan, and Russia are comparable with the USA in this regard.

India, however, seems to be at the other end of the spectrum with 50 per cent of the outlay being contributed by the government, 41 per cent by the private enterprises (of which defence accounts for a negligible proportion), and the remaining by the academia. This needs to change.

To sum up, a different approach is required to measure self-reliance, an appropriate DARPA-like agency needs to be created (without necessarily dismantling DRDO) to focus exclusively on the development of critical and futuristic technologies, and conditions need to be created for the private sector to play a major role in India's quest for self-reliance in the true sense of the term.

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

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THOUGHT POT

SHAPING THE UNKNOWN: UNMANNED TECHNOLOGIES IN THE UNDERSEA DOMAIN

Unmanned Underwater Vehicles or UUVs are set to alter the nature of undersea warfare whether in detecting, tracking or attacking undersea, surface, or land targets. The importance of unmanned underwater technologies in maritime security has been flagged as the next big step by naval leadership across the world. As this technology develops, the focus will be on manoeuvrability, endurance, size, multi-mission capability, weapons and sensors including towed array sonars

By **COMMODORE ANIL JAI SINGH**

In November 2021, during the Naval Commanders Conference, Defence Minister Rajnath Singh released the Indian Navy's Unmanned Roadmap. It was a classified document, so very little was known of its contents. An unclassified version, released by the Prime Minister in August 2022 at the Indian Navy's annual Swavlamban conference, was expected to provide the industry with a clear direction for developing these unmanned technologies. With the current focus on indigenisation, this document was made available to only a few selected Indian firms. Hence, there is still a lack of adequate information on the Indian Navy's unmanned roadmap plans in the open domain.

Unmanned technologies in the air have been around for over two decades. They have also captured the public imagination – their ubiquitous presence at marriage functions, as delivery vehicles for pizzas and groceries, and their coordinated glitzy displays at events, including the venerable Beating the Retreat in New Delhi, has spawned a whole industry of drone manufacturers. However, the technologies involved in military applications are far more sophisticated, and still available in only a few countries. This is nowhere more so than in the undersea domain, which presents a far more challenging environment, and it is here that the military dimension of unmanned technologies will soon be most evident.

The importance of unmanned underwater technologies in maritime security needs no emphasis and has been repeatedly flagged as the next big thing by naval leadership across the world, including successive Chiefs of the Indian Navy.

Navies around the world are investing considerable time, effort and resources in developing their unmanned capabilities, be it in the air, on the surface or below the surface; there is no doubt that their importance as effective force multipliers in a variety of kinetic and non-kinetic applications is going to increase exponentially.

The development of unmanned underwater technologies is not restricted to military applications alone; autonomous underwater vehicles (AUV) and Remotely Operated Vehicles (ROV) are being used extensively in civilian applications for seabed mapping, sub-bottom profiling, laying, maintaining and repairing of submarine cables, and oil and gas pipelines, geological and hydrographic research and various other applications.

The introduction of unmanned underwater technologies into the military domain is comparatively recent. Besides its deployment in traditional warfare scenarios, it is now becoming a weapon of choice in grey zone warfare, and most alarmingly, this sophisticated technology, which is still beyond the scope of many countries, is now becoming available to non-state actors through their state sponsors. In the ongoing West Asian crisis, the Houthi attacks on shipping in the Red Sea and the Bab-el-Mandeb have gone from missile and airborne drone attacks to underwater drones, which has triggered serious alarm because of the limited ability to interdict and neutralise them.

Unmanned Underwater Vehicles, or UUVs as they are more commonly referred to, include a wide range of platforms and capabilities. At its most basic level, 'smart torpedoes' and pre-programmed mines are two examples of unmanned underwater technologies that have been in use by navies for many decades, to the extent that they are no longer even considered

UUVs. The SeaHake Mod 4 ER (Extended Range) Heavyweight torpedo developed by the German firm Atlas Elektronik has a range of about 150 km (which is three times that of any other contemporary torpedo in the world) and once fired, proceeds to its target through a series of pre-planned waypoints, while periodically updating its position through GPS. It has no communication with the firing platform and is autonomous in the true sense of the term.

Modern developments in unmanned underwater technologies are focussed on three important aspects; firstly, in minimising the human element by taking the man out of the loop and away from direct kinetic action; secondly, as effective force multipliers, where they can support large and expensive manned platforms with cheaper unmanned options capable of performing roles and missions underwater at a much lower cost, while submarines can focus on their primary warfighting role; and thirdly, deploying these in various configurations with flexible payloads to get a better understanding and awareness of the underwater domain, and operating in conjunction with existing sensors on manned platforms to enhance maritime situational awareness.

UUVs are being developed for a range of roles and missions ranging from extra-large UUVs (XLUUV), armed and equipped with weapons and sensors for surveillance of large ocean areas to small ROVs mounted with an explosive charge being used as dispensable fire-and-forget options to detonate mines etc. The US Navy has recently inducted its first XLUUV called Orca. The US XLUUV programme commenced over a decade ago (in 2012) with Boeing developing its 'Echo Voyager' as a proof-of-concept. It is arguably the most advanced UUV in the world. With a displacement of 85 tonnes and a length of over 25 metres, it can carry a 34-tonne payload and remain submerged for over 15 days.

XLUUVs are presently at various stages of development with most of the world's leading navies, and will add the much-needed flexibility of movement over fixed seabed sensors like the SOSUS which monitored the movement of Soviet submarines through the Greenland Iceland-UK (GIUK) Gap during the Cold War or the more recent 'Fish Hook' system extending from Japan to Sumatra.

XLUUVs are in various stages of development in most modern navies. The UK is developing the 12-metre-long CETUS which is expected to be ready in two years. France has ordered an XLUUV demonstrator. Canada has begun sea trials of its Solus- XR XLUUV. South Korea is developing an MRXUUV (Mission Reconfigurable Extra Large Unmanned Underwater Vehicle) system and expects it to be operational by 2027. Japan showcased its 'Long endurance, multi-role UUV research prototype at the DSEI in Tokyo in 2023. Israel showcased its Blue Whale XLUUV at the UDT Conference in 2023.

While XLUUVs are meant for independent long-endurance missions, there are a wide range of smaller

The US Navy has recently inducted its first XLUUV called Orca. The US XLUUV programme commenced over a decade ago (in 2012) with Boeing developing its 'Echo Voyager' as a proof-of-concept. It is arguably the most advanced UUV in the world

THOUGHT POT

The maritime tension constantly simmering in the Indo-Pacific with China's Grey Zone strategy gives cause for concern. China has focused a lot of attention on strengthening its undersea warfare capability in recent years

medium-sized UUVs with reconfigurable multi-mission payloads capable of effective mine countermeasure, shallow water operations, Intelligence, surveillance and reconnaissance (ISR) missions, electronic warfare, hydrographic survey and other undersea tasks in the littorals where undetected submarine deployment is a challenge.

The US has developed the REMUS 620, based on the very successful REMUS 300 small UUV programme, and is probably amongst the most advanced in the world at present. It has a battery endurance of about 110 hours and a range of about 275 nautical miles and can be launched from submarines, small unmanned surface craft, larger surface platforms and also from helicopters. UUVs can also be launched from larger UUVs. Fitted with synthetic aperture sonars, these medium-sized UUVs offer unmatched capability in underwater detection and tracking and greatly assist the commander's decision-making in an operational theatre. The REMUS is not unique.

Many large and medium navies are focussing attention on developing this capability with a mission suite tailored to their requirements. They also include LDUUVs like Kongsberg's HUGIN family or the US Sharkfish amongst others. LDUUVs and Medium UUVs provide the capability for IPOE (Intelligence Preparation of the Operational Environment) and Seabed Warfare (SBW). Medium and small UUVs like the REMUS 620 can be launched simultaneously from different platforms for the same mission.

The maritime tension constantly simmering in the Indo-Pacific with China's Grey Zone strategy gives cause for concern. China has focused a lot of attention on strengthening its undersea warfare capability in recent years. The monitoring of the undersea domain and enhancing its underwater domain awareness (UDA) is critical to its submarine deployments in its 'far abroad. The recovery of a Chinese underwater glider by Indonesia in the Sea of Natuna a few years ago dispelled any doubt about China's intentions to monitor undersea maritime activity in the region. The frequent deployment of its research vessels in the eastern Indian Ocean and now moving further westward to the Maldives is in line with its stated intent of expanding its naval footprint in the Indian Ocean. Underwater gliders launched from these research vessels collect valuable undersea data which can then be analysed and disseminated.

In the next decade or so, the presence of a few Chinese nuclear attack submarines (SSN) in the Indian Ocean complemented by an unmanned presence is an inevitability if it intends to contain the Indian Navy, and make a bid for maritime domination of this critical sea space. A knowledge of what lies below the surface in the Indian Ocean and the hydrological profile of its waters will greatly assist the deployment of Chinese submarines besides its other economic interests in exploiting the Indian Ocean for economic and strategic gain.

China's unmanned programme has been under wraps but satellite imagery has shown that the development of XLUUVs is very much in progress. Based on its HSU-001 LDUUV which was first seen in public in 2019, this one seems much larger and could

be similar in size and capability to the US Navy's ORCA. Chinese unmanned ambitions also extend to using unmanned surface vessels for undersea roles and missions. In 2020, it conducted a 'National Intelligent Unmanned Ship Search Competition' which aligns with its Civil-Military Fusion (CMF) Strategy of harnessing cutting-edge disruptive technologies simultaneously for civil and military applications, towards achieving its national strategic objectives.

The advantages and multi-mission capabilities of unmanned underwater vehicles as effective force multipliers are leading to a rapid acceleration in their research, development, design and construction across the world. Navies are constantly demanding improvements in range, endurance and autonomous capabilities for addressing the wide spectrum of emerging traditional and non-traditional maritime security challenges. For example, the US Office of Naval Research is exploring 'Next-Generation Autonomous Underwater Vehicle Sensors and Capabilities' to further enhance its Subsea Warfare, Seabed Warfare and other undersea warfare capabilities and has awarded three prototype contracts to leading US firms for accelerated and cost-effective development of these.

UUVs are well suited for IPOE (Intelligence Preparation of the Operational Environment). By using their sensors to collect hydrological and operational information about a particular area in advance of submarine deployment, they enable submarines to operate safely and improve their situational and domain awareness for high-risk operations including special operations in shallow waters.

The Indian programme to develop unmanned underwater technologies has all stakeholders working on developing different platforms, both in the civilian as well as the military domain. The MoD has focussed its attention on the development of XLUUVs and has articulated a requirement of 12, while also initiating a programme for HEAUVs (High Endurance Autonomous Underwater Vehicles) capable of performing a host of tasks with an ability to not only be launched from a submarine but also recovering it on board. In addition to these, there is a lot of cutting-edge development work being undertaken in the public and private sectors, academia and research institutions towards maturing these technologies into capabilities.

UUVs are set to alter the nature of undersea warfare whether in detecting, tracking or attacking undersea, surface, or land targets. Such missions will require new and advanced capabilities, from seamless, real-time communications among UUVs and manned platforms to advanced undersea navigation and real-time data transfer in a multi-static networked battlespace. As this technology develops, the focus will be on manoeuvrability, endurance, size, multi-mission capability, weapons and sensors including towed array sonars.

–The writer is a veteran Indian Navy officer and Vice President, Indian Maritime Foundation. The views expressed are of the writer and do not necessarily reflect the views of ***Raksha Anirveda***

The advantages and multi-mission capabilities of unmanned underwater vehicles as effective force multipliers are leading to a rapid acceleration in their research, development, design and construction across the world. Navies are constantly demanding improvements in range, endurance and autonomous capabilities for addressing the wide spectrum of emerging traditional and non-traditional maritime security challenges

SPECIAL FEATURE

CHARTING UNMANNED

Since the implementation of Unmanned Aircraft System (UAS) Rules in 2021 and subsequent strategic initiatives, India has aimed to position itself as a global drone hub by 2030. However, despite these aspirations, the pace of growth has not matched projections. What are the key factors hindering India's ascent in the UAS industry, and how can the nation overcome them?

By **BRIGADIER P S RAMESH**

The promulgation of the Unmanned Aircraft System (UAS) Rules in 2021 marked a momentous milestone for India's unmanned systems. On the heels of that, India banned the import of drones except for research and development, defence, and security purposes. However, the ban did not extend to drone components. In addition, the Indian government stepped up efforts to encourage the market's expansion by launching various programmes, such as Drone Shakti, a production-linked reward system, additional air space, and other initiatives. The stage was set for driving India's ambitious aim of making India a global drone hub by 2030. In August 2022, EY-FICCI published a report titled "Making India the drone hub of the world." The report projected a CAGR of 80% growth in the period from 2020 to 2025 for the UAS industry, a surge in market size from Rs 2,900 crore to Rs 81,600 crore. However, the pace of growth for unmanned systems in India has been nowhere near the projected figures. The sluggish growth rate can be attributed to several factors.

Defence Minister Rajnath Singh at the event Bharat Drone Shakti 2023

DRONE MINDSET

Bollywood blockbuster 3 Idiots introduced 'Drones' to many Indian households in 2009. A few years down the line, the easy-to-operate DJI Phantom Quadcopters became a photographer's delight, hovering ubiquitously at weddings and other social events. Inspired by the design, many hobbyists started building quadcopters and some of them graduated to start-ups. Over time, the design was scaled up by adding propellers to make Hexacopters and Octacopters of various shapes and sizes. Tested and proven imported propellers, electronic speed controllers, flight controllers, and open-source software formed the bedrock for these battery-operated machines. Most businesses stuck to their comfort zones and continued importing parts and assembling drones because the 2022 drone ban did not apply to components. The only notable change was the manufacture of the airframe. This approach is popular since it is a simple, quick, and affordable option that does not require an extensive amount of research and development. However, the problem with the multicopters is their low performance, which does not match up to the requirements of applications, particularly military applications. This 'drone mindset' devoid of any meaningful design and development is perhaps the biggest impediment to India's ascent to prominence on the global stage in the UAS industry.

IDEA VERSUS PRODUCT FUNDING

Successful technology creation

SKIES

requires an imaginative idea that is supported by solid research to produce a novel product. However, converting an idea into a product is an expensive proposition in the aerospace domain. Moreover, there are risks associated with the fructification of the idea into a product, along with the challenges associated with the journey from drawing board to flight. Modern software to scrutinise and simulate aircraft design, both aerodynamically and structurally, can reduce the risk to a considerable extent. Despite this, even good designs do not find too many takers, even while there are sufficient investors for subpar products. Even when the risk-to-reward ratio is favourable, investors are hesitant to put money into start-ups with novel designs, presumably due to ignorance and a lack of risk-taking appetite and/or knowledge. Lack of funding for small companies further propels the 'drone mindset.'

ROLE OF DRDO

Sanctioned with a budget of Rs 1,650 crore in February 2011, the Rustom-2 MALE UAS project was scheduled to be completed by 2016. But the project failed to meet the deadline and the development continued with rechristened Tapas BH-201.In January 2024, Adani Defence and Aerospace, in collaboration with Israeli Elbit Systems, delivered the made-in-India Drishti-10 Starliner MALE UAS to the Indian Navy. Rather than relying on DRDO, this model can be adopted for the development of a sophisticated MALE class requiring high capital investment and a long gestation period. DRDO is also involved in the development of several smaller UAS. Given its track record of cost overruns and failure to meet deadlines, DRDO may not be best suited for the development of tactical, mini, and micro unmanned systems, more so because of the presence of many private players in the UAS industry. Funds earmarked for these DRDO projects can be allotted for development of innovative designs by small private companies.

REALISTIC REQUIREMENTS FROM ARMED FORCES

UAS design and development are driven by military needs worldwide. Therefore, India's armed forces have a big responsibility for the growth of the Indian UAS ecosystem. Technology development is often hindered by unrealistic requirements. It is imperative for the armed forces to clearly distinguish between essential and desirable requirements in the request for proposal (RFP). Essential requirements could include the basic performance parameters like altitude, range endurance, operating temperature, and similar mandatory specifications. Desirable requirements would depend on the type of applications and should avoid 'just born' technology. Theatre-or sector-specific RFP requirements that adapt to the demands of the operational terrain are a more prudent and cost-effective option because of the design limitations of smaller UAS. A formalised armed forces-industry forum with high-frequency interaction should aid in overcoming this hurdle.

The problem with the multicopters is their low performance, which does not match up to the requirements of applications, particularly military applications

SUBSYSTEM ECOSYSTEM

Apart from the aerial vehicle, UAS comprises several subsystems. The ground control station, datalink, software, payload, and technical support systems are equally important. While there are numerous international companies specialising in subsystems, most of the Indian companies are focused on the crowded 'drone' space. However, with companies like PDRL developing software and GalaxEye offering SAR payloads, the subsystem space is slowly filling up. Similarly, Indian companies must grab the opportunity to

SPECIAL FEATURE

DRDO may not be best suited for the development of tactical, mini, and micro unmanned systems, more so because of the presence of many private players in the UAS industry

fill up the huge void in components and specialise on engines, communication modules, servos, airframe, batteries, flight controllers, navigation systems etc.

CERTIFICATION

One of the biggest hurdles for UAS growth in India is the expensive and complex certification process involving multiple agencies. Without a certification process that is simple, quick, and economical, most start-ups will wear out and fade away. Hence, the need for establishing a single location integrated testing facility to facilitate design and development of indigenous systems cannot be overemphasised. Ideally, the government must bear the expenses for the certification, at least for small start-ups.

TAXATION

Review of the existing policies and creating a tax friendly atmosphere is essential for the growth of Indian companies. At least in the near to mid-term, there will be reliance on imports to develop UAS. Therefore, there is a need to reduce or eliminate the import duties till the Indian UAS ecosystem matures. Facilitating exports with friendly policy framework for Indian industries is a must.

DEVELOPING HUMAN RESOURCES

Apart from the armed forces and the recently introduced master's program at IIT Kanpur, there are not many structured curriculums on UAS technology in India. A large enough talent pool with both knowledge and skill is necessary for the long-term, sustainable growth of UAS. Hence, more institutions should integrate UAS technology into their bachelor's and master's degree programmes.

TAKEAWAYS

Although there has been considerable buzz since the introduction of the new UAS policy and the import ban that followed, is there a significant change in India's unmanned ecosystem? The answer is undeniably, a resounding no. Unless the policy is backed by a strong action plan by all the stakeholders, the ambitious plan to become a global leader will remain a pipe dream. India has the potential for disruptive and leapfrog technology, provided that the right vision is supported by talent and investment. If the momentum is accelerated, India can replicate the software success story. But for that to happen, both the government and industry must raise the bar. The government must take the lead in establishing a strong collaborative and consultative mechanism with all the stakeholders, and the industry must drop the 'drone mindset' and start thinking on a global scale.

–The writer, amongst the pioneers of UAS in India, has spent the last 20 years developing a niche specialisation in the technology. He is currently pursuing his PhD on UAS. He has several publications on UAS in reputed international scientific journals, and his work has been cited extensively. The author can be contacted at psramesh1026@gmail.com. The views expressed are of the writer and do not necessarily reflect the views of ***Raksha Anirveda***

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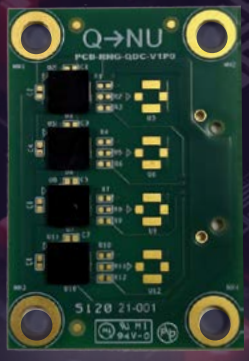

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SPECIAL FEATURE

BRIDGING THE GAP

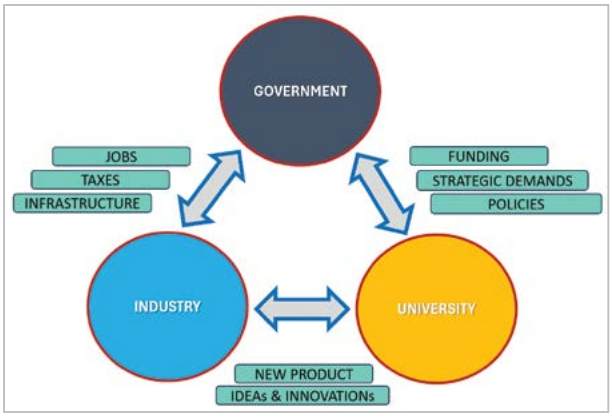
To achieve defence autonomy, India needs to draw insights from the Triple Helix model by enhancing collective synergy among the armed forces, industry, and academia. This collaborative framework necessitates a centralised foundational structure, fostering local talent, innovation, and technology

By **LT COL NARENDRA TRIPATHI**

In recent global conflicts, revolutionary technologies such as swarms of drones, loiter munitions, AIML, and mixed reality have emerged, challenging conventional systems with their enhanced efficiency, agility, and security in combat tactics and training. India stands at a crucial juncture, poised for a transformative leap toward achieving defence autonomy. The convergence of factors, including a thriving domestic defence industry—especially the Indian start-up ecosystem—the expertise of Indian academia in cutting-edge research, and the substantial demand for technological solutions from the Indian defence, presents a unique opportunity for India to become completely "Atmanirbhar."

GLOBAL TRENDS: MODEL OF TRIPLE HELIX

Outlining the dynamic interplay among academia, industry, and government, The Triple Helix model was introduced in the US in 1995, emphasising its collaborative role in fostering entrepreneurship, innovation, and economic growth. In this model, each actor plays a distinct role: Government provides funding, industry contributes resources and expertise, and academia generates knowledge through research. Together, they form an interconnected network to generate ideas, test them in real-world scenarios, and refine them into commercially viable products or services. We see the testimony of the model in many countries like China's "Made in China 2025" and the European Union's "Horizon 2020," which aim to move away from low-cost manufacturing towards high-tech industries like robotics or AI software development and focus on stimulating economic growth through investing in research projects.



(Triple Helix Model, Courtesy: Wikipedia)

In India, this collaborative effort has been demonstrated in some fields to address critical challenges and achieve significant outcomes, such as the collaboration between the Government (ICMR,

MoH), Academic institutions (IISc, AIIMS), and Industry (Bharat Biotech, Serum Institute of India, Dr Reddy's Labs) in the development and distribution of COVID-19 vaccines. This synergy has also been proven successful in multiple goal-oriented missions like Mangalyaan and Chandrayaan missions by ISRO.

STRENGTHS & OPPORTUNITIES IN DEFENCE

In the 2024 interim budget, ₹6,21,540.85 crore was allocated for the Ministry of Defence (MoD) with 70.6% for revenue and 29.32% for capital, reflecting a commitment to India's economic aspirations to rank in the world's top three. This year, through Emergency Procurement (EP) deals worth ₹23,500.00 crore are executed, highlighting ongoing efforts by the Government, such as establishing Defence corridors, launching Innovation for Defence Excellence (iDEX) programs, Public-Private Partnerships (PPP), Production Linked Incentive (PLI) scheme, MAKE (I,II,III), Defence India Start-up challenges (DISC), Centres of Excellence (CoE), targeted funds, and revised financial powers. Multiple MoUs are getting inked between MoD/armed forces with defence public sector undertakings (DPSUs)/academia/private players. UP defence corridor alone has signed more than 138 such MoUs recently.

These current initiatives largely focus on requirements within specified domains, whereas many grassroots opportunities in the armed forces can be explored. Achieving complete defence autonomy requires synergy among these efforts through a centralised and comprehensive framework of collaboration among industry, academia, and the armed forces. This article aims to study broader strategies to enhance collective synergy and bridge the demand-supply gap effectively.

EXPLORING THE SYNERGY

The Indian defence ecosystem can draw insights from the triple helix model, where armed forces, academia, and industry can join hands in a collaborative framework, implementing key elements such as fostering interdependence, adapting strategies, promoting cross-sector collaborations, establishing feedback loops, aligning government policies with private sector actions, encouraging public-private partnerships, facilitating open access to information, conducting technology transfer activities, protecting intellectual property rights, offering incentives for innovation, building capacity among stakeholders, and providing education and training programs for modern innovation systems.

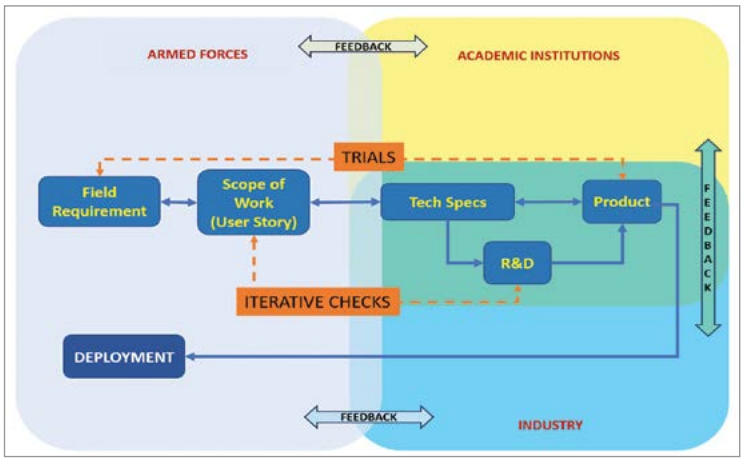
It is essential to develop policy formulation and regulatory frameworks in accordance with government guidelines to synchronise and operationalise this synergy, which should act as a facilitator in handling defence concerns through academic innovation and industry resources. An initial exploration of bilateral equations is necessary to achieve synergy among the armed forces, academia, and industry.

ACADEMIA & ARMED FORCES

Indian academic institutions, including but not limited to IITs, IISc, and IIMs, possess knowledge, resources, and state-of-the-art research facilities. They currently collaborate with the armed forces through Quality Improvement Programs (QIPs) and project engagements via MoUs. In the proposed synergy, fostering active involvement between academia and the armed forces is crucial. Existing

In the proposed synergy, fostering active involvement between academia and the armed forces is crucial. Existing schemes require restructuring to facilitate a stronger connection between them

SPECIAL FEATURE



(Functional Model of synergy between Academia, Industry and Armed Forces)

DefExpo 2022 at Gandhinagar

schemes require restructuring to facilitate a stronger connection between them. Research conducted should align with current defence needs, necessitating centralised infrastructure for knowledge repositories.

Priority to Defence Start-up Incubation programs aimed at addressing specific defence solutions is a must. Such collaborations necessitate dedicated funding and access to armed forces datasets, encouraging partnerships between local military authorities and academic institutions to enhance resource accessibility. Students should be given exposure to the armed forces through internships and vice versa. Additionally, academia should design programs tailored to directly support the armed forces, as demonstrated by initiatives like the 3-month drone training program hosted by IIT Guwahati exclusively for defence personnel.

Academic institutions within the armed forces like military colleges (MCEME, MCTE, CME) having the capitalisation of knowledge can build strong ties with industry. The students and faculty, being part of the armed forces, have an advantage in mapping military requirements with multi-discipline technology solutions.

INDUSTRY & ARMED FORCES

The Indian industry (public and private sectors) excels in manufacturing electronics and software development. Initiatives like industry-sponsored research projects, internships, and joint ventures promote essential skill development. Until recently, there has been a 200% increase in defence licensing for MSME start-ups. Collaboration between the industry and armed forces requires a framework for resource exchange, including methods for technology transfer, inter-domain long-duration transfer between academia and industry (including private players), and the establishment of hybrid facilities for production.

Given the modern warfare landscape's reliance on digitisation and rapid data processing, this synergy can prioritise access to indigenous processors and semiconductor development to ensure readiness for future challenges.

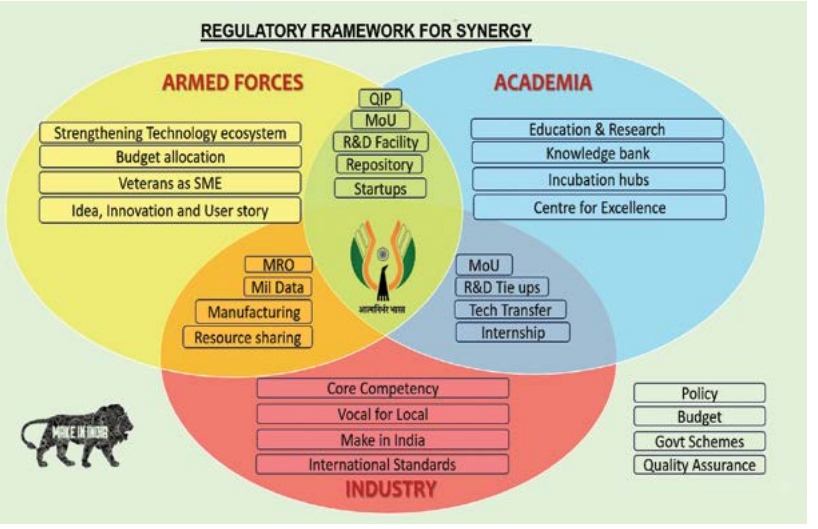
ACADEMIA & INDUSTRY

The industry should leverage the knowledge and research acumen of academia to develop defence inventory through interaction engaging both industry managers and university faculty. Strengthening knowledge transfer can occur through internships, informal communication, conferences, publications, and cooperative programs. Defence start-ups emerging from academia should collaborate with established industry partners.

In addition to the defence PSUs, product development and proliferation within the armed forces are customised to operational needs and supervised by organisations like the Army Design Bureau (ADB), Simulator Development Division (SDD), and Army Based Workshops (ABWs), along with similar ones in the air force and navy like Weapons and Electronic Systems Engineering Establishment

(WESEE) and Software Development Institute (SDI). These entities collaborate closely with the industry and academia to meet the requirements on the ground through innovation.

Advanced simulators and drone systems developed internally by SDD of the Indian Army are appreciated by the Indian top leadership. The base workshops have been directly tackling production and MRO challenges, which require a thorough reassessment to realise their significant potential as key players within this synergised framework, effectively functioning as both an industry entity and an integral part of the armed forces. Continued momentum to such institutes, interdepartmental synergy, and internal dissemination within the armed forces are essential.



Recommended Framework for Synergy

WAY AHEAD

In a centralised framework, the focus is on exploring the essence of synergy and the anticipated contributions from academia, industry, and the armed forces to establish a closed-loop ecosystem where ideas circulate seamlessly between sectors. This requires a comprehensive roadmap integrating goal-oriented R&D programs to promote innovation and indigenous manufacturing with key aspects of managing niche technologies, mapping user stories, defining product scope and pricing, and bringing together stakeholders from diverse sectors.

The goal is to reduce reliance on imports leveraging India's advanced research capabilities. Establishing a comprehensive database of indigenous research and enabling stakeholders to connect research findings with practical applications can achieve self-reliance. Additionally, creating technology transfer centres at academic institutions and a clear determination of intellectual property rights facilitate the transition of research into commercial goods, fostering this collaboration.

Supporting synergy requires capital, a challenge for the start-up industry. Customised engagement schedules can offer initial financial support for proof of concepts (POCs) and demos, enabling practical field trials instead of non-committal demonstrations. Defence authorities overseeing projects should exercise financial independence under Delegation of Financial Powers for Defence Services (DFPDS) schedules to further streamline research and development coordination.

The armed forces may contemplate outsourcing high-tech roles to veterans, along with retired Agniveers, who can contribute as subject matter experts in training and maintenance tasks, benefiting both the armed forces and the industry. Simplifying processes, decentralising decision-making based on technological complexity, and streamlining procedures are key to effectively scaling up innovative ideas. Despite the annual generation of numerous ideas and innovations within the armed forces, only a few successfully scale and persist over time. The synergised framework should ensure that every genuine idea progresses to the patent stage and fulfils its intended purpose. Establishing combined sandboxes for testing and execution is crucial, as it allows for thorough exploration of high-tech systems, gathering essential data, and implementing standardisation measures to maximise their potential.

CONCLUSION

India's journey towards defence self-reliance and global leadership relies on the synergy among the armed forces, industry, and academia. This collaboration drives innovation to address the demands of digitised warfare, enhancing autonomy in defence manufacturing. While recent budget allocations and initiatives reflect government commitment, there's room for further exploration. Expectations encompass strengthened R&D, industry initiatives, and advancements in key technologies like semiconductors, drones, blockchain, and big data analytics.

Ultimately, embracing synergy with evolution and adaptation will position India as a leader in defence innovation, enhancing national security, and contributing to global peacekeeping through interdisciplinary collaboration. Genuine self-reliance will be achieved through leveraging local talent, local innovation, and local technology within a centralised foundational framework.

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

In a centralised framework, the focus is on exploring the essence of synergy and the anticipated contributions from academia, industry, and the armed forces to establish a closed-loop ecosystem where ideas circulate seamlessly between sectors

SPECIAL FEATURE

SKYWARD SURGE: UNMANNED AIRCRAFT SYSTEMS PROPEL INDIAN AEROSPACE

India's aerospace industry has been rapidly advancing, with unmanned aircraft systems emerging as a focal point for innovation and self-reliance. With the vision of Aatmanirbharta driving policy initiatives, India is strategically investing in the development and deployment of UAS to bolster its defence capabilities, enhance civil applications and foster technological advancement

By **RAKESH KRISHNAN SIMHA**

On January 10, 2024, the Indian Navy unveiled the Drishti 10 Starliner unmanned aerial vehicle manufactured by Adani Defence and Aerospace at the company's Aerospace Park in Hyderabad. Drishti 10 is an advanced ISR (intelligence, surveillance and reconnaissance platform) with 36 hours endurance and 450 kg payload capacity. India's only all-weather military platform with NATO standardised certification, it is cleared to fly in both segregated and unsegregated airspace.

What is remarkable about Drishti 10 is the speed of its development. From the Ministry of Defence awarding the contract to field testing by the Indian Navy, it took just 10 months. In a country where the defence public sector companies take decades to produce weapons platforms, this is nothing less than stupendous.

Commenting on Adani Defence's efforts in establishing an ecosystem of partners and capabilities to fastrack the UAS project, navy chief Admiral R Hari Kumar said: "This is a momentous occasion and a transformative step in India's quest for self-reliance in ISR technology and maritime supremacy. Drishti 10's integration into our naval operations will enhance our naval capabilities, strengthening our preparedness for the ever evolving maritime surveillance and reconnaissance."

BUILDING INDIGENOUS CAPABILITIES

India's pursuit of Aatmanirbharta is happening even as the country's armed forces leverage UAS for a wide spectrum of roles such as drone warfare, border patrol, counter-terrorism operations and strategic surveillance, thereby enhancing situational awareness, strike capability and operational effectiveness.

The DRDO, along with other research institutions and private players, are actively engaged in designing and manufacturing advanced drones tailored to meet diverse operational requirements. Projects like

Drishti 10 Starliner Unmanned Aerial Vehicle

the Rustom series, Lakshya and the Ghatak UCAV (Unmanned Combat Aerial Vehicle) exemplify India's progress in developing indigenous UAS platforms.

While prioritising indigenous development, India also recognises the value of strategic partnerships and collaborations in fostering innovation and technology transfer. Collaborative ventures with international partners bring access to cutting-edge technologies, expertise and global best practices, thereby augmenting capabilities in UAS design, manufacturing and operations. These partnerships not only accelerate the pace of innovation but also contribute to building a robust ecosystem for indigenous production and export of UAS.

As part of the Aatmanirbhar Bharat initiative, the government has sanctioned the Production-Linked Incentive (PLI) scheme, allocating Rs 120 crore over three fiscal years for drones and drone components. A provisional list of 23 PLI beneficiaries, including 12 drone manufacturers and 11 drone component manufacturers, has been released by the government. Additionally, the FY 2022-23 budget introduced the Drone Shakti scheme to foster start-ups in Drone-As-A-Service (DrAAS) and announced skilling courses in select ITIs across all states.

The involvement of the private sector in the military drone industry is expected to provide a significant strategic advantage to Indian defence. Presently, India boasts over 200 drone startups, a number anticipated to grow substantially given the sector's potential and evolving technology. To ensure a proficient pool of drone operators, various government and private institutions have initiated training programmes. Notably, the Indira Gandhi Rashtriya Uran Akademi, an autonomous body under the Ministry of Civil Aviation and one of the nation's largest flight training organisations, commenced Directorate General of Civil Aviation (DGCA) certified training at India's inaugural and exclusive drone flying site in Gurugram in February 2021.

STRATEGIC ASPECT

Military drones are the new eyes in the sky over the battlefield and provide reconnaissance that can't be provided by manned aircraft. Admiral Kumar calls the Drishti-10 the "third eye" in the maritime domain. UAVs, such as the US Reaper-9 can loiter for up to 42 hours on internal fuel and potentially indefinitely with aerial refuelling. The Indian Army has acquired Israeli drones, which now keep constant vigil on the borders. Significantly, there are now more hours flown by America's military drones than by its manned strike aircraft and more pilots are being trained to fly them than their manned equivalents.

According to Strategy Page, "Micro UAVs can be deployed in large numbers, often by small infantry units or by artillery spotters, granting frontline ground units fast, easy, cheap and direct

While prioritising indigenous development, India also recognises the value of strategic partnerships and collaborations in fostering innovation and technology transfer. Collaborative ventures with international partners bring access to cutting-edge technologies, expertise and global best practices, thereby augmenting capabilities in UAS design, manufacturing and operations

SPECIAL FEATURE

India has approved the acquisition of 31 high-altitude long-endurance unmanned aerial vehicles for all three services. As part of this roadmap, both the Navy and Army will get two Drishti-10 each in the next few months

access to a part of surveillance capabilities that before had to be requested from and organised by higher level headquarters, which often prevented the vital intelligence from arriving to the ground troops in time." A US Air Force document "Unmanned Aircraft Systems Flight Plan 2009-2047" predicts drones of the future would be built around common airframes of differing size incorporating a modular, "open-architecture" approach so they could be as flexible as possible.

The largest of these drones would "operate as airborne warning and control aircraft (AWACs), aerial refuelling tankers, strategic lift transports and long-range bombers." The next generation of drones will also have artificial intelligence giving them a high degree of operational autonomy including the ability to shoot to kill.

On March 22, 2023, Ukrainian forces raided Russia's Sevastopol harbour using seaborne and airborne UAVs - an ingenious employment of emerging and disruptive technology. However, the Russian Navy was prepared and the raid did not produce the desired results. Despite the mission's failure, it forced the Russian Navy to become more defensive.

In this backdrop, India has approved the acquisition of 31 HALE (high-altitude long-endurance) unmanned aerial vehicles for all three services. As part of this roadmap, both the Navy and Army will get two Drishti-10 each in the next few months. This highlights a key transformation of the modern battlefield - in the area of real time theatre reconnaissance, modern armies and navies are now almost completely independent of the air force.

The question that remains unanswered is who gets majority control of these new - and potentially game changing - weapons. Will it be the air force, army, navy or a purpose built service? Will these new UAS platforms lead to turf wars between the various services? This is not a farfetched scenario - in 2012 the IAF suffered a major setback when the government agreed to transfer most of its attack helicopters to the Indian Army. In all, the army got control of over 270 armed helicopters while the IAF was left with just a dozen or so helicopter gunships.

REGIONAL RIVALRY

Aatmanirbharta in defence UAS is urgently needed in the backdrop of India's adversaries possessing significant drone warfare capability. According to a report in the New Delhi-based Manohar Parrikar Institute for Defence Studies and Analyses, India is at least a decade behind Pakistan and even further behind China in the sector. Both Pakistan and China have been closely collaborating in the development of and acquisition of various military platforms and weapons, including combat drones.

"China had relied on UAVs and built a robust aviation programme right from the 1950s. Government support, reliable infrastructure,

MQ-9 Predator

quality education, research and development have collectively helped China in this domain. Collaboration and joint ventures with other countries and clandestine operations also aided China in its objectives. Pakistan on the other side owes the development of its programme to the PSUs and support extended by China," says the report.

CIVIL APPLICATIONS

Beyond defence, UAS hold immense potential for civil applications spanning agriculture, infrastructure monitoring, disaster management, environmental conservation, and aerial logistics. India's agricultural sector, in particular, stands to benefit significantly from the adoption of UAS for precision farming, crop monitoring, and pest control, thereby improving productivity and sustainability. Similarly, UAS-enabled aerial surveys and monitoring expedite infrastructure development projects while minimising costs and risks associated with conventional methods. The civil market is likely to be several orders of magnitude larger than the military one and therefore will provide an added fillip to the UAS sector.

REGULATORY FRAMEWORK AND ECOSYSTEM SUPPORT

Realising the transformative potential of UAS, India has established a conducive regulatory framework and ecosystem support to facilitate their safe and efficient integration into airspace. The DGCA has formulated regulations governing UAS operations, ensuring compliance with safety standards and privacy norms. Furthermore, initiatives like the National Drones Portal and UAS Traffic Management (UTM) systems are fostering a conducive ecosystem for UAS innovation, testing and deployment.

CHALLENGES AND WAY FORWARD

Despite significant strides, India's journey towards Aatmanirbharta in UAS is not without challenges. Technical complexities, regulatory constraints, cybersecurity concerns and the need for skilled manpower pose formidable hurdles that require concerted efforts from government, industry and academia. Addressing these challenges necessitates continued investments in research and development, capacity building, and collaborative partnerships to propel India towards technological self-reliance and global leadership in unmanned aircraft systems.

On a positive note, both the public and private sector are involved in UAS development. Says the IDSA report: "While India is establishing a strong aviation ecosystem by bringing together all stakeholders, including the government, promotional bodies, DPSUs, tri-services, academia and industry partners, experts believe that in the next 10 to 15 years, private Indian industries will be the crusaders for the government in defence production, particularly in the UAV vertical. Correlation between industries and the economy will also be crucial in the future."

CONCLUSION

India's pursuit of Aatmanirbharta in unmanned aircraft systems reflects its commitment to harnessing indigenous innovation and technology for national development and security. By fostering indigenous capabilities, nurturing strategic partnerships and addressing regulatory challenges, the country is poised to emerge as a key player in the global UAS market while catering to diverse defence and civil applications. As India accelerates its journey towards self-reliance in this critically important sector, it not only strengthens its defence posture but also unlocks new avenues for economic growth, employment and innovation.

– The writer is a globally cited defence analyst. 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 the views of ***Raksha Anirveda***

India's pursuit of Aatmanir-bharta in unmanned aircraft systems reflects its commitment to harnessing indigenous innovation and technology for national development and security. By fostering indigenous capabilities, nurturing strategic partnerships and addressing regulatory challenges, the country is poised to emerge as a key player in the global UAS market

SPECIAL FEATURE

THE RISE OF AERIAL

The combat worthiness of Unmanned Aerial Systems (UAS) has been unequivocally proven. Their critical role in recent conflicts has only bolstered their extensive track record of success on the battlefield. The system's versatility has garnered global attention, prompting substantial investments in research and development led by the US. India must increase its efforts in this domain to bridge the gap

By **RAVI SRIVASTAVA**

Since the Israeli UAVs inflicted significant damage on the Syrian Air Force in 1982, the concept of battlefield utilisation of unmanned remotely operated flying machines has undergone significant evolution. From its modest beginnings in September 1917 to modern-day high-endurance, high-altitude combat UAVs, the transformation and operational performance of these systems have been breathtaking. The most compelling aspect is that these platforms offer a three-dimensional perspective at a remarkable low cost, a capability previously exclusive to fighter aircraft.

COMBAT VERSATILITY

The US, Israel, Turkey, and China are widely recognised as leaders in this revolution of modern warfare. The past two decades have seen substantial advancements and refinements over the initial concept of "flying bombs" that ignited imaginations. As these unmanned aerial tools evolved, they were labelled with various terms such as Aerial Torpedoes, Remotely Piloted Vehicles (RPV), Drones, Unmanned Aerial Vehicles (UAV), and, more recently, Unmanned Combat Aerial Vehicles (UCAV), each highlighting certain specific features and reflecting the preferences of their developers. However, the term Unmanned Aerial Systems (UAS) is gaining favour as the concept and infrastructure become more sophisticated, encompassing multiple components within a unified system.

AVENGERS

OODA LOOP

UAS in modern times are leading the fight in a combat field whether it is stealth surveillance, directing fire from fighter aircraft or the artillery on the enemy position, acting as a communication relay hub, working as the pathfinder, delivering crucial situational awareness in urban warfare or carrying warheads themselves affording real-time engagements of time-sensitive targets. The major dividends to the commander have been the elimination of the need for elaborate sensor-to-shooter coordination. With the arrival of long-range and long-endurance combat drones cruising at altitudes of 30,000ft or above, controlled through secure satellite links, there's no delay in identifying sensitive targets and delivering the payload at the click of a button.

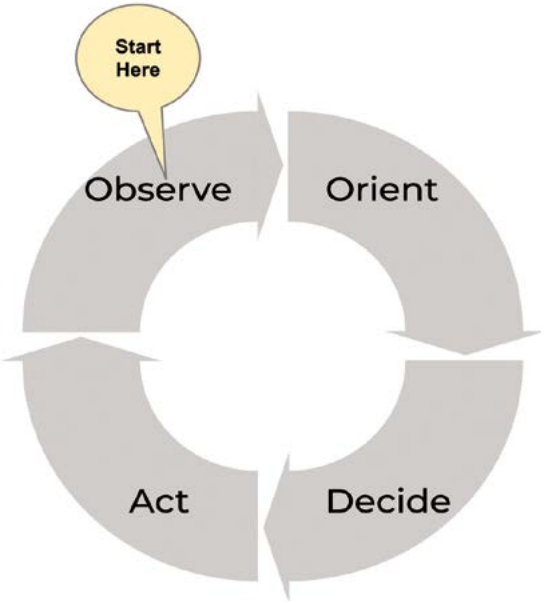
John Boyd, the US Air Force veteran had once advocated about the OODA (Observe, Orient, Decide, and Act) loop, as the crucial factor in combat that decidedly influences the outcome of a duel. His theory was by and large accepted by militaries the world over. As the UAS evolved, combat drones became a flying platform miniaturising the entire battle theorem. It offered everything to the command centres enabling commanders to Act while removing all time lapses in between. The results became very obvious, those who possessed high-end UAS undisputedly started to dominate and dictate the modern battlefield.

The story of combat drones dominating war fronts was not only repeated but literally scripted during the September 2020 Armenian and Azerbaijan war in Nagorno-Karabakh. Azerbaijan integrated Turkish-supplied UCAVs emboldened by the success of these against Russian Air defences in the Syrian conflict. In no time the Armenian army was overwhelmed. This war has thus been distinctly regarded as the first conventional war with extensive employment of combat drones on the battlefield, scripting a victory almost by themselves. The question of whether or not the UAS should form part of the armed forces has long been answered in a thumping affirmative. What forces are now looking at is the fastest timelines these expansive systems can be deployed on the front lines.

THE COMPLICITY

Indian armed forces have been operating some of these machines since the 1999 Kargil conflict but mostly they are all ex-import and carry certain limitations due to challenging terrain and battlefield conditions. Being the extremely sought-after and high-end technology, foreign governments are very hesitant to share them in the first place. In India's context where it needs to factor the active border management in its Western and Northern theatres both, the dynamics become very challenging.

The complicity between India's Northern and



The harsh reality is that high-end expertise like stealth aircraft, combat drones, network-enabled command & control, space-based surveillance & communi-cation, aircraft carriers, nuclear submarines, and long-range missiles will unlikely be shared by any country that may possess them today

SPECIAL FEATURE

For Indian armed forces the 'global realism' has made a strong case to go with probably second-best domestic systems rather than the best foreign import. Possession of state-of-the-art weapons is one thing but keeping them up and running is another challenge altogether. A sophisticated system like combat UAS needs heavy maintenance and spare support

A video clip of Turkish drone strike on Syrian regime positions

Western adversaries often makes the resource allocation very dynamic to effectively counter them. It is believed that the Indian armed forces mostly factor that the technology and weapon -systems available with China may in fact show up in its Western Theatre as well. Given the geopolitical considerations, the appearance of even the Turkish systems cannot be ruled out. Such eventualities though catered for, also create increased complications for the armed forces, which therefore must be provisioned with matching resources, if not the better ones.

There are some critical enabling technologies as demonstrated in various new-generation conflicts from Operation Desert Storm to the ongoing Ukraine war. The harsh reality is that high-end expertise like stealth aircraft, combat drones, network-enabled command & control, space-based surveillance & communication, aircraft carriers, nuclear submarines, and long-range missiles will unlikely be shared by any country that may possess them today. The end result will be far less than satisfactory and a product of compromises, with which one cannot go to war and think of winning it!

GLOBAL REALISM

For India, all these technologies and platforms must therefore be the focus for domestic R&D and participation from the private sector to help economise and diversify the products. The good part is the country has already achieved considerable self-reliance in most of the critical technologies but the true combat-worthy UAS still remains an arena to master. For Indian armed forces the 'global realism' has made a strong case to go with probably second-best domestic systems rather than the best foreign import. Possession of state-of-the-art weapons is one thing but keeping them up and running is another challenge altogether. A sophisticated system like combat UAS needs heavy maintenance and spare support. This has been the most troubling case witnessed by Middle-East countries that jumped to import Chinese Wing Long combat drones. Seeing no other country willing to part with such sensitive platforms UAE, Egypt, Saudi Arabia, and Pakistan quickly bought them. However, the teething maintenance and unreliable supply of spares have kept their machines mostly grounded.

The lesson is, that India needs its own manufacturing of high-end combat UAS systems which will allow our military unrestricted exploitation and assured serviceability of these force multipliers even in the heightened threat scenarios. It is commendable that DRDO and some private sector firms have shown promising approaches for the development of UAS. The government's push will further encourage them to expand their efforts as the actual requirements will make it a good proposition for industries as well.

It is estimated that the US has made an investment of more than $2.6 billion in 2023 alone in its UAS program. Similar high investments are being expected from other major powers in the UAS and counter-UAS systems in the next few years. These systems today have turned out to be an essential component not only for the three services but even the paramilitary forces that extensively use them. Domestic consumption in the form of its civilian utility is also highly promising. The entire gamut of technology and its application makes for a heady mix of demand for the same, it's the assured supply that everyone is waiting to finally fructify!

–The writer, with expertise in security and geopolitics, regularly contributes to national publications. His insightful articles can be found on the popular website newsanalytics.in, where he delves into various aspects of geostrategic affairs. The views expressed are of the writer and do not necessarily reflect the views of ***Raksha Anirveda***

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SPECIAL FEATURE

THE QUEST FOR FUTURE AIR DOMINANCE

India continues to place a high premium on border security because of the country's complicated geopolitical setting and persistent security risks. UCAS can minimise collateral damage and civilian losses by using sophisticated sensors, payload cameras, and communication systems to track rebels, monitor suspicious activity, and execute precise targeted strikes. This will improve our defence ability to protect territorial integrity by providing real-time situational awareness

DRDO's flying wing UAV

By **ALINA USMANI**

What comes to your mind when you think of a Combat Drone? The history of Unmanned Combat Aerial Systems (UCAS) in India begins in the early 2000s, a time when the country's own drone technology saw tremendous growth and innovation. India first concentrated on using drones for surveillance and reconnaissance, setting the way for the development of more sophisticated UCAS capabilities. The foundation was laid with the Light Canard Research Aircraft (LCRA) project by the National Aerospace Laboratories (NAL) in the 1980s, which later influenced the Rustom design. The Defence Research and Development Organisation (DRDO) with the Aeronautical Development Establishment (ADE) in the 1990s came up with India's first UAV, Nishant, but it had a few operational limitations. The creation of Nishant and Lakshya was crucial in forming India's unmanned aerial systems competence. The mid-2000s witnessed the emergence of projects aimed at developing armed UCAS capable of conducting precision strikes with minimal human intervention. These efforts culminated in the development of prototypes such as the Rustom series and armed UAVs like Ghatak, designed to meet the diverse operational requirements of the Indian Armed Forces.

As the demand for UCAS increased globally for military operations, India embarked on initiatives to enhance its combat drone capabilities. In India, UCAS are being assessed for use in battle, reconnaissance, and surveillance, among other areas. The use of UCAVs has revolutionised border monitoring and counterinsurgency operations, greatly enhancing India's defence capabilities. Despite notable progress, India faced several challenges in the development and deployment of UCAS. Technical hurdles, budget constraints, and regulatory issues posed significant obstacles to the timely realisation of indigenous combat drone projects. Moreover, India's reliance on imported technologies for critical components underscored the need for greater self-reliance and indigenous innovation in defence manufacturing.

India has been working harder in the last few years to improve its UCAS capabilities, in line with the government's "Make in India" policy and encouraging domestic defence manufacturing. The incorporation of cutting-edge technologies and the successful test flights of prototype UCAS show India's

dedication to becoming a self-sufficient combat drone manufacturer. Moreover, partnerships with top defence research institutions and commercial enterprises have reinforced India's technological superiority in unmanned aerial systems development

While India possesses a variety of UAVs for monitoring its sensitive borders, it has embraced the challenge of developing advanced defence and attack systems within the context of modern network-centric warfare. As highly advanced drones such as 'Predators' equipped with precision-guided missiles emerge in the West, India is also on the path to deploying its indigenous combat-ready smart drone in the foreseeable future.

India has acquired expertise in pilotless target aircraft systems with the creation of the Lakshya, from which there has been a product improvement in the form of the Abhyas high-speed expendable aerial target. The autonomous stealth UCAS Ghatak's successful flight demonstration is evidence of the nation's advanced technological readiness, armed with missiles and precision-guided munitions. It features a flying-wing design with an internal weapons bay and a turbofan engine. Previously named AURA, standing for Autonomous Unmanned Research Aircraft, the design of the Ghatak UCAV is carried out by ADA, with the prototype expected by 2025.

Medium-altitude long-endurance (MALE) unmanned aerial systems with various configurations are being built for the Indian armed forces. Such long-range UAVs are necessary not just for effective Intelligence, Surveillance, and Reconnaissance (ISR) but also for combat-capable anti-air defence.

The Indian defence market is witnessing a significant emergence of advanced technologies in loitering munitions and kamikaze drones. These unmanned aerial systems are garnering considerable attention from various defence and drone start-ups in India, actively engaged in their research and development endeavours. Loitering munitions and kamikaze drones are gaining traction primarily due to their effectiveness in conducting precise short-distance strikes at a relatively low cost. This cost-effectiveness,

While India possesses a variety of UAVs for monitoring its sensitive borders, it has embraced the challenge of developing advanced defence and attack systems within the context of modern network-centric warfare

SPECIAL FEATURE

coupled with their ability to deliver targeted strikes with precision, has sparked substantial interest from Indian military entities, leading to notable procurement requirements.

These drones are equipped with warheads and designed to loiter over the battlefield, leveraging advanced high-definition cameras and tracking systems to identify and lock onto targets. Once a target is identified, these drones execute a calculated descent, ensuring precise destruction of the designated target. This capability significantly enhances the Indian military's operational effectiveness, providing a potent tool for engaging adversaries with minimal collateral damage.

Furthermore, there is a growing demand for First Person View (FPV) drones within defence setups. FPVs offer the advantage of rapid deployment and low acoustic signatures, enabling swift and discreet surveillance, target detection, and engagement. The ability of FPVs to provide real-time situational awareness enhances the operational capabilities of defence forces, enabling them to respond swiftly to emerging threats on the battlefield.

Leveraging drone swarm technology offers the potential to deploy real-time battalion and troop support on the battlefield. This innovative concept involves the coordinated operation of multiple drones acting as a cohesive unit to achieve various military objectives. Drone swarms offer flexibility and adaptability in combat scenarios. They can be programmed to autonomously adjust their formations, trajectories, and objectives based on real-time situational awareness and changing battlefield dynamics. Individual drones within the swarm can be equipped with different payloads and sensors tailored to specific mission requirements, allowing for a diverse range of operational capabilities within a single swarm. This dynamic responsiveness enables drone swarms to effectively respond to evolving threats and support ground troops in dynamic combat environments. Drone swarms have the potential to enhance force protection by serving as decoys or providing cover for friendly forces during engagements with hostile elements.

India continues to place a high premium

on border security because of the country's complicated geopolitical setting and persistent security risks. UCAS can minimise collateral damage and civilian losses by using sophisticated sensors, payload cameras, and communication systems to track rebels, monitor suspicious activity, and execute precise targeted strikes. This will improve our defence ability to protect territorial integrity by providing real-time situational awareness.

India has a large marine domain that includes a vast coastline and important sea lines of communication, emphasising the necessity for strong maritime security and monitoring systems. When UCAS are fitted with the ability to monitor the maritime environment, they may be extremely useful in protecting maritime rights, thwarting pirate activities, and improving maritime domain awareness. They act as force multipliers, expanding the Indian Air Force's operational reach and sustaining its presence in contested or hostile environments to augment its capabilities.

Nonetheless, there are certain difficulties associated with implementing UCAS in the

The Indian military can establish a networked and coordinated defence infrastructure by integrating UCAS with current aerial and ground-based capabilities. A viable resolution is that Unmanned Ground Systems and Unmanned Aerial Systems work together to overcome these obstacles

Indian setting, including several serious technical challenges such as indoor navigation, package identification, and limited drone flight autonomy. The Indian military can establish a networked and coordinated defence infrastructure by integrating UCAS with current aerial and ground-based capabilities. A viable resolution is that Unmanned Ground Systems and Unmanned Aerial Systems work together to overcome these obstacles. This configuration will be effective in terms of intelligence sharing, coordination, and communication, greatly increasing their utility for tasks like route planning, transportation, surveillance, and rescue operations.

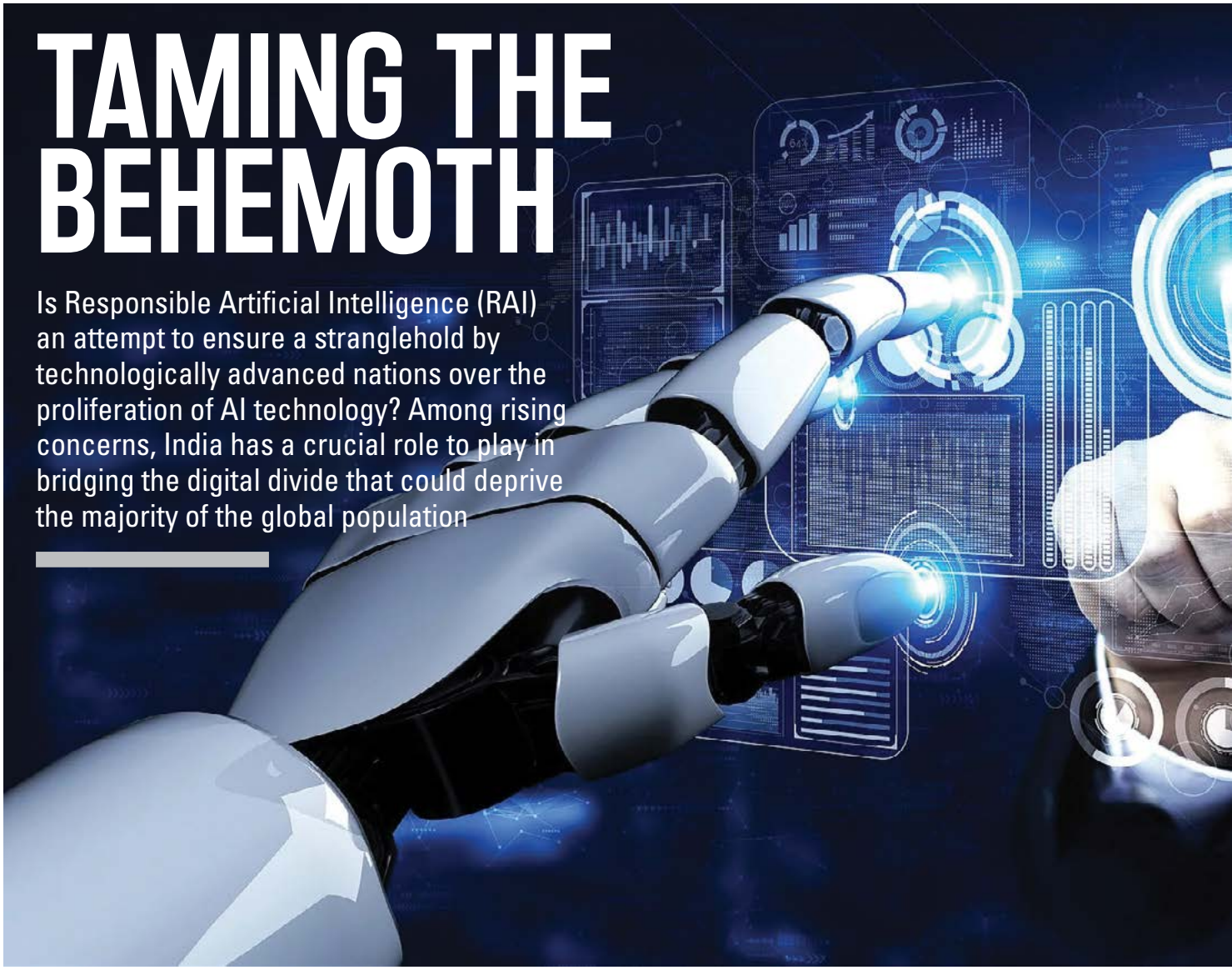
Recognising the importance of proficient personnel in operating these advanced drone systems, there is a concurrent rise in the demand for drone-specific training programs. All branches of the Indian armed forces are actively seeking specialised training initiatives tailored to the operation and utilization of UCAS and other advanced drone technologies. This emphasis on training underscores the Indian defence system's commitment to effectively integrate these cutting-edge capabilities into its operational ecosystem. In conclusion, without a doubt, UCAS will add a new perspective to the idea of air power and its uses in the Indian context.

Looking ahead, India envisions a future where UCAS play a central role in safeguarding national security and maintaining strategic superiority. The integration of artificial intelligence, autonomous navigation systems, and advanced sensors will enhance the operational effectiveness of Indian UCAS, enabling them to adapt to dynamic battlefield scenarios. By advancing its indigenous research and development capacity and reducing dependence on external sources, coupled with policy reforms to facilitate defence innovation, India's UCAS program will be propelled towards greater success.

–The writeris an Aerospace engineer and UAS professional, Founder & Head of UAS & Drone Wing at International Women Professionals in Aviation & Aerospace (IWPA est 1967). She currently holds the position of Manager Business Development at DroneAcharya Aerial Innovations Limited. The views expressed are of the writer and do not necessarily reflect the views of ***Raksha Anirveda***

INSIGHT

TAMING THE BEHEMOTH



Is Responsible Artificial Intelligence (RAI) an attempt to ensure a stranglehold by technologically advanced nations over the proliferation of AI technology? Among rising concerns, India has a crucial role to play in bridging the digital divide that could deprive the majority of the global population

By **MAJOR GENERAL LAV BIKRAM CHAND**

Artificial Intelligence (AI) is now the path to the future. Yet, it has been a breakthrough development of the mid-20th century. Coincidentally, AI conceptualisation in the 1950s ran parallel to the Atomic Age. Their evolutionary rates differed, and both were viewed as posing existential threats to humanity. In the 21st century, atomic power and AI have become intertwined. Both have unmatched benefits as well as inherent dangers. One operates in the physical, sub-atomic domain, while the other operates in the cognitive domain. The former can mutate the body, while the latter can mutate the mind.

Weaponised atomic energy is a weapon of mass destruction, and militarised AI has the potential for mass chaos and disorder. The devastating powers of the atom bomb and its horrors were witnessed by the world post-Hiroshima and Nagasaki. Nuclear arsenals during the Cold War became tools for a balance of power. The liberalisation of their use was never an objective of the nuclear powers. International strategic decisions were dictated by a select few. Nuclear dominance revolved around stringent technology control and non-proliferation.

AI, on the other hand, operates in the virtual and digital world. It is like an iceberg; 20% is discernible, and 80% is in the virtual world. Its virtual nature poses many challenges in its control and regulation. Another unique characteristic of AI is that while harnessing nuclear energy requires expertise and technology, AI is within easy reach

of the IT masses and minds. It just needs "Maths + Programming to develop Algorithms," and these "Algorithms + Data Result in ML Models." These models, trained over a robust IT infrastructure (Central or Edge), generate AI. Any logical and mathematical mind can develop an AI system. In this ecosystem, the implementation of non-proliferation of AI for military (weaponised) purposes would be extremely challenging.

The launch of a nuclear attack causes mass-scale physical destruction with long-lasting effects of radiation. Similarly, AI, when used to target a society, can have long-lasting psychological impacts. Deepfakes and extensive use of cyberspace to launch psychological operations have the potential of eroding not only the character but also the culture of a society. Weaponised AI, both kinetic and non-kinetic, makes it a potent weapon of destruction. Unlike range restrictions for missiles, AI has global reach with no range restrictions. The virtual nature of non-kinetic AI attacks offers anonymity and deniability.

Participants at the Summit on Responsible AI in the Military Domain 2023 (REAIM 2023) held at The Hague on February 15-16, 2023 acknowledged that the use of AI in the military domain is still fuzzy. There is a lack of knowledge on the risks involved in the use of military (weaponised) AI, and more assessment needs to be done. Two definitive, undisputed derivatives of the meeting were, firstly, the great potential of AI as a service to humanity in the civil domain, and secondly, that weaponised AI must have a man-in-the-loop. The absence of this vital human interface in AI-governed decision-making in the use of military weapon systems has the potential for escalation into an all-out nuclear war.

India has an inherent advantage of an abundance of skilled individuals qualified in fundamental AI, which is an important resource for algorithm development, Exploratory Data Analysis (EDA), and the testing and training of AI models. There is a flip-side too. Due to the slow start in capturing digital data, the lack of labelled data is a major stumbling block for India's AI advancement. A positive indication is that digitisation and data hygiene are gaining momentum in India, though at an excruciatingly slow pace.

PEEP INTO TIMELINES OF AI DEVELOPMENT

Many scholars attribute the study of intelligence to as early as the 4th century BC when syllogistic logic was first introduced by Aristotle. However, Alan Turing is often considered the Father of AI due to his groundbreaking work on the Turing Machine, which brought about the formalisation of algorithms and computation. Back then, computation power and data storage capacity were grossly inadequate to support the growth of AI. AI Model testing and training is a result of millions of iterations of an algorithm. Processors in early 80s, could only store and execute codes. They were incapable of remembering what they did in earlier sequences of code executions. In the 1980s, expert systems were introduced, but they continued to remain expensive and lacked the ability to perform desired levels of statistical analysis and prediction. Despite the lack of governmental funding in the developed world, AI flourished in the 1990s and saw rapid development. The era of big data, neural networks, and deep learning is upon us,

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INSIGHT

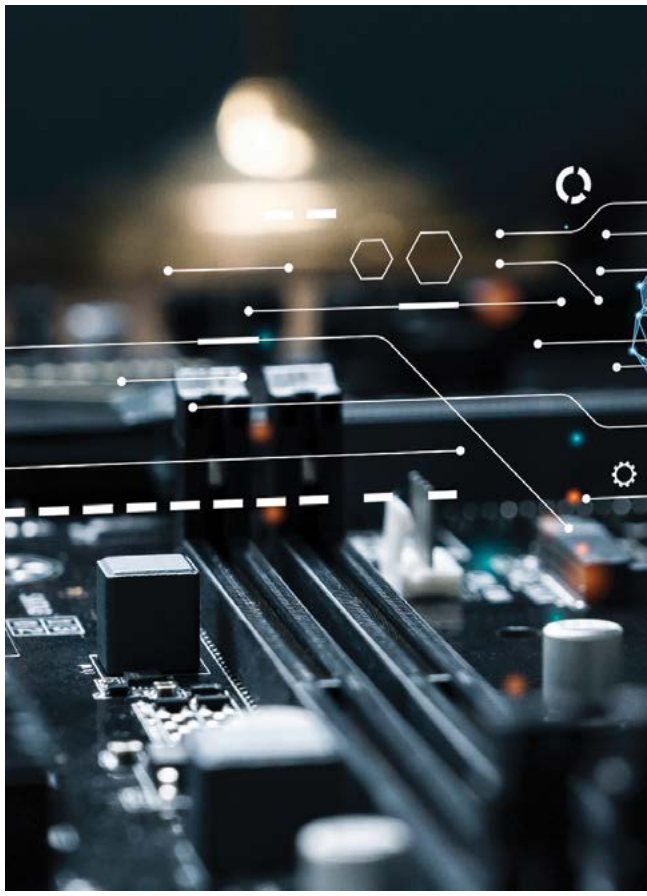
with processors now specifically designed for AI functionalities. Even the current processors on our mobiles are AI-capable.

AI has already progressed beyond the first stage of its deployment, known as Machine Learning (ML) or Narrow AI stage. It is now advancing into the stage of Intelligent AI (General AI) and is expected to become reliable Cognitive AI (Super AI) in the next 30-40 years, if not earlier. The fast pace of AI development and acceptance in civil as well as military domains has been a wakeup call for all developed and developing nations to commence exercising control over AI. Technologically advanced nations are compulsively dependent upon AI and automation for sustained growth and as a substitute for aging population. The complexity involved in enforcing and monitoring control over AI forced the developed nations to commence influencing the general public and garnering support for the "Responsible use of AI". Whether it remains mere lip service or evolves into concrete action will only be revealed with time.

India during the 1990s was totally dependent on the import of the entire set of technology. The late 20th century saw a major shift in the IT sector. India emerged as the largest IT and telecom market. The 21st century saw Indian techies being recognised as an expert workforce. During this period many Persons of Indian Origin (PIOs) held strategic posts in technology and R&D verticals. These same people are now CEOs / CTOs in leading IT MNCs. The development of numerous Data Analysis Algorithms has been attributed to PIOs. India is producing Unicorns in IT, AI, semiconductors, and electronics at a fast rate. The road to AI advancement is clear, and the government is removing barriers, if any.

In the context of the 21st century, another important and undisputed fact is that any advancement in AI is dependent upon data. Information and Communication Technology (ICT) infrastructure is the nervous system of data (neurons). ICT must support AI at the edge as well as in the cloud. ICT and AI complement each other and are inseparable. ICT provides computational power, storage, and transportation of data, which are the foremost requirements of successful and accurate AI. It would be prudent for India to build AI organisations over the existing Information Communication Technology, Electronics, and Cyber (ICTEC) structures and not in silos under various ministries / departments. Divorcing the two or dealing with them in isolation is a sure-shot call for failure.

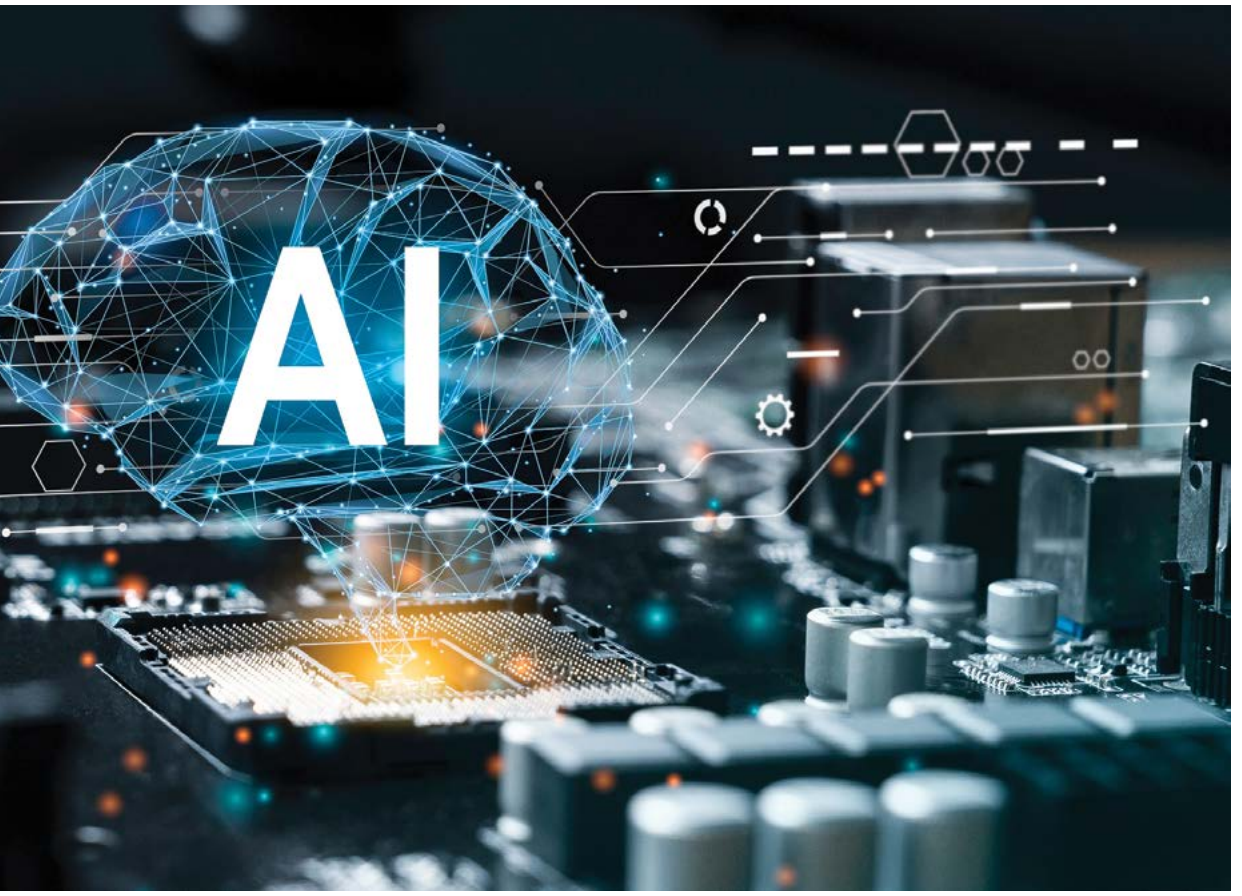
Participants at the Summit on Responsible AI in the Military Domain 2023 (REAIM 2023) held at The Hague on February 15-16, 2023 acknowledged that the use of AI in the military domain is still fuzzy. There is a (deliberate) fuzziness created on the risks involved in the use of military (weaponised) AI, and more transparency and collaboration is desirable



RESPONSIBLE AI

If the world cannot come to a consensus on the clear and immediate danger of Climate Change, what would be the efficacy of a common roadmap for the ethical and responsible use of AI drawn out by them? I don't see any commonality of purpose, and it doesn't arouse much confidence. Is Responsible AI (RAI) an exercise in perception management? Or is it an attempt to ensure a stranglehold by developed nations over the proliferation of AI technology? The latter is certainly a matter of great concern. Control over AI by a select few and their attempt to deny AI to the world at large or provision it at a huge financial cost, in my mind, is unethical.

In the ambiguous complex domain of cyber-digital space, consensus is extremely difficult to arrive at. The virtual realm makes it impossible to evaluate adherence to agreed rules. Enforcement of the Acts and laws governing AI poses many challenges for a monitoring body. In the 21st century, technology ascendancy is the defining yardstick of global power. There is a race between technology giants to convert this gap into an unfathomable crevice. Data is the new currency. "Money Talks" has been replaced by "Data Talks".



The USA's ownership of almost all relevant data servers gives it an unbeatable advantage and a position of unquestionable and unchallenged AI front runner. It is no surprise that the USA has enacted laws related to AI that are favourable to them and it make all-out efforts to retain the insurmountable lead and advantage

Data is the universal fuel for AI, and unfortunately for the world, 30% of servers are located in the USA. Adding to this scarcity, platforms like Facebook, Google, Twitter, WhatsApp own most of the data generated over the internet. In today's digital world, whoever controls data controls the AI world.

The AI race and eagerness to control it were very much evident during REAIM 2023, Hague. Sixty countries participated in REAIM 23. Russia, undoubtedly an important world technology leader of today, was not invited. Israel participated but was not a signatory. The USA's ownership of almost all relevant data servers gives it an unbeatable advantage and a position of unquestionable and unchallenged AI front runner. It is no surprise that the USA has enacted laws related to AI and will make all-out efforts to retain the insurmountable lead and protect its data dominance.

For the benefit of the readers, let me highlight the key issues flagged by some of the significant participants in REAIM 2023.

The US Secretary of State said, "AI-Weapon systems should involve the appropriate level of human judgment."

China representative Jian Tan said, "Countries should oppose seeking absolute military advantage and hegemony through AI and work through the United Nations." (Come on world wake up and smell the coffee)

Human Rights Watch challenged the US to define the appropriate level of human judgment and not to tinker with political declarations but to begin negotiating internationally binding laws. AI expert Academia called the US statement a missed opportunity.

Incidentally, India did not participate in the REAIM 2023 at Hague. But the statements made by India during GPAI 2023 have far more relevance and impact than overshadowed REAIM Hague statement. The Indian government and think tanks are fully aware of the dangers of AI. It is praiseworthy that India has taken a decision on AI as "AI for All". In the recently concluded GPAI Summit in New Delhi, PM Modi extended an invitation to the Global South to cooperate in the development of AI. Enhancement of AIRAWAT (An Automated System to Increase transparency and accountability in social welfare schemes of India) and AI in agriculture were flagged by the PM as priority areas. India has demonstrated her

intent to be a responsible user of AI and to emerge as a provider for the technology-deprived Global South. Some may see it as India's attempt to garner votes and increase her global influence. I see it as the furtherance of her policy of "Vasudhaiva Kutumbakam" (world as a family).

INTERNATIONAL LAWS GOVERNING AI

International laws governing the military use of AI are yet to be formalised. In 2019, the USA and China participated in a Dialogue on the "Code of Conduct on Artificial Intelligence in Military Systems" under the aegis of the Centre of Humanitarian Dialogue (HD). The outcome was not a law but a code of conduct. The governing factor of this Code of Conduct was adherence to the existing Laws Of Armed Conflict (LOAC). Three major aspects stand out that have a direct bearing on laws governing AI.

LOAC are of the pre-AI era, and these need to be AI-inclusive.

The Draft Code of Conduct did not aim at defining laws or limiting the use of AI in military systems. It considers the impact of AI in weapons, related intelligence, and targeting systems as they would be used in real-world conflicts.

All players, without exception, are focusing on laying down principles of Responsible AI in Military. The main guiding principles are "Responsibility & Accountability", "Explainability & Traceability", "Reliability", "Governability", and "Bias Mitigation". An interesting aspect is that only NATO has added "Lawfulness" to the guiding principle list. I am sure others will follow suit, but the degree of unlawfulness would vary.

International legal rules are often general and abstract. For universal acceptability, they are meant to cover a large spectrum of actors and situations. Accordingly, Responsible AI (RAI) principles guide states on how to make military and defence-related applications of AI compliant with these guidelines. In the instances where the rules are in sync with the laws; RAI is implementable. But in the scenario

AI ECOSYSTEM IN INDIA: STRENGTH	WEAKNESS
• National strategy of automation • Political will and supporting policies • Large IT skilled manpower; need fine-tuning to up/re-skilling • Policy of AI for All • GoI's objective of benefits for the World (Primarily Global South) has been accorded equal priority as its business profits • Reverse brain drain • Fastest producer of start-ups and unicorns in the world	• Lack of clarity on AI amongst policy makers and supporting consultancy organisations. • Lack of Digitised labelled data • Digital Hygiene • Absence of world class tech minds that can roll out AI algorithms. • Weak AI eco-system and ICT infrastructure • Dependence on the West for data centres and data science techniques • Lack of culture of policy updates / revision or refinement • Inadequate eco-system in terms of deep technology development, incubation and commercialisation • Dependence on imports for AI enabled processors and electronics • Systemic failure of India's supply chain management with tendency of banning deployment of an electronic device / system without giving alternatives sources
OPPORTUNITIES	**THREATS**
• Globally, implementation of AI and Robotics is witnessing fastest growth. • AI has shortest development and commercialisation cycle. Offers quick returns. However, rate and accuracy of AI model is directly proportional to the quality of data. • India emerging as champion of Global South cause. • India's Chairmanship of GPAI • Partnerships between India's and world's smart Gen Z	• Lack of production base of AI enabled processors and electronics • Miss-information and fear mongering in AI • Widening digital divide between Global South and Global North • The world's over dependence on electronics from China. As per 2022 reports, global share of electronics production of China was 42%, followed by USA at 17% and India at 3.3%

where the laws are silent or ambiguous, the meaningfulness of RAI is debatable. Unfortunately, in the current scenario, the ambiguity outweighs clarity. The Codes of Conduct on RAI focus on technical preconditions on the design and development of AI-assisted Military Systems. Enforcing these would always remain a challenge.

SWOT ANALYSIS OF INDIAN AI

India has the potential and the national will to improve the lifestyle of rural and weaker sections of society. India has a vision of #AI for All – Transformation for Greater Good. The focus areas are agriculture, health, education, smart cities, and smart transportation. India's AI transformation strategy is laid down in the "National Strategy for AI" prepared by Accenture for NITI Aayog and AI Task Force Report by the Ministry of Commerce and Industry think-tank. AI transformation has multidimensional ramifications and directly determines rules and ways to do business efficiently. A SWOT analysis is tabulated on the page.

TAKEAWAYS

India harbours a powerful vision of AI for All. Its commitment to inclusiveness, coupled with its leadership position in GPAI for the next year, presents an opportunity to champion the cause of the Global South. Collaborating with global partners, India, during its tenure as lead chair, must spearhead the formulation of an international policy on RAI, a roadmap for AI innovations and commercialisation, and an actionable plan for its implementation. Collaboration among the 29 GPAI members, including the USA, Japan, South Korea, Germany, etc., can transform identified weaknesses in the SWOT analysis into strengths. Ashwini Vaishnaw, Minister of Electronics and Information Technology and Lead Chair of GPAI, must solidify the policy, roadmap, and apex organisation for AI and ICTEC in India.

Without unified organisational structures, valuable expertise and organisational knowledge could be lost. In my opinion, the Ministry of Defence (MoD) and the Ministry of Electronics and Information Technology (MeitY) have ample resources and should collaborate to coordinate ICTEC, Cyber Space, and AI efforts. The appointment of a serving Lt Gen from the Corps of Signals as the head of the National Cyber Coordination Centre is a positive step in this direction. Equipping the NCCC with adequate resources to facilitate collaboration and coordination between all stakeholders in ICTEC and AI is imperative.

The 21st century presents tremendous opportunities for India to make its mark. The burgeoning number of young technology professionals holds the potential to propel India into the modern digital age. Technology is the linchpin of economic and politico-military power, with AI and robotics serving as primary catalysts for growth. Indian human resources must transition from mere system operators, programmers, and coders to system architects and process designers and developers. India's chairmanship of the Global Partnership in AI provides a platform for it to ascend to the leadership ranks in AI. However, ambition and enthusiasm must be matched with tangible actions and results. In my view, study of AI roadmaps and implementation plans reveals that India is falling short in fully leveraging this opportunity.

ICTEC and AI should be treated as interconnected entities. A holistic ecosystem encompassing both, with a focus on R&D and production, needs to be developed with a cohesive roadmap. Fragmentation of ICTEC and AI under separate organisational heads will not yield optimal results. An overarching national-level organisation should be established to formulate ICTEC and AI doctrines and govern the collaborative development, deployment, and protection of ICTEC and AI. All government departments/agencies, academia, R&D institutions, and industry players involved in ICTEC and AI must adhere to the guidelines and advisories issued by this apex organisation.

–The writer, a member of the Corps of Signals, brings extensive expertise in Electronic Warfare, Strategic ICT Infrastructure implementation, and Tactical ICT infrastructure development. With a PG in Computer Science from IIT Madras and another in AI for Leaders from Austin University, his current focus lies in ICTEC, AI and Robotics

INNOVATION PARTNERSHIP

INDUS-X BOOSTS INDO-US DEFENCE COLLABORATION

Since its launch in June 2023, the INDUS-X has successfully brought together the government officials, defence companies, investors, accelerators and universities in India and the United States to collaborate and accelerate defence technology innovation between the two nations

By **SRI KRISHNA**

With increasing collaboration in the defence sector between India and the US, the two-day bilateral defence cooperation meeting, called the India-US Defence Accelerator Ecosystem (INDUS-X), held in New Delhi from February 20 marked a significant milestone in defence cooperation between the two countries in defence innovation.

The INDUS-X launched in June 2023 during the visit of Prime Minister Narendra Modi to US has driven the expansion of bilateral ties in defence innovation. It was during this visit that the US Department of Defence (DoD) and Indian Ministry of Defence (MoD) launched the INDUS-X, guided by a bilateral collaboration agenda.

The INDUS-X has continued to advance the commitment by the US and Indian national security advisors to build a defence innovation bridge between the two countries under the initiative on Critical and Emerging Technology (iCET). INDUS-X facilitates, with the support of the US and Indian governments, partnerships among the US and Indian defence companies of various sizes, incubators and accelerators, investors, and universities.

This defence collaboration assumes significance in the wake of the continuing border tension with China which even after over 14 rounds of talks remains unresolved, and the prevailing tension on the border with Pakistan on India's western front.

There have been numerous achievements under INDUS-X including the US DoD's Defence Innovation Unit (DIU) and Indian MoD's Innovations for Defence Excellence (iDEX) coordinated to design, launch, and select winners for the first round of INDUS-X joint challenges, in which companies competed to identify commercial technology solutions that address warfighter challenges. HydroNet, OceanComm, PierSight, Pixxel, and Sea-Gal Technologies collectively won $300,000 to develop technologies on maritime intelligence, surveillance, and reconnaissance (ISR) and undersea communications. AlKairos, Airbotix Technology, Prof D Saha and Prof S Ganguly, SAR Space, and Zeus Numerix collectively got $900,000 for the same challenge topic.

During the 2+2 Ministerial Dialogue in November 2023, the US Secretary of Defence and Indian Minister of Defence announced the INDUS-X Gurukul, a hybrid education and information series for the US and Indian defence start-ups. In the series, experts convened with defence companies to discuss a range of topics that include harnessing private capital, navigating export controls, and building industrial partnerships. The Gurukul Series, was launched by DIU's National Security Innovation Network (NSIN) and iDEX, on February 9 with an inaugural virtual session on sourcing private capital. A hybrid session on technology export control policies and regulations followed at the February 2024 INDUS-X Summit in New Delhi.

FedTech, as well as IIT Hyderabad in partnership with Hacking4Allies, organised workshops for over 120 defence start-ups on best practices for navigating the US and Indian defence establishments. Indian and the US universities also hosted three academic workshops to exchange best practices on technology transfer and licensing, the role of the government as a customer, and advancing research in emerging defence technology domains, including space.

At the 2024 INDUS-X Summit, the US and Indian government officials, researchers, investors, technology incubators and accelerators, start-up leaders, and defence executives convened to discuss next steps for INDUS-X. The US-India Business Council (USIBC) and

US Secretary of State Antony Blinken, Defence Secretary Lloyd Austin with External Affairs Minister S Jaishankar and Defence Minister Rajnath Singh in New Delhi during annual "2+2 Dialogue"

the Society of Indian Defence Manufacturers (SIDM) organised the Summit, which assembled the US and Indian defence companies, investors, researchers, and government officials. INDUS-X will continue to expand opportunities for defence innovation.

At the February 2024 INDUS-X Summit, DIU and iDEX announced that they would open applications for two joint challenges focused on space-based ISR in the coming months.

Penn State University and the Association of University Technology Managers (AUTM Foundation), an educational non-profit are developing workshops under INDUS-X to strengthen technology transfer from academia to start-ups. The Indian Space Association (ISpA), Indian Institute of Science (IISc), Indian Institute of Technology, Kanpur and Penn State University hosted virtual workshops on building academia-industry partnerships and developing solutions for space situational awareness and the transfer of technology.

A consortium of industry, academia, and non-profit organisations across the United States and India will explore further pathways to help companies access their premier testing facilities, creating new opportunities for researchers to collaborate and for companies to demo their technology together. The following organisations announced the INDUSWERX consortium to expand testing facility access for defence and dual-use companies: FATHOMWERX, Penn State University, North Carolina State University, The Texas A&M University System (TAMUS), University of Texas at Austin, University of Maryland, Skydio, Liquid Robotics (a Boeing Company), Albers Aerospace, the Society of Indian Defence Manufacturers (SIDM), the Indian Institutes of Technology (IITs) led by Roorkee, IISc Bengaluru, Astrome Technologies, Space Pixxel, and Thermaissance.

The US-India industrial partnerships provide advanced defence capabilities and reinforce defence supply chains. Skydio, a US-based manufacturer of AI-enabled unmanned aircraft systems (UAS), announced a new partnership with Aeroarc, an Indian-based UAS manufacturer. Through this partnership, Skydio and Aeroarc will strengthen defence capabilities, expand artificial intelligence (AI) collaboration between the US and India, and support demand from global customers. General Atomics Aeronautical Systems, Inc., a US-based unmanned aerial vehicle (UAV) manufacturer, announced two partnerships to support the US-India industrial collaboration on India's future MQ-9B UAV programme. General Atomics will leverage expertise from 114ai, an Indian technology company, to jointly develop software and artificial intelligence models to process ISR data more effectively. General Atomics is also partnering

The INDUS-X was launched in June 2023 during the visit of PM Modi to US, and it has driven the expansion of bilateral ties in defence innovation

INNOVATION PARTNERSHIP

Defence Secretary Lloyd Austin, shakes hand with Chief of Defence Staff of the Indian Armed Forces, General Anil Chauhan as Defence Minister Rajnath Singh watches

At the February 2024 INDUS-X Summit, DIU and iDEX announced that they would open applications for two joint challenges focused on space-based ISR in the coming months

with Bharat Forge, an Indian engineering company, to manufacture MQ-9 components and assemblies in India for use on all MQ-9B aircraft worldwide. Liquid Robotics, a Boeing Company, highlighted their collaboration with Indian partners to develop capabilities of the Wave Glider Uncrewed Surface Vehicle (USV) to enhance maritime security through maritime domain awareness.

The MoD and DoD will also engage senior leaders from the private sector and academia through the INDUS-X Senior Leaders Forum (SLF). The US Institute of Peace (USIP) and Society of Indian Defence Manufacturers (SIDM) held the first SLF at the 2024 INDUS-X Summit to identify pathways for advancing industrial partnerships. The DoD and MoD established a Senior Advisory Group (SAG) to guide both governments' efforts to advance INDUS-X. The SAG supports all INDUS-X initiatives, including the joint challenges, the Gurukul Education Series, accelerator workshops, and investor engagement events.

For the two-day INDUS-X Summit, stakeholders from both nations had converged in New Delhi to explore emerging opportunities and chart the future trajectory of defence relations. Organised by Innovations for Defence Excellence (iDEX) under the Ministry of Defence (MoD), and the US Department of Defence (DoD), in conjunction with the US-India Business Council (USIBC) and Society of Indian Defence Manufacturers (SIDM), the summit sought to drive strategic technology partnerships and defence industrial cooperation between India and the US.

There is much in common between the INDUS-X and a similar the US-India cooperation initiative called the Defence Trade and Technology Initiative (DTTI) that was put in place during the presidencies of George W Bush and Barack Obama. Like the DTTI, the INDUS-X is breaking information silos, building networks of cooperation and reducing bureaucratic and regulatory friction between the two defence ministries. Two Washington-based scholars of US-India relations, Sameer Lalwani and Vikram J Singh, wrote that INDUS-X could become one of the most consequential US-India cooperation frameworks in the days ahead.

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

ADVANCEMENTS AND CHALLENGES IN INDIA'S DEFENCE SPACE INITIATIVES

India's defence space initiatives reflect a proactive stance in leveraging space technology for national security

By **ANIL PRAKASH**

In the realm of defence, the integration of space technology has become indispensable, revolutionising military operations through enhanced communication, remote sensing, and navigation capabilities. This fusion of technologies has significantly reduced the OODA cycle (Observe, Orient, Decide, Act) across various warfare domains, enabling heightened situational awareness and precise targeting. Moreover, the evolution of non-kinetic warfare strategies, emphasising Command, Control, Communications, Computers (C4), Intelligence, Surveillance, and Reconnaissance (C4ISR), underscores the crucial role of space-based systems in modern defence paradigms.

India's recent strides in defence space initiatives exemplify its commitment to leveraging space technology for national security. The successful demonstration of anti-satellite (ASAT) missile capabilities by the Defence Research and Development Organisation (DRDO) underscores the nation's ability to develop indigenous solutions for safeguarding assets in space. Initiatives such as Space Situational Awareness and the Technology Development Fund highlight India's dedication to fostering innovation and advanced research in defence space. Additionally, reforms within the Indian armed forces, including the establishment of

Streamlining trade relations and overcoming regulatory barriers are crucial steps towards unlocking the full potential of collaborations in the space sector, particularly with the United States

the Defence Space Agency (DSA) and Defence Space Research Agency (DSRA), signify a strategic shift towards integrating space capabilities into military operations.

Collaborations with strategic partners, particularly the United States, have further bolstered India's defence space capabilities. Agreements such as the Defence Trade and Technology Initiative (DTTI) and the Basic Exchange and Cooperation Agreement (BECA) facilitate the sharing of geospatial intelligence and foster joint endeavours in space exploration. The Quadrilateral Security Dialogue (Quad), comprising the US, India, Japan, and Australia, serves as a crucial platform for promoting regional security and cooperation in space.

India's proactive approach is evident in initiatives like 'Mission DefSpace' at DefExpo, aimed at spurring innovation in space defence through collaboration with startups and the private sector. The burgeoning satellite communication market, projected to reach USD 7.76 billion by 2029, underscores the immense growth potential in defence applications within the space sector. India's space industry, forecasted to reach $44 billion by 2033, is poised for substantial expansion, driven by policy reforms and strategic investments.

Despite these advancements, challenges persist, including the need for policy reforms, faster deployment of military satellites, and reducing reliance on arms imports. India's arms imports constitute a significant portion of the global market, highlighting the imperative to strengthen domestic defence manufacturing capabilities. Streamlining trade relations and overcoming regulatory barriers are crucial steps towards unlocking the full potential of collaborations in the space sector, particularly with the United States.

Looking ahead, India must adopt a comprehensive strategy encompassing defence space policy guidelines, organisational architecture, and infrastructure development to optimise its defence space capabilities. Collaboration with allies and commercial entities, coupled with result-based budgeting methodologies, will be instrumental in achieving strategic objectives efficiently. Drawing lessons from successful defence space partnerships worldwide, India can chart a trajectory towards enhanced resilience, interoperability, and flexibility in its defence space architecture.

India's defence space initiatives reflect a proactive stance in leveraging space technology for national security. With strategic reforms, partnerships, and investments, India is poised to emerge as a formidable player in defence space, contributing to regional security and economic growth. However, addressing persistent challenges and adopting a holistic strategy will be imperative to realise the full potential of India's defence space capabilities in the evolving global landscape.

–The writer is Director General of SatCom Industry Association (SIA-India)

INSIGHT

BITING THE SILVER BULLET: HOW WEIGHT AFFECTS PERFORMANCE

Bullet grain refers to the weight of the projectile, influencing factors such as velocity, recoil, and terminal ballistics. It is intrinsically linked to shooting performance, highlighting its relevance in various contexts, from target shooting to self-defence

By **SANJAY SONI**

In continuation to the earlier article which discussed the lethality of different firearms, this part will now delve into the stopping power of different bullet weights. That has a significant impact on the final outcome of a shot fired whether it is from a handgun or a rifle.

If you're a new gun owner, you probably don't know what "bullet grain" means. You may look at a box of ammo, see "115-grain" written on the side, shrug, and flip it over to look at what you really care about: the price tag. Before you do that, take some advice from a few seasoned firearm experts and consider the ammunition grain you're purchasing.

WHAT IS 'BULLET GRAIN'?

A grain ("gr" for short) is a basic unit of weight measurement. One grain is equal to 1/7,000 of a pound or 1/437.5 of an ounce.

All bullets are classified based on their weight in grains. For example, the most common 9mm Luger cartridges have bullet weights of 115 grains, 124 grains, 147 or 158 grains.

A common misconception of the term "grain" on the ammo box is that it is a reference to the amount of gunpowder in the cartridge. To be fair, gunpowder is also measured in grains if you're into handloading. The label, however, is strictly speaking about the weight of the bullet – the projectile that exits the barrel.

Now that we've covered the basics of what "grain" refers to, take a look at how you can use that knowledge to improve your shooting.

WHAT EFFECT DOES BULLET GRAIN WEIGHT HAVE ON SHOOTING?

The weight of the bullet influences its performance. A light bullet has less energy and is more vulnerable to wind. It may be blown off target far

more readily than a heavier bullet. In terms of precision, neither is clearly superior. It all depends on your shooting style and what you value most in a bullet.

The relationship between bullet weight and velocity is complex but generally agrees with the following equation: **V = k x w** Where V is velocity, k is a constant for each particular cartridge, w is weight in grams, and V is measured in meters per second (m/s).

Based on this equation, we can see that heavy bullets will produce higher velocities. This is because there's more mass attached to the end of the bullet, so it will take longer to stop when it hits something. Heavy bullets are also better at holding their shape during flight, which allows them to travel farther before collapsing under their own weight. Finally, heavy bullets tend to have more surface area, which inflicts more damage as the bullet enters the body.

As for light bullets, they're not suitable for use with every firearm, especially those that don't have an internal mechanism for spinning the bullet as it leaves the barrel. These include many older designs and some modern replicas.

IS A HIGHER GRAIN BULLET BETTER?

Lighter bullet weight often implies faster and further travel, but also greater recoil and less power at the target. For competitive and long-range shooting, lighter rounds are preferable. Heavier weight equals more efficacy, making them ideal for defence, huge game, and conflict. Of course, the opposite is true as well - heavy bullets are preferred for close-up work and animal hunting.

It's all about trade-offs. If you need/want a fast bullet that gives you much recoil, then a heavier bullet is recommended. A heavy bullet will tend to stop more quickly than a light one, giving you time to adjust your aim before the target moves out of range. On the other hand, if you want a low-recoil bullet that doesn't necessarily go far, then a light bullet is better. The key here is to find a balance between speed and control that works for you.

In general, higher grain means faster velocity and therefore faster travel and reduced size on impact. However, this comes with the cost of increased recoil. So, not only do you get more energy out of each shot, you also feel it in your shoulder too! However, weapons with longer barrels and newer technology can lower the recoil significantly. Going subsonic also lowers the recoil felt by the shooter.

MOST SPECIAL FORCES USE HEAVY SUBSONIC BULLETS WITH THEIR SUPPRESSED WEAPONS

Subsonic cartridges are loaded to operate at speeds less than the speed of sound, which prevents the bullet from making a supersonic shockwave or "crack" as it travels through the air.

When used in conjunction with suppressors, the subsonic bullet significantly reduces the total sound signature of the firearm, as the majority of the muzzle blast is suppressed by the silencer, while the lower velocity projectile removes the supersonic crack. The only audible noise would come from the mechanical moving parts made by the firearm, aside from the noise produced by the escaping gases at the muzzle end.

The downside is that subsonic ammo reduces the effective range and stopping power of the firearm, while also incurring a much steeper

The weight of the bullet influences its performance. A light bullet has less energy and is more vulnerable to wind. It may be blown off target far more readily than a heavier bullet

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Many law-enforcement agencies are starting to choose rounds on the heavier side. The Federal Bureau of Investigation (FBI) recently selected the Hornady Critical Duty 175-grain .40 S&W as its preferred ammo

trajectory. For this reason, subsonic ammunition usually uses heavier bullets that retain more energy and momentum. If you would normally go with a 124gr 9mm bullet at supersonic speed, you would need a 147gr or 158gr to achieve similar results at subsonic speeds.

Let's deep dive a bit into how you can calculate the ballistics of a bullet:

External ballistics (from gun to target)

The external ballistics of a bullet's path can be determined by several formulae, the simplest of which is:

Kinetic Energy (KE) = 1/2 MV^2

Velocity (V) is usually given in feet per second (fps) and mass (M) is given in pounds, derived from the weight (W) of the bullet in grains, divided by 7000 grains per pound times the acceleration of gravity (32 ft/sec) so that:

Kinetic Energy (KE) = $W(V)^2$ / (450,435) ft/lb

This is the bullet's energy as it leaves the muzzle, but the ballistic coefficient (BC) will determine the amount of KE delivered to the target as air resistance is encountered.

Forward motion of the bullet is also affected by drag (D), which is calculated as:

Drag (D) = $f(v/a)k\&pd^2v^2$

f(v/a) is a coefficient related to the ratio of the velocity of the bullet to the velocity of sound in the medium through which it travels, k is a constant for the shape of the bullet and & is a constant for yaw (deviation from linear flight), p is the density of the medium (tissue density is >800 times that of air), d is the diameter (calibre) of the bullet, and v the velocity. Thus, greater velocity, greater calibre, or denser tissue gives more drag. The degree to which a bullet is slowed by drag is called retardation (r) given by the formula:

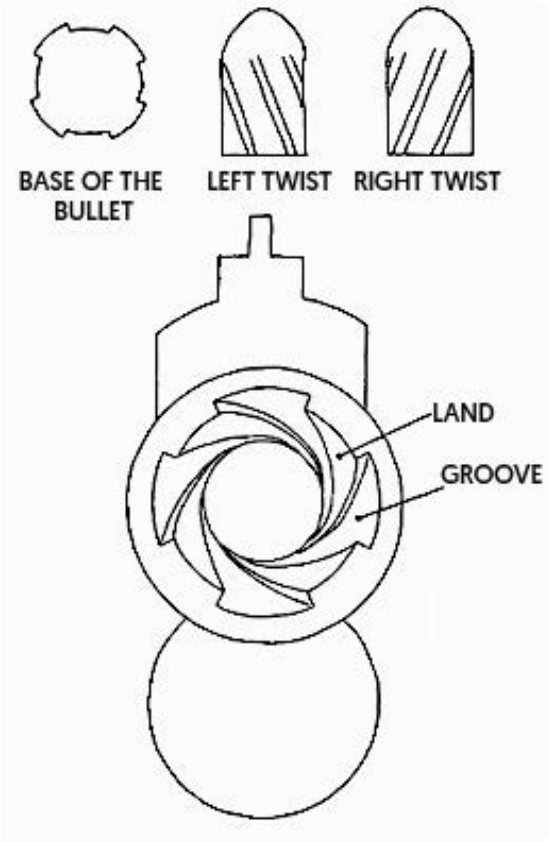
r = D / M

Drag is difficult to measure, so the Ballistic Coefficient (BC) is often used:

BC = SD / I

SD is the sectional density of the bullet, and I is a form factor for the bullet shape. Sectional density is calculated from the bullet mass (M) divided by the square of its diameter. The form factor value I decreases with increasing pointedness of the bullet (a sphere would have the highest I value).

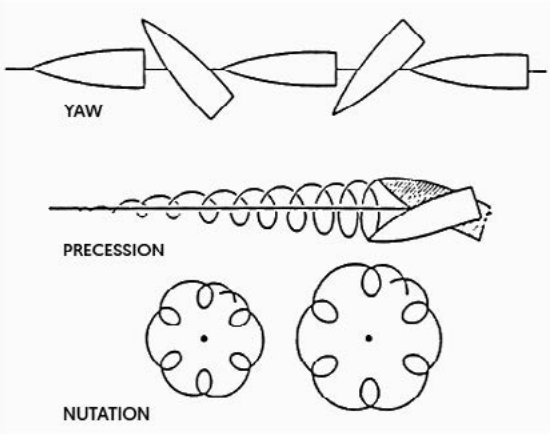
Since drag (D) is a function of velocity, it can be seen that for a bullet of a given mass (M), the greater the velocity, the greater the retardation. Drag is also influenced by bullet spin. The faster the spin, the less likely a bullet will "yaw" or turn sideways and tumble in its flight path through the air. Thus, increasing the twist of the rifling from 1



in 7 will impart greater spin than the typical 1 in 12 spiral (one turn in 12 inches of barrel).

Bullets do not typically follow a straight line to the target. Rotational forces are in effect that keep the bullet off a straight axis of flight. These rotational effects are diagrammed below:

Yaw refers to the rotation of the nose of the bullet away from the line of flight. Precession refers to rotation of the bullet around the centre of mass. Nutation refers to small circular movement at the bullet tip. Yaw and precession decrease as the distance of the bullet from the barrel increases.



WHAT DO ALL THESE FORMULAE MEAN IN TERMS OF DESIGNING CARTRIDGES AND BULLETS?

Well, given that a cartridge can be only so large to fit in a chamber, and the steel of the chamber can handle only so much pressure from increasing the amount of gunpowder, the kinetic energy for any given weapon can be increased more easily by increasing bullet mass. Though the square of the velocity would increase KE much more, it is practically very difficult to increase velocity, which is dependent upon the amount of gunpowder burned. There is only so much gunpowder that can be burned efficiently in a cartridge. Thus, cartridges designed for hunting big game animals use very large bullets.

To reduce air resistance, the ideal bullet would be a long, heavy needle, but such a projectile would go right through the target without dispersing much of its energy. Light spheres would be retarded more within tissues, releasing more energy, but might not even get to the target. A good aerodynamic compromise bullet shape is a parabolic curve with low frontal area and wind-splitting shape.

WHY CHOOSE A HEAVY BULLET?

As we have seen earlier, the two major variables in handgun ballistics are diameter of the bullet and volume of gunpowder in the cartridge case. Cartridges of older design were limited by the pressures they could withstand, but advances in metallurgy have allowed doubling and tripling of the maximum pressures so that more KE can be generated.

Many different cartridges are available using different loads and bullet designs. Some of these are outlined in the table below to compare and contrast the ballistics.

WHAT CAN BE LEARNED FROM SPECIFIC CARTRIDGE DATA?

If the 44 magnum is compared with the 357 magnum, the effect of bore diameter is evident.

The larger area of the 44 magnum creates more force with the same pressure, allowing the 44 magnum to produce more energy at the muzzle. The effect of case capacity can be demonstrated in a comparison of the 9 mm parabellum (para) with the 357 magnum. These cartridges have similar diameters and pressures, but the 357 magnum is much longer, yielding more case volume (more powder), and delivering more energy. Finally, despite the Colt 45 having the largest bore diameter and one of the longest cases, it does not deliver the maximum energy because the outdated 1873 design of this cartridge case severely handicaps its pressure handling capability.

The most important reason for selecting a larger bullet is the energy delivered to the target, which improves "terminal ballistics." Basically, if you want better expansion and penetration you will likely want to choose a heavier bullet. Both expansion and penetration are affected by bullet shape, material, and other factors as well, but weight plays a role.

This essentially means that in most cases heavier bullets are reserved for hunting and self defence. When loaded into hunting rifles, a heavier bullet is more likely to deliver more energy into the target, resulting in a more humane shot. For self defence, a heavier bullet gives you a better chance at stopping a threat.

There are people who swear by a heavier bullet weight in their self defence rounds. The Federal Bureau of Investigation recently selected Hornady Critical Duty .40 S&W 175 grain as their bullet of choice.

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COMMON REPRESENTATIVE HANDGUN CARTRIDGES							
Name	**Comment**	**Case Length**	**Case Diameter**	**Bullet Weight (grains)**	**Velocity (muzzle) in fps**	**Energy (muzzle) in ft lbs**	**Energy (at 100 yd) in ft-lbs**
.22 LR	for inexpensive guns, rimfire (R and A)	0.625	0.222	40	1060	100	75
.25 auto	small pocket gun (A only)	0.615	0.251	45	815	66	42
.380 auto	popular pocket auto (A only)	0.680	0.355	85	1000	189	140
9 mm para	popular military handgun (A only)	0.754	0.355	115	1155	391	241
.38 special	popular police revolver (R only)	1.155	0.357	110	995	242	185
.357 SIG	popular police pistol (A only)	0.865	0.381	115	1550	614	N/A
.357 magnum	popular police and hunting revolver (R and A)	1.290	0.357	125	1450	583	330
.40 S&W	rimless police pistol (A only)	0.850	0.421	165	1150	484	342
10 mm	same projectile as .40 S&W (A only)	0.992	0.421	165	1425	744	N/A
.44 magnum	hunting revolver (R only)	1.290	0.430	180	1610	1036	551
.45 auto	popular military handgun (R and A)	0.898	0.451	185	1000	411	324
Colt .45	cowboy "sixgun" (R only)	1.285	0.452	225	920	423	352
.50 AE	Big game and metallic targets (A only)	1.285	0.540	325	1400	1415	930

Key: R=made for revolver; A=made for semi-automatic; velocity in fps

This issue came up in the trials of 9mm 158gr subsonic ammunition being conducted by the armed forces. Two companies offered the 147gr 9mm subsonic ammunition instead of the 158gr ammunition stating that the ballistic properties are the same as that of the 158gr ammunition. They achieved subsonic shots with lighter rounds by reducing the quantity of powder to a very low level, which is not safe. This was of course a totally misleading claim made by the companies who did not have the 158gr ammunition in their product line up. Since the subsonic ammo was to be used with a suppressed MP-5 by the Special Forces, even a difference of 11 grains would make a huge difference in the performance of the ammo:

The kinetic energy of the bullet and the terminal ballistics are very different between the 147gr and 158gr bullets. The heavier 158gr bullet carries much more energy and so the terminal effect would be more pronounced.

The sound produced by the 158gr bullet would also be less pronounced than that made by the 147gr ammo.

Unless you have a short barrel, the 147gr bullet will break supersonic out of a 16" barrel. To prevent that you would drop the powder charge to a minimum; this is not only unsafe but would also lead to a perceptible drop in the bullet

trajectory even over a short distance. So, accuracy would be a major issue!

The 158gr bullet has a higher ballistic coefficient and higher sectional density which would cause much more damage upon entry into the target. Therefore, lethality and stopping power would be much more pronounced in a 158gr bullet as compared to a 147gr bullet.

The only reason 158 gr. 9mm even exists is so 9mm rifles/carbines can fire a round that will still stay subsonic even though the barrel is longer. With a 147gr bullet, the subsonic is not guaranteed.

Shockingly, the person doing the testing also seemed to buy into this argument that the bullet weight of 147gr would perform the same as a 158gr!!! It seems that most people - even those in charge of testing ammo for the armed forces - are unaware of the behaviour of bullets with different grain weights.

Many law-enforcement agencies are starting to choose rounds on the heavier side. As previously mentioned, the FBI selected the Hornady Critical Duty 175-grain .40 S&W as its preferred ammo. When you think about how your choice in bullet weight will affect your shooting, keep these things in mind:

Lighter weight generally means more speed and

distance, but also more recoil and less power at the target. Lighter bullets are good for competition and long-range shooting.

Heavier weight generally means more effectiveness, making them excellent for defence, large game, and combat. Added benefit is that heavier bullets generally have higher Ballistic Coefficient's and always have higher sectional density for a given calibre.

–The writer is a 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

MUSINGS FROM RUSSIA

COLLECTIVE WEST'S ONSLAUGHT GALVANISES RUSSIANS

NATO's proxy war against Russia in Ukraine has galvanised the Russian society, which stood behind President Putin unitedly. With no signs of any diplomatic activities for a peaceful settlement, war is likely to continue, and Ukraine will remain on the receiving end of Moscow's formidable war machine. Time is running out for Volodymyr Zelinsky as his constitutional term expires next month

By **VINAY SHUKLA**

Since the last edition of this column, several major developments have taken place in Russia as it entered into the third year of proxy war with the collective West on the battleground Ukraine, where its initial Special Military Operation (SMO) initiated on February 24, 2022, to denazify and disarm the second most powerful former Soviet republic has effectively transformed into a full-blown war. Neither Moscow achieved a quick military triumph, nor the US-led NATO's hope of a quick downfall of "Putin's unpopular regime" materialised under the pressure of thousands of crippling sanctions imposed by the collective West.

Russians are considered really strange people by their Western counterparts who are out of sync with their history. Russians with a strong sense of history have Napoleon and Hitler's invasions embedded in their national memory when troops from the occupied western and central European countries plundered their homeland. In a show of their resolve, they lined up in an unusually large voter turnout to elect President Vladimir Putin for the fifth term with over 88 per cent of the vote, the highest percentage in a presidential election in post-Soviet Russia. As expected, the voting held on March 15-17 in the election was qualified as a 'sham' in Washington and major European capitals. But for the common Russians, Putin became a symbol of unity and his election for the fifth term with an unprecedented over 88 per cent votes was a virtual challenge to the collective West. Some of his liberal opponents conceded that actually, it was a vote against the US-led NATO.

Even the death of the US-appointed "Putin's main opponent" Alexei Navalny serving a jail term in an Arctic prison colony days before voting failed to stir a popular uprising against the Kremlin as most people saw in him a "CIA asset", which President Putin in his election victory speech virtually confirmed by disclosing plans to swap him for jailed Russian agents in the West.

Even the horrific terror attack on Crocus City Hall by the Islamist terrorists on March 22 further galvanised the Russian society who, forgetting past

differences and criticism of the authorities, stood united behind their leadership. Although the ISIS-K had taken the responsibility of attack on concertgoers killing 144 and wounding about 600, however, it lacked the typical signature of a classical Islamist terror attack, without jehadi slogans and fidayeen. This gave grounds to suspect Ukrainian intelligence's hand behind it as four terrorists were detained 400 km away from Moscow near the border with Ukraine. One of the accused confessed that he got 500,000 roubles in advance and was to get the rest in Kiev.

A prominent TV channel NTV described the terror attack as "proxy terrorism" as NATO's proxy war against Russia in Ukraine failed to achieve military goals and Kiev was on the verge of a rout due to the West's inability to seamlessly provide financing and weapons to President Zelensky's regime.

Russians are considered really strange people by their Western counterparts who are out of sync with their history. Russians with a strong sense of history have Napoleon and Hitler's invasions embedded in their national memory when troops from the occupied western and central European countries plundered their homeland

FALL OF AVDIIVKA, A MAJOR BLOW TO UKRAINE

After the failure of its much-touted counteroffensive last summer with the help of NATO hardware, the Ukrainian army is now on the back foot. It suffered a major blow in February when it lost control over its main stronghold in Avdiivka, a mid-sized industrial town in the Donetsk region in the East. Since then, it has been rolling back towards the East bank of the Dnieper river bisecting the country, which could become a borderline in case of a frozen conflict. Russia has cut the supply lines of the Ukrainian army based in the south.

Meanwhile, Ukraine is escalating its drone war by effectively attacking Russia's oil refineries and civilian targets in border towns and villages in Belgorod and Kursk regions.

Russia, on the other hand, has spruced up its weapons production and is introducing new systems in combat from smart drones to FAB3000 GPS-guided bombs with the power equivalent to a tactical nuclear bomb.

According to local defence experts, with no signs of any diplomatic activities for a peaceful settlement, the hostilities are likely to continue for at least the next three years. Meanwhile, Defence Minister General Shoigu has announced plans to raise two fresh armies and 36 brigades and divisions this year to face the challenges of NATO expansion with the entry of Finland and Sweden into the bloc.

Meanwhile, time is running out for Volodymir Zelinsky as his constitutional term expires on May 20 and Ukraine's Constitution Court can easily overturn any agreement signed by him after this date by declaring it null and void. Moscow, rejecting Zelensky's peace formula providing for the withdrawal of Russian forces to the position that existed on February 24, 2022, insists that any peace would be possible only by the principle of equal security guarantees for Russia by Zelinsky's NATO masters. With no signs of the West agreeing to new Yalta or Helsinki conferences like in the past, Ukraine seems to remain on the receiving end of Moscow's formidable war machine gathering momentum with every passing day.

*–The writer is a Moscow-based independent analyst. The views expressed are of the writer and do not necessarily reflect the views of **Raksha Anirveda***

INSIGHT

FATHOMING THE DEPTHS

Since the implementation of Unmanned Aircraft System (UAS) Rules in 2021 and subsequent strategic initiatives, India has aimed to position itself as a global drone hub by 2030. However, despite these aspirations, the pace of growth has not matched projections. What are the key factors hindering India's ascent in the UAS industry, and how can the nation overcome them?

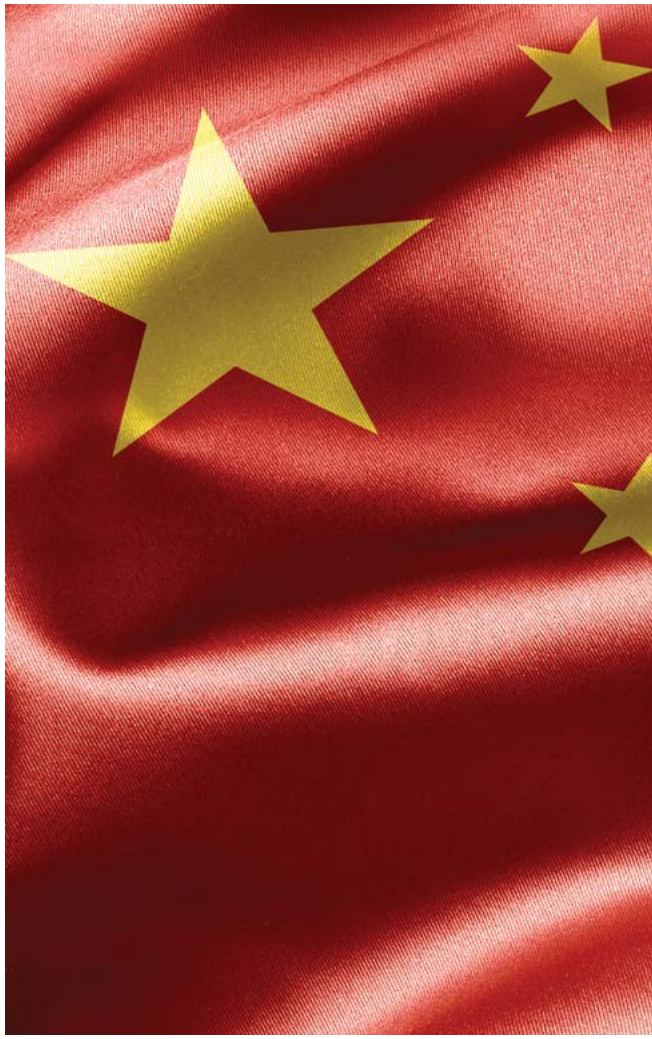
By **COMMANDER SUMIT GHOSH**

India's technological prowess has propelled advancements in the development and production of Unmanned or Autonomous Underwater Vehicles (UUVs/AUVs), which play critical roles across various sectors due to their ability to operate autonomously underwater for maritime applications such as underwater mapping, surveillance, oceanographic research, and underwater inspections. Several Indian organisations, including research institutions, defence organisations, and private players, are involved and/or have demonstrated their potential in the development and production of AUVs or UUVs, with a high focus on their diverse applications.

India and China both have active programs and capabilities in the production of AUVs and UUVs, but their respective positions and levels of advancement vary greatly across different aspects. China appears to have a better-established system in the production of such vessels. India is also making strides in this field with growing investments and initiatives. Both countries have the potential to become significant players in the global market for underwater vehicles, each leveraging its unique strengths and capabilities. This article briefly examines the potential of China and India in terms of their overall capability related to research, development, and production of AUVs/UUVs and also recommends a way ahead for India.

THE CHINESE CAPABILITIES

China commenced the development of its first remotely operated vehicle (ROV) in the late 70s, and by the late 90s, they had over 10 different variants. In the period from the 90s to the early 2000s, this technology was mastered by them and developed quickly to a much higher level. In the last 15-20 years, China has become an international player in unmanned underwater vehicles. Earlier, four key organisations, the China Ship Scientific Research Centre (CSSRC), Shanghai Jiao Tong University (SJTU), Shenyang Institute of Automation (SIA), and Harbin Engineering University (HEU), formed a special division for submersible development. China now has several key agencies and organisations



involved in the production and development of AUVs and UUVs, reflecting the country's strategic emphasis on maritime technology and naval capabilities. Collaboration between government agencies, research institutes, universities, and industry partners is commonly seen in China's efforts to advance its capabilities in underwater technologies. Some of the main agencies include the following:

China Shipbuilding Industry Corporation (CISC): The CSIC is one of the largest state-owned shipbuilding parent companies in China, encompassing various research institutes, shipyards, and subsidiaries. This industrial corporation is deeply involved in the design, development, and production of underwater vehicles. Subsidiaries of CISC, such as the China Shipbuilding & Offshore International Co Ltd (CSOC), are directly involved in the projects related to underwater vehicles.

China Ship Scientific Research Centre: This research institute, under CSIC, focuses on underwater technology research and development and is involved in the design, prototyping, and testing of underwater vehicles for various applications, including military and civilian use.

Harbin Engineering University (HEU): HEU is a leading university in China known for its research and education in naval architecture, ocean engineering, and underwater technology. The university's several research institutes and laboratories conduct R&D activities dedicated to marine engineering and underwater technology in various places. These facilities conduct research on underwater vehicles, AUV and UUV technologies & systems, propulsion systems, sensor integration, and underwater communication protocols, in collaboration with government agencies and industry partners. Harbin Institute of Technology (HIT) conducts research in various areas of robotics and autonomous underwater systems.

Despite the fact that India has made considerable progress in AUV and UUV technology, there are still challenges such as funding, technological complexity, and the need for skilled manpower. However, there are significant opportunities for further growth and innovation in this field, driven by the high demand for such systems

China State Shipbuilding Corporation (CSSC): CSSC is another major state-owned enterprise in China specialising in shipbuilding and maritime engineering. CSSC is engaged in the development and production of naval vessels and underwater technologies. Its research institutes and affiliated companies contribute to UUV and AUV projects.

China Aerospace Science and Technology Corporation (CASC): While primarily focused on space exploration and aerospace technology, CASC is also involved in the development of underwater vehicles for scientific research and defence applications.

Chinese Academy of Sciences (CAS): CAS is the leading academic institution in China for scientific research across various disciplines. Institutes and research centres under CAS, such as the Institute of Acoustics and Institute of Oceanology (CASIO), are involved in AUV and UUV projects, particularly in areas related to underwater acoustics and marine sciences.

China Ocean Mineral Resources R&D Association (COMRA): COMRA, under the Ministry of Natural Resources, is responsible for exploring and exploiting deep-sea mineral resources. It conducts research and development activities related to underwater vehicles and robotics for deep-sea exploration and resource assessment.

Ocean University of China (OUC): The OUC conducts research in marine science and technology, which includes underwater robotics and autonomous systems.

Northwestern Polytechnical University (NPU): This is involved in aerospace and marine technology research, including underwater vehicles.

Private Companies: In China, there are also private companies involved in producing UUV and AUV systems. However, their information is less transparent compared to state-owned enterprises. Some known private agencies are:

Ocean-alpha Company Private Ltd: Ocean-alpha is a Chinese technology company specialising in Unmanned Surface Vessels (USVs) and UUVs. They develop and manufacture a range of underwater drones and autonomous vehicles for applications such as oceanographic research, environmental monitoring, and underwater inspections.

Deepfar Ocean Technology Co Ltd: Deep-far is a Chinese company focused on underwater technology, including AUVs and UUVs. They design and produce autonomous underwater vehicles for various purposes, including hydrographic surveying, seabed mapping, and underwater exploration.

Dalian Deep All Ocean Technology Co Ltd: This is involved in the development and production of underwater robotics and autonomous systems. They offer AUVs and UUVs for marine research, underwater surveys, and offshore operations.

Qingdao Deepfar Ocean Technology Co Ltd: Qingdao Deepfar is a subsidiary of Deepfar Ocean Technology Co Ltd, and offers AUVs and UUVs equipped with advanced sensors and payloads for underwater exploration and research.

Shen Zhen Scoutbots Technology Co Ltd: Scoutbots is a Chinese company specialising in the design and manufacturing of underwater robots and remotely operated vehicles (ROVs) and may be involved in AUV and UUV technologies.

Ocean-alpha Intelligent Technology Co Ltd: This company specialises in intelligent maritime solutions and provides AUVs, UUVs, and other unmanned systems for marine applications, including oceanography, aquaculture, and maritime security.

Industrial laboratories in China are also actively involved in research and development related to UUVs. Some of these are:

CSSC 702 Research Institute: This focuses on marine engineering & technology development and is involved in R&D projects related to underwater vehicles, for naval and civilian applications.

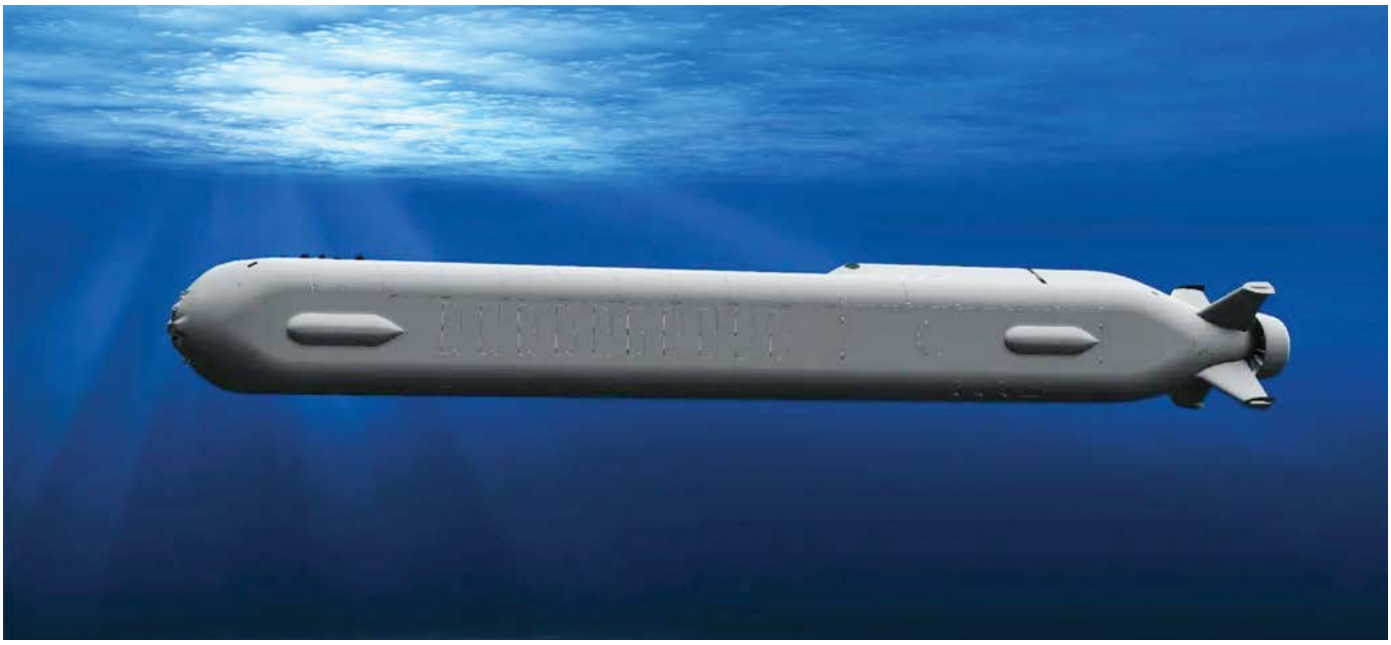
China Ship Scientific Research Centre (CSSRC): CSSRC is a leading research institution in China specialising in ship science and technology. It conducts research on underwater vehicle design, propulsion systems, control algorithms, and underwater communication technologies.

Shenyang Institute of Automation (SIA), Chinese Academy of Sciences (CAS): SIA is actually part of the CAS and is involved in robotics research, including underwater robotics. It conducts research on autonomous navigation, sensing, stability aspects and manipulation in underwater environments.

Wuxi Research Institute of Shipbuilding Technology (WRIST): WRIST is focused on shipbuilding and marine technology. It conducts research and development on AUVs and UUVs for marine exploration, seabed mapping, and underwater surveillance.

Huazhong University of Science and Technology (HUST): It also undertakes R&D on underwater vehicles.

China Ship Research and Development Academy (CSRDA): CSRDA is a research institution under CSIC, specialising in ship research and development. It conducts research on underwater vehicle design, hydrodynamics, materials, and propulsion systems.



Concept art for Boeing's Orca Extra Large Unmanned Underwater Vehicle *(Photo Boeing)*

THE INDIAN CAPABILITIES

Commencing in the late 90s, India has been making progress in the development and production of AUVs & UUVs. However, India's research base and industrial might in this field are underdeveloped and much needs to be done to generate credible results. Some organisations working in this field are mentioned below:

National Institute of Ocean Technology (NIOT): NIOT, under the Ministry of Earth Sciences, is a premier research institution in India dedicated to ocean technology and exploration. NIOT has been actively involved in the design, development, and deployment of indigenous AUVs and UUVs. India has developed several AUVs for oceanographic research and defence applications which operate autonomously underwater, collecting data on parameters such as water temperature, salinity, and ocean currents. NIOT's 'Mach-1' and 'Mach-2' AUVs are examples of indigenous AUVs developed for oceanographic research.

Defence Research and Development Organisation (DRDO): This organisation has been working on the development of UUVs for naval applications (mine countermeasures, underwater surveillance, and anti-submarine warfare etc).

Naval Physical and Oceanographic Laboratory (NPOL): While NPOL is a government laboratory under DRDO, it also collaborates with private companies for the development of underwater technologies. NPOL has been involved in projects related to AUVs and UUVs for defence applications and has collaborated with private firms on certain initiatives.

Larsen and Toubro Defence (L&T), Naval Science and Technology Laboratory (NSTL), Electronics Corporation India Ltd (ECIL), and Aerospace Engineering Private Limited (AEPL) are also some of the organisations involved in developing and testing AUVs/UUVs.

Dockyards like Garden Reach Shipbuilders and Engineers (GRSE) and Mazagaon Dock Shipbuilders Limited (MDL) are also involved in handling and testing of UUVs.

Saab India: Saab India has been involved in the development of underwater systems, including UUVs, for defence and security applications. They have collaborated with Indian partners on projects related to underwater surveillance and mine countermeasures.

L&T Hydrocarbon Engineering: A subsidiary of L&T, it is involved in engineering, procurement, construction, and project management in the hydrocarbon sector. They have capabilities in underwater engineering and have been involved in the development of underwater vehicles for offshore oil and gas operations.

EyeROV Technologies: EyeROV Technologies is a start-up based in Kerala, India, specialising in underwater drones for inspection and surveillance. They develop compact and portable ROVs for applications such as underwater inspections of ships, ports, and underwater structures.

Seabird Exploration India Pvt Ltd: Seabird Exploration India is a subsidiary of Seabird Exploration, a global provider of marine seismic services. While their primary focus is on marine

seismic operations, they may have involvement in the development or utilisation of underwater vehicles for survey and exploration purposes.

Planys Technologies: Planys Technologies is a Chennai-based start-up specialising in underwater robotic inspections and solutions. They design and manufacture ROVs and AUVs for various underwater applications, including infrastructure inspection, dam monitoring, and environmental surveys.

Indian Navy (IN), Indian Space Research Organisation (ISRO), and academic institutions such as IITs, NITs, and IISc also undertake R&D on material, performance, and technologies related to UUVs/AUVs. Indian research institutions and defence organisations often collaborate with international partners for technology transfer, joint research, and capacity building in the field of AUVs and UUVs.

CHALLENGES AND OPPORTUNITIES

Despite the fact that India has made considerable progress in AUV and UUV technology, there are still challenges such as funding, technological complexity, and the need for skilled manpower. However, there are significant opportunities for further growth and innovation in this field, driven by the high demand for such systems. While India and China both have active programs and capabilities in the production of AUVs & UUVs, their respective positions and levels of advancement vary greatly across different aspects. A general comparison is given below:

WAY AHEAD FOR INDIA

To improve its expertise in UUV & AUV technologies, India should undertake several strategic initiatives:

Invest in Research and Development (R&D): Allocate significant resources towards R&D efforts focused on advancing UUV and AUV technologies, including propulsion systems, sensor integration, autonomy, and communication protocols.

Enhance skill development and training opportunities: Prioritise the training and development of professionals in robotics, marine engineering, and oceanography to nurture a skilled workforce capable of driving innovation in underwater technology.

Increase collaboration and

S.No.	Factor	China	India
1	No. of R&D institutions	> 150 small and big institutions (with over 49 Universities and 50 research units)	Approx. 15-20
2	Industrial Capacity	Extensive and Well developed	Not so developed
3	Technological Capability	Excellent	Good
4	Government Investment	Very High	Low
5	Government Support	Very High	Low
6	Diversity and Range of Platforms	Wide Range & Variety	Limited Range & Variety
7	No. of Projects being undertaken	Approximately Over 150	Approximately Less than 30
8	Military Applications	Significantly Developed and Deployed	Being Developed
9	Civilian Applications	Significantly Developed and Deployed	Being Developed
10	Commercial Applications	Significantly Developed and Deployed	Being Developed
11	International Collaboration	Very High with numerous countries	Initiatives Taken
12	International Export	Global Reach and exported to numerous states	NA
13	Policy and Regulations	Strong and Tested	Nascent & Being Developed
14	Experience in this field	> 50 years	20-25 years
15	CAGR of AUV/UUV market	23 - 26 % Very High Priority	<10%

India is currently lagging behind China in the development and production of AUVs and UUVs. However, with concerted efforts from the government, research institutions, defence organi-sations, and the emerging private sector, supported by a cohesive national strategic plan, India can accelerate its progress in this field

partnerships: Foster collaboration between government organisations, private companies, research institutions, and international partners to leverage collective expertise, resources, and capabilities in the development and deployment of UUVs and AUVs.

Opt for technology transfer and acquisition: Engage with leading international manufacturers and research institutions to acquire advanced UUV/AUV technologies through technology transfer agreements and strategic partnerships.

Develop regulatory frameworks and standards: Establish robust regulatory frameworks and industry standards for the design, testing, and operation of UUVs and AUVs to ensure safety, reliability, and interoperability.

Encourage start-ups and SMEs: Provide incentives and support mechanisms to promote indigenous manufacturing and production of UUVs and AUVs by nurturing start-ups and small to medium enterprises (SMEs) in the sector.

Plan and execute market development strategies: Develop comprehensive market development strategies to identify and capitalise on opportunities for the deployment of UUVs and AUVs in various sectors, including defence, maritime security, scientific exploration, environmental conservation, and economic development.

Establish dedicated testing and validation facilities: Invest in the establishment of specialised testing and validation facilities to evaluate the performance, reliability, and safety of UUVs and AUVs under simulated real-world conditions.

Facilitate information sharing and networking: Create platforms for stakeholders to share information, collaborate, and network, fostering a conducive environment for knowledge exchange and innovation in underwater technology.

Create a long-term vision and national strategy: Formulate a comprehensive long-term vision and national strategy for the development and deployment of unmanned underwater vehicles, aligning with national priorities and objectives related to maritime security, scientific exploration, environmental conservation, and economic development.

India is currently lagging behind China in the development and production of AUVs and UUVs. However, with concerted efforts from the government, research institutions, defence organisations, and the emerging private sector, supported by a cohesive national strategic plan, India can accelerate its progress in this field.

–The writer is a former Indian Navy Submarine Officer, commissioned in 1991 (10+2 X First Course). An alumnus of Naval Academy, Goa, and DSCSC Mirpur, Dhaka, Bangladesh, he served on Kilo Class Submarines, and commanded INS Sindhurakshak. He is a specialist in Anti-Submarine Warfare and deep-sea diving. The views expressed are of the writer and do not necessarily reflect the views of ***Raksha Anirveda***

ISRAEL DIARY

CHARTING EXPANSION AND ADAPTATION

Against the backdrop of conflict with Hamas, Israel is charting a course for long-term resilience and effectiveness by bolstering capabilities and addressing supply deficiencies. The crucial lessons learned during the conflict are being implemented in real-time, while others are earmarked for post-war adjustments

By **ARIE EGOZI**

After the war with Hamas ends, the Israeli Defence Forces (IDF) will expand in size. The slogan "Small and Smart" will be replaced by "Big and Smart." There will be more infantry units, more tanks, and a significant increase overall.

Meanwhile, the IDF is endeavouring to implement lessons learned during the ongoing conflict, while others will be addressed post-war. These interim lessons, along with those clarified after the conflict, will significantly impact the Israeli defence industries, with a focus on production capabilities. The Israeli Ministry of Defence, in collaboration with defence industries, is already formulating an emergency plan to enhance Israeli capabilities related to maintaining a substantially larger stock of ammunition. This is to prevent shortages arising from the ongoing conflict with Hamas in Gaza and Hezbollah in Lebanon. "The current situation is nonsensical. Oversight led to Israel having to take emergency measures to supply ammunition to forces in the war zones," a defence source informed *Raksha Anirveda*.

For years, Israel relied on receiving all necessary ammunition during conflicts from American emergency stockpiles. This stockpile includes air-dropped bombs and artillery shells. According to a report on the website of the Jewish Institute for National Security of America (JINSA), these weapons, valued at more than $1 billion, are funded by the US, while the IDF is responsible for storage, facilities, and maintenance costs. This arrangement is mutually beneficial. Israel has accessed the stockpiles

Israeli Merkava Tanks

(by paying for and withdrawing the weapons) at least twice, in 2006 and 2014, during conflicts in Lebanon and Gaza, respectively.

"The current stockpile mainly consists of so-called 'dumb munitions' (those lacking sophisticated guidance systems), such as 155-mm rounds and thousands of 'iron bombs' dropped from aircraft relying solely on gravity. One reason Israel is inclined to withdraw the 155-mm rounds is to free up space for precision-guided munitions, which the Israeli Air Force predominantly utilises."

The Israeli Ministry of Defence ignored the fact that almost the entire US stockpile had been sent to aid Ukraine in its conflict with Russia. The ministry declined to comment on this matter. When the IDF commenced its operation following the October 7 attack by Hamas, the shortage of various types of ammunition became apparent. This shortage was most keenly felt in the "Dumb" bombs category and 155 mm artillery shells. Although these types of ammunition are manufactured in Israel, it is evident that the quantities ordered by the Israeli Ministry of Defence were based on incorrect assumptions. According to sources, Israel will need to at least double its domestic production capabilities for various types of ammunition, primarily bombs and artillery shells.

The situation resulting from the ongoing extensive warfare on both fronts will impact the future plans of the Israeli weapons industry, with a focus on air-dropped bombs and interceptors. Rafael will need to at least double the production rate of the Tamir interceptors used by the Iron Dome air defence systems. The proliferation of Iranian-made armed UAVs launched by Hezbollah in Lebanon has led to the extensive use of these interceptors.

The large number of rockets launched by Hamas and Hezbollah has created a "saturation" scenario that compelled Israel to procure additional interceptors for the Iron Dome air defence systems, which once again achieved an impressive over 90% kill rate. As this saturation is expected in future conflicts, Israel is expediting the development of the "Iron Beam" laser system, developed by Rafael, designed to intercept aerial threats such as rockets and armed UAVs.

Sources indicate that Elbit Systems and Rafael are already planning a "massive" upgrade of their production lines. Elbit manufactures artillery and tank shells, while Rafael produces air-dropped bombs, among other weapon systems. The sources added that the change will not only affect production capabilities but will also impact budgets allocated to new types of ammunition.

The extensive use of Iranian-made armed drones by Hamas and Hezbollah compelled the IDF to devise


Iron Dome

an immediate solution to the numerous attacks carried out by armed drones on Israeli Merkava 4 tanks involved in combat in Gaza. While these tanks are protected from anti-tank rockets by the Rafael Trophy active protection systems (APS), the upper part of the tank lacks protection against drones dropping anti-tank rocket warheads from above. The solution involves an emergency installation of protective metal nets placed above the tank's turret. These "Cope Cages" have proven their effectiveness, but they represent a temporary solution.

The Israeli Ministry of Defence, in collaboration with some Israeli defence companies, is currently working on a version of the two existing Israeli Active Protection Systems (APS) that will address the new threat not covered by the existing ones.

A significant portion of the Israeli-made Merkava tanks involved in the fighting in Gaza will be repurposed according to a longstanding idea now elevated in priority on the IDF's agenda: equipping the tanks with advanced loitering weapon systems. The concept involves tasking Israeli defence companies that produce this type of weapon to develop a system deployable by the Merkava. This system would allow the tank commander to significantly extend the platform's reach by launching a

"The focus, in my opinion, will be on systems incorporating AI and Big Data. While precision weapon systems were the focus before the war, more efforts will now be directed towards weapon systems produced in larger quantities."

Boaz Levy, CEO of Israel Aerospace Industries

ISRAEL DIARY

loitering weapon system capable of searching for and destroying targets beyond the commander's line of sight.

"This will represent a major enhancement of the tank's capabilities, particularly in densely populated urban areas like Gaza," a senior defence source stated.

The extensive number of rockets launched by Hamas and Hezbollah will expedite the development of the "Iron Beam" laser system by Rafael, designed to intercept aerial threats such as rockets, armed UAVs, and drones. As part of this intensified effort, the prototype of the Iron Beam has been deployed for advanced testing near the Gaza Strip during the ongoing conflict.

Sources indicate that the initial focus is on developing an electric 100-150 kW solid-state laser capable of intercepting rockets and missiles. The plan is to utilise two laser guns to generate the necessary power. A source in the defence industry mentioned that in order to intercept more than short-range rockets and missiles,

"Since the start of the war, given our crucial role as a primary supplier of defence solutions to the IDF across all domains, we have initiated the recruitment of hundreds of new employees and transitioned to a 24/7 operational model in some of our production lines."

Joseph Gaspar, Senior Executive Vice President
Business Management, Elbit Systems

Israel will require a laser generator capable of producing a 1 Mega Watt beam.

Another idea gaining traction is the formation of a dedicated unit tasked with operating highly accurate ground-to-ground rockets. This proposal was previously raised by former Defence Minister Avigdor Lieberman, but was shelved largely due to opposition from the Israeli Air Force, which, according to defence sources, sought to prevent acquisition budgets from being redirected to the proposed unit. Now, with the ongoing conflict demonstrating that the target list of Hezbollah includes many air force bases, the idea is poised for a more serious re-evaluation.

Boaz Levy, CEO of Israel Aerospace Industries (IAI), told *Raksha Anirveda* that the war will lead to the development of new systems and increased collaboration with foreign companies. "The focus, in my opinion, will be on systems incorporating AI and Big Data," Levy said pointing out that while precision weapon systems were the focus before the war, more efforts will now be directed towards weapon systems produced in larger quantities. "These are considered more fundamental, but the war has shown that they are needed in large numbers." Levy also noted that Israel will need to build larger stockpiles of weapons, both domestically and in cooperation with other countries. The increased production, according to the CEO of IAI, will rely on a growing number of subcontractors in Israel and abroad.

Joseph Gaspar, Senior Executive Vice President – Business Management, Elbit Systems, told *Raksha Anirveda* that due to the ongoing conflict, the company has implemented several organisational measures. "Since the start of the war, given our crucial role as a primary supplier of defence solutions to the IDF across all domains, we have initiated the recruitment of hundreds of new employees and transitioned to a 24/7 operational model in some of our production lines. This proactive approach has enabled us to fulfil most of our commitments to our many overseas customers while addressing the ongoing needs of the IDF during wartime."

"In places where we recognise there might be a challenge, we coordinate with our partners and clients. Moreover, as part of our strategic approach, we have established subsidiaries and partnerships in key markets such as Europe, India, and the United States, serving as local industrial bases managed by local employees. By decentralising our operations, we provide comprehensive services and products to local industries, leveraging Israeli technology. This integration into local markets has led to securing significant contracts," he stated. Adding, "For instance, in the US, with approximately 4,000 employees, we are recognised as a leader in helmets, night vision, and more. Through this strategy, integrated into our business model, we effectively balance global operations amid significant demand."

The conflict has impacted Rafael in several different aspects. According to a senior official from the company, since the outbreak of the conflict, over 2,000 employees were called up for emergency reserves, and hundreds were forced to evacuate their homes. "Operationally, we have witnessed numerous Rafael-made systems in action during the war, from the Iron Dome and David's Sling Air Defence systems to the TROPHY APS and various other technologies. Throughout this time, we have seen, once again, how crucial these systems are for protecting and empowering military forces and shielding the civilian population. In 2023, our exports reached 58%, before the war. We had an all-time record year. Our order backlog increased by 32% compared to the previous year, reaching NIS 43 billion."

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

Unravelling
CIVIL AVIATION

INDUSTRY UPDATE

GROWING OWN WINGS

India's aerospace sector is gradually gaining momentum with growing domestic initiatives in aircraft manufacturing, fuelled by a conducive policy environment and global collaborations

By **VISHAL DUGGAL**

With the government's focus on fostering domestic capabilities and leveraging indigenous talent in aviation, India is making gradual strides in aerospace manufacturing. By encouraging domestic production and reducing dependency on imports, India aims to bolster its aerospace ecosystem and enhance its global competitiveness.

The lack of domestic manufacturing capabilities for several decades after Independence, both in civil aviation and defence aerospace manufacturing, had remained a major worry till the early 1990s. After opening up of this segment to the private players in the post-liberalisation period in 1990s, the sector has shown considerable progress. Especially, subsequent to the Make in India initiative announced by Prime Minister Narendra Modi in September 2014, there are signs that things are changing for the better.

Several Indian cities, such as Lucknow, Koraput, Nasik, Hyderabad, and Bengaluru, host aircraft-building industries, contributing significantly to India's aviation landscape. Here is a quick look at some major companies driving the country's aerospace growth:

HINDUSTAN AERONAUTICS LIMITED (HAL)

HAL is a state-owned aerospace and defence conglomerate headquartered in Bengaluru. It is among the prominent, largest and most renowned aircraft manufacturing companies in the country. Established on 23 December 1940, HAL has been instrumental in the design, development, and production of various aircraft, helicopters, and aero engines, as well as the supply of a wide range of avionics and communication equipment, catering to both civil and military markets. It has built military trainer aircraft, fighter jets, helicopters, and agricultural aircraft and has one of the largest maintenance depots and engineering services in the world. HAL stands as one of India's largest and most prestigious aircraft manufacturing entities, credited with the production of indigenous aircraft like the Tejas Light Combat Aircraft (LCA) and the Advanced Light Helicopter (ALH). HAL's expertise extends to aircraft upgrades, overhaul services, and the manufacture of aerostructures, avionics, and other critical components.

TATA ADVANCED SYSTEMS LIMITED (TASL)

TASL, a subsidiary of Tata Sons, is a leading private aerospace and defence company in India. With state-of-the-art manufacturing facilities and strategic partnerships with global aerospace giants, TASL has been at the forefront of aerospace innovation. They have successfully delivered critical aerospace components and systems, including fuselages, wings, aerostructures, and avionics for various international programs. TASL's collaboration with original equipment manufacturers (OEMs) and their commitment to research and development have positioned them as a trusted partner in the global aerospace industry.

TASL is set to undertake the manufacturing and assembly of 40 C-295 transport aircraft within the country. This initiative underlines the company's commitment to bolstering indigenous aerospace capabilities and fostering strategic partnerships in the defence sector. TASL is close to acquiring the capability to manufacture full aircraft, radars, and unmanned aerial vehicles (UAVs). It has tied up with Airbus for the manufacture of C-295 transport aircraft, a replacement for Avro HS-748. Its partnership with Airbus includes the supply of 16 aircraft in fly-away condition and 40 to be built in India.

MAHINDRA AEROSPACE

The Mahindra Group entered the aerospace industry in 2008 through its new entity, Mahindra Aerospace. In 2010, it acquired the Australian entities Gipps Aero

Recently, the Directorate General of Civil Aviation (DGCA) granted approval to a new variant of 'Hindustan 228-201 LW', manufactured by HAL. With a 19-passenger capability, this milestone marks HAL's first venture into the civil aviation space, signalling India's ambition to become a key player in commercial aerospace manufacturing

and Aerostaff. It is the first Indian company to go into full aircraft production, albeit on a small scale and outside India. In 2010, the company began developing a 25,000 square meter facility outside Bengaluru to produce airframe parts and assemblies within the country. The facility was formally inaugurated in 2013 and is now delivering aerospace sheet metal parts and assemblies for global companies. The company recently signed a "Statement of Intent" with Airbus Helicopters to form a joint venture for producing military helicopters in India.

Mahindra Aerospace's portfolio includes the design, development, and production of aircraft, aerostructures, and aircraft components. Its achievements include the production of the Airvan series of utility aircraft, which have gained international recognition for their ruggedness, versatility, and cost-effectiveness. The company's focus on advanced manufacturing techniques, quality standards, and collaborations with global aerospace companies has elevated its presence in the industry.

BHARAT FORGE

Bharat Forge, the flagship company of the Kalyani Group, has established itself as a renowned manufacturer and supplier of forged and precision-machined critical components and sub-assemblies widely utilised in high-performance engines, aerospace applications, and defence systems.

Bharat Forge has emerged as a leading supplier of various components, including airframe, structural, and engine parts for the aviation sector. The company is well-known for its manufacturing capabilities of aircraft compressors, turbines, and fan blades in India.

Expanding beyond the military market, Bharat Forge also operates in the commercial sector, supplying critical Indian components in fully finished condition to industry giants such as Rolls Royce and Honeywell.

AERONAUTICAL DEVELOPMENT AGENCY (ADA)

ADA plays a crucial role in the development of aerospace technologies and platforms in India. The company collaborates with HAL and various other aerospace organisations to harness expertise from across the country. ADA, under the aegis of the Department of Defence Research and Development (DDR&D), and the Ministry of Defence has successfully type-certified Tejas LCA, a multi-role supersonic fighter aircraft, which has showcased India's capabilities in advanced aircraft manufacturing and technology. Indian Air Force has already operationalised Tejas LCA Mk1.

DYNAMATIC TECHNOLOGIES LIMITED

Dynamatic Technologies is a leading aerospace and defence manufacturing company in India, specialising in precision engineering and manufacturing solutions. They boast a diverse product portfolio, including aerospace structures,

INDUSTRY UPDATE

systems, and components. Dynamatic has earned recognition for its expertise in complex aerostructures and hydraulics, supplying critical components to major global aerospace programs. Their commitment to research and development, and innovation, has positioned them as a reliable supplier to the global aerospace industry.

AEQUS

Aequs operates as a global aerospace ecosystem with comprehensive capabilities across forging, precision machining, surface treatments, and aerostructure assemblies. Aequs has garnered various quality certifications essential for aerospace manufacturing, including NADCAP accreditation for chemical processing, surface treatments, and NDT, as well as AS9100D certification for its quality management system. These certifications underscore Aequs's commitment to excellence and have established it as a trusted partner for industry giants such as Airbus, Boeing, Safran, Dassault, Collins Aerospace, Eaton, Honeywell, SAAB, and GKN Aerospace.

The road to an independent Indian aircraft manufacturing OEM is long and arduous, given the challenges of import dependence, technical complexities, and fierce competition. However, the large domestic market, which is set to become the third largest in the world, by 2030, has the potential for creating robust demand for domestic manufacturing of both commercial and military aircraft

KINECO

Kineco, established by Shekhar Sardessai in 1995, is a leading Indian composites manufacturing company focusing on mass transit, aerospace, and defence. Employing around 700 people across three manufacturing sites in Goa, India, including the Kineco Kaman JV, it serves diverse industries such as railways, industrial, defence, automotive, and marine.

Recently, Pilerne Goa-based Kineco Kaman Composites India secured a significant contract worth Rs 100 crore ($12.39 Mn) from BAE Systems. This contract entails the manufacture and export of fully assembled Mission Crew Workstations ("Consoles") for the Boeing P-8 Poseidon Aircraft, a versatile patrol and reconnaissance aircraft, operated by the Indian Navy.

Having been involved in this program since 2013, Kineco Kaman has already supplied over 700 Consoles to BAE Systems, earning several Gold Supplier awards for its impeccable delivery and quality performance. In 2020, it received the prestigious BAE Systems "Partner2Win Supplier of the Year" award for outstanding performance.

MOTHERSON

Established in 1975, Motherson is a prominent auto component manufacturer renowned globally, operating from over 350 facilities in 41 countries across five continents and employing over 180,000 individuals. It serves as a key supplier to OEMs worldwide. Motherson's Aerospace division marks a strategic expansion beyond the automotive sector. With a focus on becoming a preferred global solutions provider to aerospace customers, this initiative leverages Motherson's existing capabilities while actively acquiring new competencies to meet evolving demands. Collaborating closely with

Motherson's other business divisions, the Aerospace division undertakes greenfield and brownfield projects to cater to clients in India and abroad.

SASMOS

SASMOS is a leading design and manufacturing company specialising in electrical wiring interconnection systems, electromechanical assemblies, electronic sub-systems, and fiber optic interconnectivity products for various industries including air, land, weapon, marine, space, and nuclear segments. Its defence systems division is relentlessly focusing on R&D for customised electronics/electrical/electro-mechanical solutions.

These are just a few examples of the leading aircraft manufacturing companies in India. Apart from them, many innovative start-ups showcase their achievements, technological expertise, and commitment to quality, propelling India's aerospace industry to new heights. As these companies continue to push boundaries and contribute to the global aerospace sector, the future looks promising for India's aerospace manufacturing capability.

Airbus, a global aviation leader, collaborates closely with Indian suppliers, sourcing approximately 650 million dollars' worth of manufactured parts and engineering services annually from over 45 Indian companies. Airbus commercial aircraft and helicopters incorporate critical technologies and systems designed, manufactured, and maintained in India. Airbus, in partnership with local manufacturers, supports nearly 10,000 jobs in India, with plans to increase this number to about 15,000 by 2025. India is one of the key markets for Airbus, which received orders for more than 700 planes from IndiGo and Air India last year. Also, IndiGo, the country's largest airline, has only Airbus aircraft in it.

NEW DEVELOPMENTS

Recently, the Directorate General of Civil Aviation (DGCA) granted approval to a new variant of 'Hindustan 228-201 LW', manufactured by HAL. With a 19-passenger capability, this milestone marks HAL's first venture into the civil aviation space, signalling India's ambition to become a key player in commercial aerospace manufacturing. The variant has a maximum take-off weight of 5695 kgs, and provides several operational benefits for operators, such as reduced pilot qualification requirements enabling pilots with a commercial pilot license to fly the aircraft, and lower operational cost.

Nasik: India's Next Aircraft Manufacturing Hub

Nasik, known as India's wine capital, is poised to become a focal point for aircraft manufacturing in the country. HAL is gearing up to activate new production lines in Nasik for indigenous LCA Mk-1A and Hindustan Turbo Trainer-40 (HTT-40) planes, catering to the Indian Air Force's escalating demand for fighter jets and basic trainers. The establishment of the new plant for Mk-1As is expected to expedite the delivery of 83 fighters ordered by the IAF for ₹48,000 crore, potentially advancing the timeline by at least a year. Following this announcement, Air Chief Marshal VR Chaudhari revealed plans to procure an additional 97 LCA Mk-1As at an estimated cost of ₹67,000 crore, underlining IAF's confidence in HAL's ability to adhere to delivery timelines.

HAL's capacity to produce 16 LCA Mk-1As annually in Bengaluru will be augmented by the Nasik facility, enabling a total production of 24 jets per year. As India's largest air force and the world's fourth largest, IAF is slated to operate approximately 350 LCAs, including Mk-1, Mk-1A, and Mk-2 versions, with significant emphasis on modernisation and technological advancements.

Having previously manufactured Sukhoi-30s, Nasik's aircraft division, established in 1964, boasts a rich legacy of producing MiG variants and Su-30s under license. The ancillary industry ecosystem surrounding Nasik will significantly contribute to the LCA Mk-1A production, particularly in the supply of structural parts and components, further bolstering the region's aerospace capabilities.

The LCA project, initiated in 1983, aims to replace the aging Soviet-origin MiG-21 fleet. With the retirement of MiG-21 squadrons anticipated by 2025, the LCA variants will greatly enhance IAF's combat capabilities.

Collaborations between industry players, academia, and government agencies will play a crucial role in driving innovation and sustainable growth. The journey towards an independent Indian aircraft manufacturing OEM is a complex one, but not impossible

In addition, the new variant will result in reduced training requirements for flying and ground crew, including aircraft maintenance engineers. The approval of the 'Hindustan 228' aircraft underscores India's commitment to developing indigenous aircraft for both civil and defence purposes. It marks a significant shift in the country's aerospace industry, with potential implications for regional connectivity and economic growth. HAL and other aviation companies based in India are significant suppliers of aircraft components worldwide.

In another encouragement, the Digital Fly by Wire Flight Control Computer (DFCC) was integrated with prototype Tejas Light Combat Aircraft Limited Series Production – 7 (LSP7) and successfully flown by Wing Commander Siddarth Singh KMJ (Retd) of the National Flight Test Centre on February 19, 2024. Significantly, DFCC has been indigenously developed by the ADE, Bengaluru for the Tejas Mk1A. DFCC features a Quadraplex Power PC-based Processor, high-speed autonomous state machine-based Input/Output controller, enhanced computational throughput and complex on-board software complied with DO178C level- A safety requirements.

The improved version of the aircraft, Tejas MK1A features an advanced mission computer, high-performance DFCC Mk1A, Smart Multi-Function Displays (SMFD), Advanced Electronically Scanned Array (AESA) Radar, Advanced Self-protection Jammer, Electronic Warfare Suit etc.

Furthermore, Airbus and Dynamatic Technologies have announced collaboration to manufacture A220 doors under the 'Make in India' initiative. This partnership will not only strengthen the country's manufacturing capabilities but also foster job creation and technology transfer.

TAKEAWAYS

Currently, India heavily relies on imports for most commercial aircraft and major components. Building the entire ecosystem for a robust OEM, from raw materials to design and manufacturing, requires significant capital investments and technological advancements. The road to an independent Indian aircraft manufacturing OEM is long and arduous, given the challenges of import dependence, technical complexities, and fierce competition. However, the large domestic market, which is set to become the third largest in the world, by 2030, has the potential for creating robust demand for domestic manufacturing of both commercial and military aircraft. The aerospace sector in the country is at the inflection point, similar to the telecom and automotive sectors two or three decades ago.

The question of precisely how far the Indian market is from achieving an independent aircraft manufacturing OEM remains subjective, with multiple factors influencing this journey. Initiatives like "Make in India" and "Atmanirbhar Bharat" aim to promote domestic manufacturing, including in the aerospace sector. India boasts a growing aerospace ecosystem with both public and private players engaged in component manufacturing, sub-assembly, and maintenance, repair, and overhaul (MRO) activities.

Furthermore, Indian research institutions and tech companies are increasingly contributing to aerospace technologies, such as composite materials, electric propulsion, and artificial intelligence. Collaborations between industry players, academia, and government agencies will play a crucial role in driving innovation and sustainable growth. The journey towards an independent Indian aircraft manufacturing OEM is a complex one, but not impossible.

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

The start of flight testing is an important milestone for the Pearl 10X programme and for Rolls-Royce, as it focuses on growth in the business aviation market

ROLLS-ROYCE SUCCESSFULLY KICKS OFF THE FLIGHT TEST FOR ITS LATEST BUSINESS AVIATION AERO ENGINE PEARL 10X

London: Rolls-Royce announced on April 3 that it has successfully kicked off the flight test campaign for its latest aero engine for the business aviation market, the Pearl 10X, on the company's dedicated Boeing 747 flying testbed.

The engine has been selected by French aircraft manufacturer Dassault to exclusively power its brand-new flagship aircraft, the Falcon 10X.

The start of flight testing is an important milestone for the Pearl 10X programme and for Rolls-Royce as it focuses on growing in the business aviation market, as outlined at last year's Capital Markets Day. The Pearl 10X is the newest member of the state-of-the-art Pearl engine family and the first Rolls Royce engine ever to power a Dassault business jet. The French aircraft manufacturer's selection of the Pearl 10X for its new top product is further evidence of Rolls-Royce's position as the leading engine manufacturer in business aviation.

Based in Tucson, Arizona, USA, pilots and flight test engineers will put the engine through its paces over the coming months. The flight test programme will include engine performance and handling checks at various speeds and altitudes, inflight relights, tests of the nacelle's anti-icing system and fan vibration tests at various altitudes.

So far, the development programme on the ground has included the rigorous testing of the new ultra-low emissions ALM combustor, which is compatible with 100% Sustainable Aviation Fuel (SAF) and the new accessory gearbox, which allows for higher additional power extraction. The engine, which surpassed its target thrust levels on the very first test run, will be the most powerful business aviation engine in the Rolls-Royce portfolio.

Philipp Zeller, Senior Vice President Dassault - Business Aviation, Rolls Royce, said, "We are excited to enter into this important next phase of the engine development programme with the start of our flight test campaign. All the tests completed to date confirm the reliability of the engine and show it will meet the performance requirements to power Dassault's flagship, the Falcon 10X." The programme is advancing at pace and has successfully accumulated more than 2,300 testing hours, both on the Advance 2 demonstrator and the Pearl 10X engine configuration.

The Pearl 10X features the Advance2 engine core, the most efficient core available across the business aviation sector, and combines it with a high-performance low-pressure system, resulting in a superior thrust of more than 18,000lbf.

Compared to the last generation of Rolls-Royce business aviation engines, the Pearl 10X offers a 5% higher efficiency, while delivering outstanding low noise and emissions performance. The result is an engine that offers a market-leading combination of power and efficiency. This combination will enable customers and operators to have premium airport accessibility and fly ultra-long-range connections, whilst also being able to travel close to the speed of sound.

INTERVIEW

"WE BELIEVE THAT THE B767 TANKER PROVIDES THE BEST VALUE FOR THE CUSTOMER"

Israel Aerospace Industries' Aviation Group has a unique distinction of having programs for both Boeing and Airbus models. It has demonstrated strong business performance in the last two years despite geopolitical challenges.

In an exclusive interview with Editor – Raksha Anirveda, IAI's Aviation Group Vice President and General Manager, Shmuel Kuzi (SK) discussed the group's business activities, global expansion, and more. Here are the edited excerpts:

RA: How close is Israel Aerospace Industries (IAI) on its way to becoming the world's number one conversion centre for commercial aircraft? Kindly elaborate highlighting the focus areas that IAI is looking forward to in the near future?

SK: IAI's Aviation Group is already the world's number one conversion provider. With 737-700, 737-800, 767-200 and 767-300 supplemental type certificates (STCs), we have more ongoing programs than any other company. Once the A330-300 program goes into serial production, we will be the only company with current programs for both Airbus and Boeing models. We have converted roughly twice as many 767s as the OEM, and we plan on doing at least the same in the A330-300 market. Finally, the 777-300ERSF, with an STC just around the corner, is a game-changer, with a 100-ton payload that far exceeds anything any competitor will be able to offer.

RA. The world is witnessing a continuous increase in geopolitical upheaval. Has this affected IAI Aviation Group's business overall?

SK: Our business remains strong, and on the same upward trajectory that it has demonstrated over the last two years. In fact, we have achieved a profit for the last eight straight quarters. Despite the difficulties in our region, the last two years (2022-2023) were significantly profitable. While 2024 has its own challenges, our backlog is strong enough to provide a buffer and shows the confidence our customers have in our ability to deliver.

RA. The GCC region has good business prospects for commercial aircraft conversion business. To what extent has IAI been able to make inroads into this lucrative market so far? Can you identify some constraints that require immediate focus?

SK: IAI is active in the GCC (Gulf Cooperation Council) region, and the Aviation Group has strong relationships with the leading aviation companies in the UAE. We have an agreement to convert four B777-300ER aircraft for the Dubai-based Emirates, the world's largest operator of B777-300ER aircraft. We plan to convert Emirates' aircraft, and others, at Etihad Engineering's

MRO centre in Abu Dhabi, with the first induction scheduled for later in 2024. Other aircraft in the GCC region are also candidates for conversion, and we look forward to the geopolitical changes in the works that would make doing business elsewhere in the region truly a win-win situation.

RA. IAI has developed a unique specialty in converting different aircraft types, including the B707, B767, to military tankers and multi-mission transports. Conversions of the B767 represent the most comprehensive solution as a showcase. IAI, expanding its Indian footprint, has teamed up with HAL. Taking note of the Indian Air Force's future procurement of aerial tankers, have you initiated work on creating a self-reliant IAI-HAL ecosystem including life cycle support and how is it progressing? What is your India business outlook in the next five years and how do you plan to play a pivotal role in the Make in India and Make for the World initiatives?

SK: India is the third largest aviation market after the US and China, and projections for future growth are outstanding. No aerospace and defence company can ignore the Indian market. It is no secret that IAI has always had a strong relationship with the Indian Armed Forces. IAI has a signed MoU with HAL for the provision of B767 tankers to the Indian Air Force. We believe that the 767 provides the best value for the customer out of all the options. We expect that some, if not all, of the conversion work for the tankers will take place in India, to take advantage of the capabilities of the Indian defence industry and support the 'Make in India' initiative. We are in continuous contact with HAL to close the necessary details for a comprehensive and complicated program that will support Indian needs for the long term.

RA. By mid-2024 IAI will start operating three conversion centres – in the US, Abu Dhabi, and South Korea, and plans to open two additional conversion facilities in other countries. Can you specify these countries and do they include India?

SK: We are currently focused on opening conversion centres in the US, Abu Dhabi, and South Korea, and our facility in Israel is fully committed for the foreseeable future. We are always exploring ways of adding capacity, and if demand for B777-300ER conversions remains strong we could open sites in other countries. Currently, we do not have plans in India to open a conversion centre that does not include HAL.

RA. IAI boasts of being ahead of the competition. As planned, has IAI Aviation group started the conversion of the Airbus-A330 along with the conversion of the Boeing 787? Can you also provide insights into your supply of systems and spares business for the aircraft of many airlines around the world? Have you been able to achieve your projected USD 45 million turnover target?

SK: Passenger-to-Freighter conversions demand long-term planning and the efficient use of our engineers requires that we conduct multiple staggered development programs. The 777-300 development program was launched in 2019 and is nearing completion. The A330-300 program was launched in late 2021 and the prototype aircraft is nearing induction. We are constantly looking forward to the next development program, and have therefore begun to address the feasibility of conversion of the 787.

SPECIAL REPORT

AWAITING A DRASTIC OVERHAUL

India's MRO sector, propelled by a thriving aviation market, strives for global eminence. However, discrepancies in tax regimes, regulatory complexities, inadequate infrastructure, and a shortage of skilled manpower, high land lease rentals, and numerous other obstacles pose formidable challenges on the path to achieving self-sufficiency

By **VISHAL DUGGAL**

With a market size of USD 900 million and a current fleet size of about 730 aircraft, along with an order book of more than 1000 commercial aircraft, according to a report by the independent think tank Centre for Asia Pacific Aviation (CAPA), India is poised to become the third-largest buyer of commercial planes after the US and China. Major domestic airline operators such as Air India and IndiGo have placed two of the world's largest aircraft orders with Airbus and Boeing in 2023. The rise in fleet size, driven by increased trade and passenger movement, is expected to further fuel demand for Maintenance, Repair, and Overhaul (MRO) services. The exponentially rising civil aviation industry, therefore, presents a strong case for the development of the MRO industry in India.

It is imperative to delve deep into various aspects influencing the MRO sector in India: its current status, competitiveness, challenges faced by various stakeholders, initiatives underway to bolster domestic capabilities, and finally, outline a roadmap for near and long-term developments in the sector.

MRO INDUSTRY AND ITS SEGMENTS

The MRO ecosystem comprises Original Equipment Manufacturers (OEMs), airline operators, service providers, vendors and manufacturers of parts/spares. The MRO activities comprise routine checks, repair and scheduled replacement of components/parts, and maintenance during redelivery of an aircraft with the primary purpose of maintaining 'airworthiness' of the aircraft. These procedures are mandated by national regulatory authorities, which in turn are coordinated under international standards established by the International Civil Aviation Organisation (ICAO).

MRO services are categorised into four major segments – a) Line, b) Components, c) Engines and d) Airframes. Of these four segments, Engine and auxiliary power unit (APU) maintenance constitute almost 50% of the total MRO outlay, whereas component, line and base maintenance form around 32%, 8% and 10% respectively. In general, airline operators in India perform on-tarmac inspections (A and B checks) in-house and outsource engine, heavy maintenance (C and D checks), component repair

and modification work to third party MROs. Engine and APU maintenance is majorly done in the USA, as airlines find it more competitive there as compared to other destinations. Further, there is no major helicopter MRO facility in India except for Pawan Hans and Hindustan Aeronautics Limited (HAL).

KEY PLAYERS IN THE INDIAN MRO MARKET

- **Air India Engineering Services Ltd**
- **Air Works India (Engineering) Pvt Ltd**
- **Bird ExecuJet**
- **Deccan Charters Ltd**
- **GMR Aero Technic Ltd**
- **Indamer Aviation Pvt Ltd**
- **Max MRO Pvt Ltd**
- **Shaurya Aviation**
- **Taj Air**

CURRENT SCENARIO

In India, airlines spend around 15% to 18% of their overall revenues on maintenance, which becomes the second most expensive item after fuel (45% of

operating expenses). As of 2023, the MRO market in India is valued at around $1.8 billion. The sector has predominantly relied on imports, with approximately 90% of its requirements met through imports. For instance, as per stakeholders, engines spend for civil aviation is estimated to be around INR 6,000-

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7,000 crore, which poses considerable challenges. Therefore, local capacities need to be tapped in the long run. According to Deloitte, a proper MRO ecosystem needs to be established in India to meet the rising number of civil and defence aircraft and optimise turnaround time.

POTENTIAL OF MRO SECTOR'S GROWTH IN INDIA

The MRO market in India can be primarily categorised into five regions i.e. Delhi, Mumbai, Bangalore, Chennai and Kolkata. Some of the factors which are expected to provide necessary fillip to the Indian MRO industry are as follows:

MRO demand in India is anticipated to grow at a much faster rate than the rest of the world, thereby entailing attractive investment opportunities for domestic as well as foreign investors, OEMs and leading MROs across the world. Various domestic and foreign investors could also consider investing in the MRO sector in India by way of alliance and collaboration.

Indian MRO industry, according to a NITI Aayog report on which this article comprehensively draws, is expected to reach USD 4.0 billion by 2031, registering a CAGR of 8.9% as compared to the global average of 5.6%. This growth aligns with India's broader economic ambitions and its vision to become a self-reliant and globally competitive aerospace hub. An Ernst & Young study suggests that the Indian MRO market will grow at an average annual rate of 15%.

CHALLENGES BEFORE THE MRO SECTOR

Despite the optimistic projections, several challenges hinder the development of India's MRO industry. These include regulatory hurdles, inadequate infrastructure, shortage of skilled manpower, and limited domestic capabilities. Though the Government of India has initiated an array of reforms, integrating with the global value chain – in line with the progress made in other global MRO hubs like Singapore, Malaysia and Turkey – will be a long-term process for India.

The growth of the MRO sector depends on how efficiently and collaboratively India can address some of the key challenges faced by MRO players in India. For instance, Indian MROs face considerable barriers to break into the existing value chains, involving OEMs, internationally established MROs and airline operators. Impediments are also faced with respect to implementation of offset clauses, credit accessibility, availability of infrastructure, licensing and certification, taxes/duties and land lease rentals, to name a few. As Bharat Malkani, Managing Director, Max Aero Services Limited, put it: "The MRO opportunity is simply enormous at $2.5 billion annually with Indian companies contributing a paltry 10% or lesser of the total value. The industry is surviving on its tenacity alone and hoping for the day when the ecosystem of the regulations and policies governing the same is brought on par with international standards or made better so that it can do justice to Indian aviation."

Despite persistent efforts by the government, the following are some pertinent problems faced by the MRO industry:

ECONOMIC AND INFRASTRUCTURAL BARRIERS

Economies of scale – Economies of scale refer to the cost advantage derived due to reduction in fixed cost per unit of output, as output increases. There are high fixed costs in MRO operations where significant investments are required in facilities, equipment, and skilled personnel. New entrants may face challenges in competing with established enterprises that benefit from economies of scale.

Capital Requirements – New MRO facilities entail significant upfront expenditure in facilities, personnel, initial advertising, R&D and equipment.

Switching Costs – Switching costs can indeed be significant in industries like MRO, where precision, expertise, and adherence to regulations are critical. Customers may incur expenses related to retraining staff, adapting to new procedures, and rebuilding business relationships when switching suppliers.

LABOUR ISSUES

Brain Drain – The aerospace industry suffers from the non-availability of experienced engineering, design and technical manpower in India. Because there are fewer jobs available, there is a massive brain drain of skilled personnel out of the country. However, the overall growth of the Indian MRO sector may create job possibilities in India and encourage reverse migration.

LICENSING AND COMPLIANCE ISSUES

Non-recognition of Directorate General of Civil Aviation (DGCA) standards by European authorities has been a challenge for new entrants in the Indian MRO industry. Indian MROs must obtain European Union Aviation Safety Agency (EASA) approval for European Union registered aircraft, even if they have DGCA and Federal Aviation Administration (FAA) approvals. Moreover, the EASA approval becomes expensive for Indian MROs owing to associated inspection costs.

POLICY ISSUES

Complexities surrounding GST: While GST aimed to streamline taxation and create a unified market, the MRO sector has encountered challenges related to classification, tax rates, and input tax credit. For example, different GST rates apply to various components of MRO services, such as parts, consumables, and labour, leading to ambiguity and administrative burdens. Additionally, the availability of input tax credit on goods and services used in MRO activities is crucial for cost management, but complexities in claiming credits and compliance requirements have posed challenges for MRO operators. The aviation industry has raised concerns with the civil aviation ministry regarding the significant challenges arising from the high integrated goods and services tax (IGST) rates applied to certain items. While the GST rate for maintenance, repair, and overhaul (MRO) services related to aircraft and components was reduced to 5% in 2021, a discrepancy arises due to the inclusion of certain accessories used in MRO services under other GST categories.

IGST, applicable to interstate supplies, is collected by the Centre and distributed among the states involved. However, this results in inflated IGST rates for specific items like coffee makers, paint, and lubricants, which have applications beyond the aviation sector. These items incur substantial costs for purchase and maintenance within aviation, leading to a significant disparity in cost structures compared to non-aviation industries. For instance, an aircraft coffee maker may cost between ₹400,000–500,000, whereas a household equivalent may range from ₹5,000–10,000. Consequently, the industry faces IGST rates ranging from 12% to 28%, rather than the intended 5%.

According to a report by Niti Aayog, the cost of spares and components constitutes a significantly larger portion of expenses compared to other cost factors like labour for MRO operators. Consequently, the limited benefits of GST on spares and components have emerged as a major concern. The report highlights that airlines may be reluctant to bear a tax burden that is 20% higher than destinations like Dubai and Singapore, where zero tax structures and tax holidays of up to 10 years are offered to promote aircraft maintenance activities.

Resistance of AAI to offer MRO companies facilities at Airports: The resistance of Airports Authority of India to provide facilities to MRO companies at airports presents a significant obstacle to the development of the MRO sector in India. Unlike other infrastructure services essential for air safety, such as fire brigade services, MRO facilities are not universally offered by AAI at airports. This lack of support from AAI can hinder the growth of the MRO sector by limiting access to necessary infrastructure and services for aircraft maintenance and repair. It creates disparities in the availability of essential facilities for MRO operations, potentially leading to increased costs and operational challenges for MRO companies.

No Policy to allow MRO to warehouse Aircraft parts in India: Another challenge facing the MRO sector in India is the absence of a policy framework that allows MRO companies to warehouse aircraft parts within the country. Unlike some other countries where MRO operators can store and manage aircraft parts inventory locally, the lack of a clear policy in India restricts MRO companies' ability to establish efficient supply chain operations. This limitation can result in logistical complexities, delays in obtaining critical parts, and increased costs associated with importing components from overseas.

THE WAY FORWARD

India's strategic geographical location, cost-effective labour pool, and growing aviation market present favourable conditions for MRO expansion. Moreover, the government's policy reforms and initiatives aimed at promoting domestic manufacturing and skill development are poised to drive the industry's growth. The government has taken several steps to encourage companies to set up MROs in India, including lowering the GST on domestic MRO services from 18% to 5% with full Input Tax Credit from 1st April 2020, treating transactions sub-contracted by foreign OEMs and MRO companies to domestic MROs as exports with zero-rated GST, waiving custom duty on tools, toolkits and spares imported by MROs, and permitting 100% Foreign Direct Investment (FDI) through the automatic route, among others.

The growth of the MRO sector depends on how efficiently and collaboratively India can address some of the key challenges faced by MRO players in India. For instance, Indian MROs face considerable barriers to break into the existing value chains, involving OEMs, internationally established MROs and airline operators

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"The MRO opportunity is simply enormous at $2.5 billion annually with Indian companies contributing a paltry 10% or lesser of the total value. The industry is surviving on its tenacity alone and hoping for the day when the ecosystem of the regulations and policies governing the same is brought on par with international standards or made better so that it can do justice to Indian aviation."

Bharat Malkani, Managing Director, Max Aero Services Limited

Furthermore, initiatives such as the MRO Policy 2021, National Civil Aviation Policy (NCAP) 2016, removal of Gross Turnover Tax (GTO), etc prioritise the development of MRO infrastructure and human resources. Policies aimed at incentivising domestic MRO operations and streamlining regulatory processes are expected to stimulate investment and innovation in the sector. Eight Flight Training Organisations (FTOs) at AAI airports are being set up under the PPP model in the first phase at Belagavi (Karnataka), Jalgaon (Maharashtra), Kalaburgi (Karnataka), Khajuraho (Madhya Pradesh) and Lilabari (Assam). This would also be beneficial for expanding the penetration of civil aviation domestically.

As reported by certain MROs, capabilities have been developed over the years to conduct maintenance services – which were outsourced abroad in the past – in India. To carry out such services, only piece parts are imported and the maintenance work is conducted in India, thereby increasing overall profitability. This leads to such MROs moving up the value chain, which needs to be encouraged.

Recently, the government has also come up with a new MRO policy that would provide fillip to the MRO space through lucrative steps such as land leasing through open tenders will now be for 30 years from earlier 3-4 years, and the abolition of the AAI's royalty.

Depending on the location of the airport, lease rentals account for 10–15% of the annual cost of running an MRO unit. MRO units have sought intervention by the civil aviation ministry for a reduction in rental rates at which the government renews their land leases. According to industry operators, the norms state that a new allotment of AAI land is approved at 40% of prevailing land lease rates for MRO companies. However, the rates during the renewal of leases are elevated, crossing even 100% of prevailing rates. The MRO industry wants that the lease rate be capped at 40% at the time of renewal.

BRIDGING THE SKILL GAP

To meet the growing demand for skilled aircraft maintenance engineers and technicians, India's MRO industry is undergoing significant transformation. One significant initiative is the establishment of the GMR School for Aviation in technical collaboration with Airbus. This institution aims to provide comprehensive training solutions for aviation professionals, equipping them with the requisite skills and expertise to meet industry demands.

The GMR School for Aviation exemplifies the industry's commitment to nurturing indigenous talent and fostering collaboration with global leaders. By offering specialised training programs tailored to industry needs, such initiatives contribute to building a robust talent pipeline and reducing dependency on foreign expertise.

ACCEPTANCE OF DGCA REGULATIONS AT PAR WITH GLOBAL STANDARDS

The DGCA regulations at present are considerably harmonised with EASA regulations. Despite it, OEMs and manufacturers do not accept DGCA regulations and mandate FAA/EASA certification for heavy maintenance, lease return checks, etc. These multiple approvals and certifications result in loss of business opportunities for the Indian MRO players. It is desirable that the Government of India engage in bilateral talks with the EU, the USA, Canada, UK, Australia and other countries to harmonise and standardise DGCA certifications/approvals to be accepted at par with EASA/FAA/Transport Canada/UK CAA/Australian Civil Aviation Safety Authority (CASA) standards. This will assist in getting global recognition for Indian MRO players.

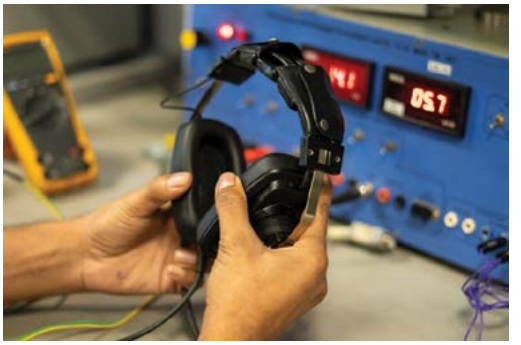
DEVELOPING A CAPITAL INVESTMENT INCENTIVE POLICY

India has a captive and growing domestic aviation market, unlike other MRO hubs such as Singapore, Malaysia, Sri Lanka, etc. which are export oriented and rely on the Indian fleet size to operate their businesses.

However, as a consequence of inadequate MRO infrastructure and regulatory bottlenecks, the domestic aviation sector is compelled to switch to international markets. To attract foreign OEMs/manufacturers and MROs, a capital investment incentive policy, encompassing component MRO, landing gears, engines and APU, with combined contributions from the Centre and the states is desirable. The incentives should be directly correlated with the degree of technology investments and capital expenditures. (Tax credits should be calculated using a percentage of capital

expenditure investments spread over 5-8 years).

Other incentives might include Production Linked Incentives (PLIs) for the manufacture of components and spares, Remission of Duties and Taxes on export products (RoDTEP) scheme on Indian manufactured parts and components, state level incentives and discount on electricity and other amenities, priority sector lending and improved soft infrastructure such as use of artificial intelligence and analytics, single window clearances, etc. to provide necessary push to the Indian MRO industry.



PUBLIC-PRIVATE PARTNERSHIP MODEL

Establishing an MRO facility involves a longer break-even period. This has been one of the major reasons for MRO players and OEMs to avoid establishing newer MROs in India. Moreover, the infrastructure and capacity utilisation of key public sector MRO players such as AIESL and HAL have not been optimal. At times, due to lack of spares or infrastructure, aircraft remain unserviceable beyond desired time periods. This is where the government can reap the benefits of a Public-Private Partnership (PPP) model, such as the private sector's efficiency, access to cutting-edge technical know-how as well as private funding.

Out of the numerous investment models, it is suggested that the government can incorporate the 'Government Owned, Privately Operated' model to collaborate with key private players and OEMs in the industry. Malaysia has efficiently leveraged the PPP model by attracting OEMs as strategic partners in developing its MRO industry.

CIVIL-DEFENCE MRO CONVERGENCE

The capacity of defence MRO players such as HAL is yet to be utilised completely. The training capacities, spares and components required in civil and defence sectors are similar. To induce holistic growth in the MRO industry, defence MRO and related infrastructure is crucial and cannot be ignored. It is, therefore, recommended to have a Civil-Defence MRO convergence for effective and efficient utilisation of available infrastructure and capacity in both the sectors.

Further, in terms of manpower, erstwhile defence personnel may be absorbed into the civil MRO industry to meet human resource requirements in the long run as well as ensure high quality output. The certification process of such personnel may also be relaxed owing to the considerable experience they possess in handling complex defence aircraft.

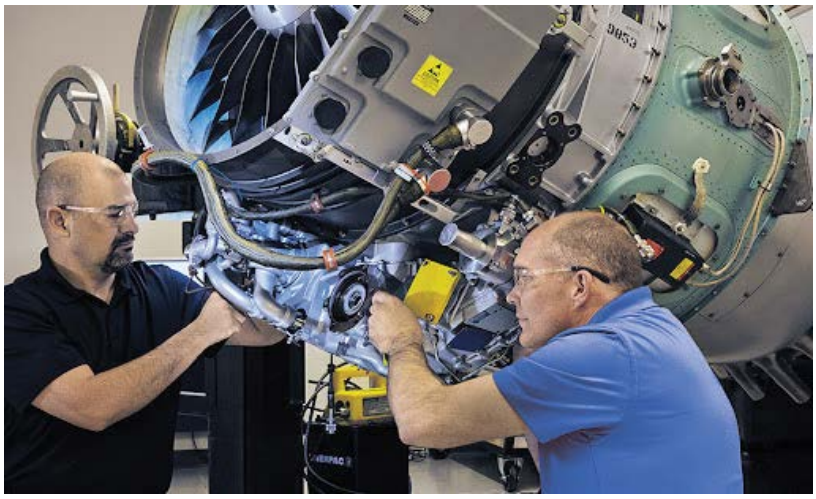
Civil-defence convergence will aid the stakeholders to jointly develop a plan on what civil and defence players could do together to enhance their capacities and identify the additional capabilities that can add value to this convergence.

RESOLVING ISSUES RELATED TO CUSTOMS DUTY, TAX, ROYALTY, ETC

To attract operators to conduct MRO services in India, the effective GST and customs duty – to the tune of 5-28% – levied on the purchase of components and spares needs to be brought down considerably, in line with countries such as Malaysia and Singapore. Further, Notification No. 55/2021-Customs dated 29thDecember 2021 has entailed duty exemptions for aircraft only, and has excluded aircraft parts. Therefore, aircraft parts continue to attract full duty as per their respective chapters – thereby making their procurement by MROs expensive – whereas airlines remain exempt from the same.

There is a need for relevant revisions to address this issue. Also, to maintain coherence in the interpretation of aircraft parts during custom checks and clearances, Illustrated Parts Catalogue (IPC) or any other appropriate document such as Aircraft Maintenance Manual (AMM), AAI Annual Report, 2021, Component Maintenance Manual (CMM), provided by aircraft/engine/component

SPECIAL REPORT



MRO units have sought intervention by the civil aviation ministry for a reduction in rental rates at which the government renews their land leases. According to industry operators, the norms state that a new allotment of AAI land is approved at 40% of prevailing land lease rates for MRO companies. However, the rates during the renewal of leases are elevated, crossing even 100% of prevailing rates

OEMs should be taken as substantive evidence by the customs department to enlist the parts and spares as aircraft parts and subsequently, all imports intended for use on aircraft – across various chapters – may be brought under a uniform GST of 5%, apart from abolition of customs duty on parts used in maintenance work of re-delivery aircraft.

The AAI, a statutory body under the Ministry of Civil Aviation (MoCA), may exercise relaxations with respect to the royalty levied on MROs, to make the business environment more competitive and viable. Another recommendation to attract the foreign investments in the MRO sector is the removal of dividend distribution tax and capital gain tax on foreign OEMs and MROs, which shall possibly attract large-scale collaborations and investments. Like Japan and Singapore, there can be registered importers in India to minimise the confusion and suspicion pertaining to misinterpretation of custom laws.

RELAXATION IN LAND RENTALS

The AAI is responsible for creating, upgrading, maintaining and managing civil aviation infrastructure in India. The land lease rentals charged by AAI to MRO players are exorbitantly high and further add on to the operating expense of MROs. The central government can provide discounts on land lease rentals (below the minimum threshold discount on ready reckoner/ circle land rates) in order to incentivise the MRO players. It is desirable that such reform measures form a part of the MRO Policy of the MoCA.

HUMAN CAPITAL DEVELOPMENT

The aviation sector is a strategic and sensitive industry that requires attention to detail and there is no scope of human error. It requires highly skilled manpower trained in the technical nuances of the aircraft models. To produce such skilled labour, a rigorous theory and practical curriculum is required. The existing training institutes should sincerely work towards upgrading their capabilities and imparting the right knowledge to the available human resources. The Government of India should invite MRO players/OEMs/ manufacturers and aviation universities to collaborate, coordinate and develop an efficient education and training curriculum to impart necessary training to the engineers and support staff engaged in the MRO industry. To incentivise aviation MRO as a viable career option for the Indian labour force, the Government of India can partly finance scholarships and other benefits such as student-exchange programmes, which will aid desirable human capital development for the MRO industry.

TAKEAWAYS

Recognising the potential and the need for self-sufficiency in this critical sector, the Indian government has set ambitious goals to transform the nation into a global MRO hub. India can ensure substantial advancements by developing a sustainable end-to-end ecosystem for commercial, general, and military MRO activities. The potential benefits include a reduction in foreign exchange outflow, greater employment opportunities, and augmentation of domestic MRO capability.

A well-established MRO industry in India, driven by favourable market dynamics, policy support, and industry initiatives, would create win-win situations for all stakeholders involved. Increasing indigenous capacities and manufacturing components and spares within the country would subsequently ensure lower MRO costs, better economic growth, and faster turnaround times while creating a sustainable end-to-end ecosystem for commercial, general, and military aviation.

By leveraging its strengths and addressing key challenges, India can gradually reduce its reliance on imports and establish itself as a preferred destination for MRO services. Through strategic investments in infrastructure, skill development, and technology adoption, India can realise its vision of becoming a self-sufficient and competitive player in the global aerospace arena.

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

BOEING COLLABORATES WITH AIESL FOR MAINTENANCE TRAINING IN INDIA

NEW DELHI: Boeing and AI Engineering Services Limited (AIESL) have agreed to work together to enhance aircraft maintenance training in India. Boeing will provide training materials, aids, and instructor support to help ensure standardisation of AIESL training programs. AIESL will provide infrastructure and instructors, while securing Civil Aviation Regulation (CAR) 147 approval from the Indian regulatory authority to conduct maintenance training for customers.

Expanding in-country expertise of maintenance employees is critical to meeting strong industry demand for trained maintenance technicians in India. The country will require almost 33,000 pilots and 34,000 maintenance technicians through 2042, according to Boeing's 2023 Pilot and Technician Outlook. This collaboration will expand local capacity to deliver comprehensive training programs required for compliance with Directorate General of Civil Aviation (DGCA) CAR-66 regulations.

The Boeing – AIESL collaboration will be the latest initiative under the Boeing India Repair Development and Sustainment (BIRDS) hub program. The BIRDS hub is a local network of suppliers working to build a robust MRO ecosystem for defence and commercial aircraft. This network aims to establish industry benchmarks in India for maintenance and repair, platform availability, customer satisfaction, and rapid turnaround time. The hub focuses on training programs aimed at increasing skilled manpower by developing sub-tier suppliers, and Medium, Small and Micro Enterprises (MSMEs) to build high-quality MRO capabilities in India.

ICELANDAIR SELECTS RTX'S PRATT & WHITNEY GTF™ ENGINES TO POWER UP TO 35 AIRBUS A320NEO FAMILY AIRCRAFT

East Hartford, Connecticut, USA. Pratt & Whitney, an RTX business, today announced that Icelandair has selected GTF engines to power up to 35 new Airbus A320neo family aircraft, comprising a mix of leased and purchased A321XLR and A321LR aircraft. With this order, Icelandair becomes a first-time GTF customer. The airline has also selected an EngineWise® agreement for the long-term maintenance, repair and overhaul of its GTF engines. Pratt & Whitney will provide support to facilitate smooth entry into service and long-term operation of the engines.

Founded in 1937, Icelandair's route network centres around the unique location of Iceland midway between North America and Europe, connecting a number of destinations to and from Iceland as well as across the Atlantic. The airline started operating aircraft powered by Pratt & Whitney Wasp engines in the 1940s. In the 1960s the airline adopted Pratt & Whitney turbojet and turbofan-powered aircraft, including the Boeing 727 and Douglas DC-8 and later the 767-300ER. Icelandair currently operates DHC Dash 8 aircraft powered by Pratt & Whitney Canada PW100 and PW150 engines.

The Pratt & Whitney GTF™ engine, featuring Collins Aerospace nacelle and engine accessories, delivers industry-leading fuel efficiency and sustainability benefits for single-aisle aircraft. The engine's revolutionary geared fan architecture is the foundation for even more efficient and sustainable propulsion technologies in the decades ahead, with advancements like the Pratt & Whitney GTF Advantage™ engine and beyond.

GLOBAL NEWS TRACK

NAVANTIA DELIVERS FIFTH CORVETTE BUILT IN BAHÍA DE CÁDIZ TO THE ROYAL NAVY OF SAUDI ARABIA IN JEDDAH

The C550 UNAYZAH was launched in December 2021 at the San Fernando Shipyard and was transported to the Saudi base where its construction was completed

Jeddah: On behalf of His Royal Highness Minister of Defence Prince Khaled Bin Salman, the Chief of Staff, General Fayyad bin Hamed al Ruwaili, and the Commander of the Royal Saudi Arabian Navy, Admiral Fahad Bin Abdullah Al-Ghofaily, presided the commissioning of the fifth corvette, built at Navantia's Bay of Cádiz shipyard, to the Royal Saudi Arabian Navy (RSNF) on March 7, 2024. The handover took place at the King Faisal naval base in Jeddah in accordance with the terms of the contract.

Delivering his speech at the commissioning event, His Excellency Chief of Staff of Royal Saudi Naval Forces, Admiral Fahad Bin Abdullah Al-Ghofaily said that HMS UNAYZAH is the fifth and last corvette of Al-Sarawat project to be delivered. HMS UNAYZAH, as the rest of her class, was built to be one of the world's most technologically advanced and powerful corvette to meet national mandates in realisation of Saudia's Vision 2030, possessing distinctive capabilities to handle multi-combat missions with high efficiency to enhance the combat readiness of the RSNF, to defend the strategic and vital interests of the Kingdom, and to maintain maritime security in the region.

His Excellency Admiral Fahad Bin Abdullah Al-Ghofaily also highlighted that the localisation of defence capabilities development and integration carried out onboard HMS UNAYZAH in the Kingdom of Saudi Arabia by the role of Saudi Arabian Military Industry (SAMI) in Al -Sarawat project, as well as, the successful accomplishment of extensive combat systems trials and live firings carried out

in KSA, has heavily contributed to achieve one of Ministry of Defence's strategy to localise more than 50% of the total military expenditure by 2030 aligning with Kingdom's Vision. The corvette, named UNAYZAH (C550), was transported to Jeddah on a specialised vessel for the completion of final construction and systems integration works, confirming the technology transfer (ToT) and production localisation capability of Navantia to the SAMINavantia joint venture.

The ceremony was attended the Admiral Chief of Staff of the Spanish Navy, Gonzalo Sanz and the President of Navantia, Ricardo Domínguez. Also in attendance were the Deputy Minister of Defence, Dr Albiyari; the Undersecretary of Procurement, Ibrahim Alsuwayed; the CEO of SAMI, Walid Abukhaled; the President of SAMINavantia, Mohammed Alkahtani; and the CEO of SAMINavantia, Sofía Honrubia.

AVANTE 2200 PROGRAMME

The corvette UNAYZAH has a length of 104 metres, a beam of 14 and seating for a total of 102 people between crew and passengers. The contract for the construction of five corvettes entered into force in November 2018 and, since the launch of the first unit (July 2020), Navantia has already launched the five units with a period of four months between each one of them, which means achieving this milestone in a record time of three years. Deliveries are taking place after just over three years from the cutting of the first plate of each ship.

The corvettes are based on the AVANTE 2200 design, adapted to the requirements of the RSNF, offering advanced performance, excellent work at sea, high survivability, and ability to operate in extreme temperatures.

Concurrently, around 500 crew members of these corvettes are completing the education and training process at the Navantia Training Centre (NTC) in San Fernando.

In addition to the corvette contract, Navantia agreed with SAMI (Saudi Arabian Military Industries) to create a joint venture in Saudi Arabia, an alliance that allows Navantia to position its integrated systems and technologically advanced solutions in the Arab market and area of influence and is aligned with the company's internationalisation strategy.

The contract assumes a global workload of around seven million hours and 6,000 jobs over five years. Of these, more than 1,100 are direct employees, more than 1,800 collaborating industry employees (more than a hundred companies participate at the programme) and more than 3,000 indirect employees generated by other suppliers.

The program includes, in addition to construction, the Life Cycle Support for five years from the delivery of the first ship, with an option for another five additional years, the last ship of which must be delivered in 2024.

It also includes the provision of various services, such as integrated logistics support, operational and maintenance training, provision of Education and Training Centres for the Combat System and Platform Control System of ships, Life Cycle Support, and ship maintenance systems at the Jeddah Naval Base.

Built to be one of the world's most technologically advanced and powerful corvette to meet mational mandates in realisation of Saudia's Vision 2030, HMS UNAYZAH possesses distinctive capabilities to handle multi-combat missions with high efficiency to enhance the combat readiness of the RSNF

TECHNOLOGY

RESEARCHERS DEVELOP NEW 3D PRINTED LATTICE METAMATERIAL

The RMIT team's artificial, multi-topology metamaterial was created using the common titanium alloy Ti-6Al-4V, and features a unique HLS design. This enables high strength with minimal weight

Researchers at RMIT University have achieved a significant breakthrough in material science with the development of a novel 3D printed lattice metamaterial. Utilising the titanium alloy Ti-6Al-4V, this innovative structure showcases exceptional strength while maintaining a lightweight composition, thanks to its unique hollow-strut lattice (HLS) design.

The high-strength structure is a "metamaterial," an artificial, cellular material specially engineered to possess unique mechanical and multifunctional properties. Previously, the production of these ultra-strong lattices has been impeded by manufacturability limitations and load stress concentrating on the interior of the hollow struts. These challenges have now been overcome by the scientists' additive manufacturing-driven approach.

Produced through powder bed fusion (PBF), the new 3D printing-optimised HLS structure has been designed to evenly distribute load stress, enhancing its strength and structural efficiency. This has been achieved by combining two complementary lattice topologies into a single structure. The researchers believe that this new material could offer value in a range of applications, including in the production of medical implants and aircraft or rocket parts.

According to the study's lead author, RMIT PhD candidate Jordan Noronha, the new metamaterial structure can be 3D printed in a variety of sizes ranging from several millimetres to several meters. Additionally, the design can also be fabricated using different types of 3D printers. Not just ultra-strong, the 3D printable lattice structure also features biocompatibility, corrosion and heat resistance to temperatures as high as 350°C. This reportedly makes it a promising candidate for numerous applications, including bone implants and key aerospace components.

Looking to the future, the RMIT team plans to further optimise the metamaterial to improve its efficiency and explore applications in higher-temperature environments. The researchers believe the material could be adapted to withstand up to 600°C by using more heat-resistant titanium alloys, ideal for the production of firefighting drones.

The researchers believe that this new material could offer value in a range of applications, including in the production of medical implants and aircraft or rocket parts

The RMIT researchers are not the first to explore the role of 3D printing in the production of highly durable metal lattices. Researchers from the University of Sheffield and Imperial College London (ICL) have previously developed 3D printed crystal-inspired metamaterials which offer high durability and damage tolerance.

Following experimental testing, the researchers found that the 3D printed parts were highly energy absorbent. The 3D printed parts were able to withstand seven times more energy than materials which mimic single-crystal structures.

Elsewhere, RWTH Aachen University's Digital Additive Production facility (DAP) is researching a new zinc-magnesium alloy combination for lattice structures as part of the BioStruct project. The DAP team is using laser beam powder bed fusion (LB-PBF) to 3D print the lattices, which offer the potential for the production of bioresorbable bone implants. The 3D printing process has reportedly opened up new design possibilities for the production of implants which meet patient-specific needs, such as mechanical stress and corrosion behaviour at the application site.

Western defence firms, even as they seek to tap into the Kingdom's substantial defence budget, grapple with its stringent mandates

WESTERN DEFENCE FIRMS CONCERNED OVER SAUDI ARABIA'S MANDATES

BEIRUT: At the recent World Defence Show in Saudi Arabia, the enthusiasm of Western defence firms to engage with the Kingdom's lucrative defence contracts was palpable. However, alongside the grand displays and networking, executives expressed concerns about deciphering the Kingdom's new local production mandates, especially regarding the requirement for local headquarters, weeks after a key deadline.

Adrian Kemps, an executive at L3Harris, emphasised the company's commitment to establishing operations in the Kingdom but highlighted the need for clarity on regulations before finalising plans. Kemps' sentiments echo those of other industry players navigating the complexities of doing business with Saudi Arabia. The heart of Saudi Arabia's localisation drive lies in its Vision 2030 initiative, which aims to boost domestic production. Introduced in February 2021, the mandates require foreign companies, including defence firms, to conduct 50% of production locally and establish a regional headquarters in the country by January 1, 2024.

While Saudi Finance Minister Mohammed al-Jadaan affirmed the freedom of companies to choose their headquarters location, he emphasised that those eyeing government contracts must have their regional headquarters in Saudi Arabia.

However, the specifics of what constitutes a regional headquarters remain unclear, leaving many companies uncertain about compliance. Despite the passing of the January 1 deadline, little seems to have changed for Western defence firms operating in the Kingdom, with many still seeking clarifications from government officials.

Companies are exploring creative solutions to navigate the mandates while maintaining operations in neighbouring Gulf countries. Some may opt for symbolic headquarters in Saudi Arabia while retaining functional operations elsewhere, such as in Dubai, to ease recruitment and operational challenges.

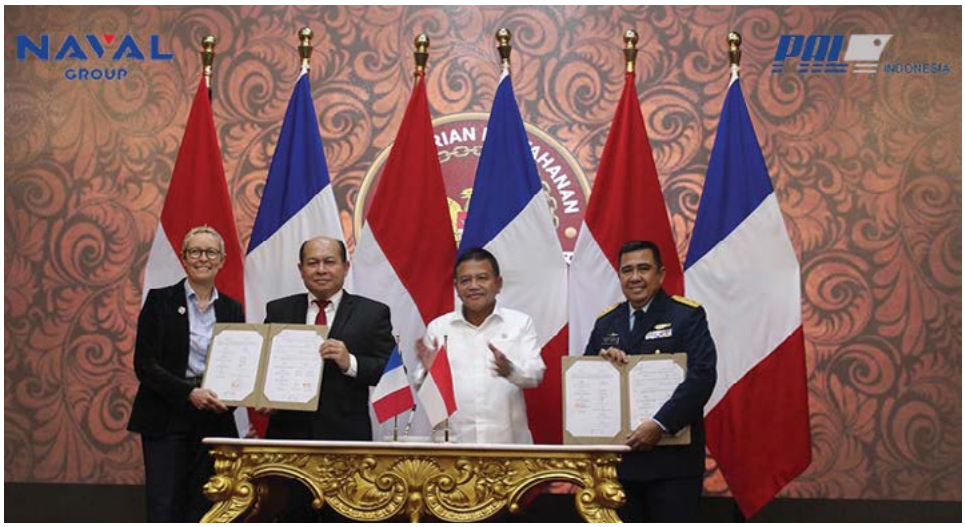
Boeing and Lockheed Martin, among others, are in discussions with Saudi authorities to ensure compliance with the regulations. Boeing has applied for a license to establish a regional headquarters in Saudi Arabia, while Lockheed Martin is engaged in talks with the Ministry of Investment regarding the headquarters program.

Despite the challenges, analysts predict that many foreign companies will eventually relocate their headquarters to Saudi Arabia, particularly those with direct government contracts. However, firms with investments in the Saudi market but no government dealings may seek to delay relocation.

While the headquarters requirement remains ambiguous, the technology transfer stipulation under Vision 2030 has been clearer and easier to meet through existing local offices or joint ventures. Lockheed Martin, for example, has initiated cooperation with Saudi firms to produce defence systems locally. As geopolitical tensions persist in the region, and with Saudi Arabia's defence production ambitions unabated, international defence firms remain eager to sail through the complexities and requirements to maintain their presence in the Kingdom.

NEWS ROUND UP

NAVAL GROUP, PT PAL SIGN CONTRACT WITH INDONESIA FOR TWO LOCALLY BUILT SCORPÈNE® EVOLVED FULL LIB SUBMARINES



Paris/Jakarta: Indonesia chose Naval Group and PT PAL on March 28, 2024 to strengthen the capabilities of the Indonesian Navy with two Scorpène® Evolved Full Lithium-Ion battery (LiB) submarines to be built in Indonesia in PT PAL shipyard, through a transfer of technology from Naval Group.

A new step in the strategic partnership with Indonesia

In accordance with the Defence Cooperation Agreement signed between the governments of France and Indonesia in August 2021, the Indonesian authorities have chosen Naval Group and PT PAL for their submarine program. The two companies had joined forces through a Strategic Partnership Agreement (SPA) signed in February 2022.

The contract includes the delivery of two Scorpène® Evolved Full LiB submarines that will be built in Indonesia within PT PAL shipyard, thanks to a proven transfer of know-how and technology from Naval Group, and reusing 100% of PT PAL assets.

"Naval Group is very honoured to be part of this new chapter in the strategic alliance between Indonesia and France. With Scorpène® Evolved Full LiB, Indonesia has chosen a high-performant, sea-proven submarine that will strengthen the country's maritime sovereignty and support the Indonesian Navy in achieving regional superiority at sea. In addition to the submarines, our strategic partnership with PT PAL will also support the Indonesian defence industry to actively prepare the future of naval warfare in the country. We are pleased to welcome the Indonesian Navy in the Scorpène® family," commented Pierre Éric Pommellet, Chairman and CEO of Naval Group.

Dr Kaharuddin Djenod, President Director of PT PAL said, "This step is a high commitment and trust of the Indonesian government in the capability of local engineers to advancing defence technology, especially submarine technology. The government's commitment in realizing the independence of the defence industry is also supported by the provision of Government Capital (PMN) to fully support the whole local production of submarine at PT PAL. In the future, Indonesia is expected to be able to master submarine technology."

Strengthening the Indonesian naval and defence industry

Naval Group and PT PAL have a firm intention of pursuing cooperation not only regarding submarines, but also about building Indonesian sovereignty to the benefit of the Indonesian defence industry. Thanks to an extensive transfer of know-how and the development of Indonesian industrial specific skills, the management, operation and maintenance of the force will be conducted in Indonesia, by Indonesian actors, ensuring both the autonomy of the country and the creation of thousands of long term high skills jobs.

To this day, Naval Group and PT PAL have already signed various cooperation agreements with Indonesian partners, for the submarine program and beyond.

Scorpène® Evolved, a high-performant attack submarine equipped with a cutting-edge energy system

Scorpène® is a modern, high-performant, and stealthy submarine. Robust and enduring, it's an ocean going submarine also designed for shallow waters operations. Multipurpose, it fulfils the entire scope of missions such as

Scorpène® is a modern, high-performant, and stealthy submarine. Robust and enduring, it's an ocean going submarine also designed for shallow waters operations. Multipurpose, it fulfils the entire scope of missions such as anti-surface and anti-submarine warfare, special operations, and intelligence gathering

anti-surface and anti-submarine warfare, special operations, and intelligence gathering.

Extremely stealthy and fast, it has a level of operating automation that allows a limited number of crew, which reduces its operating costs significantly. Its combat edge is highlighted by the fact that it has 6 weapon launching tubes, 18 weapons (torpedoes, missiles).

Scorpène® is equipped with the latest generation of combat system, SUBTICS®, which addresses the growing challenges of modern submarines missions in blue and shallow waters in the entire domain of submarine warfare.

The Indonesian Scorpène® submarines will be fitted with a cutting-edge energy system based on a full lithium-ion configuration which encompasses the highest security and safety standards and allows a higher range of useful energy, a better indiscretion rate and a reduced charging time. Thanks to this technology, high speed is available no matter the state of charge, increasing the submarine tactical mobility.

In addition to these two Indonesian Scorpene® submarines, 14 other units designed and adapted by Naval Group for the export market are in operational service or under construction around the world: 2 for the Chilean Navy, 2 for the Malaysian Navy, 4 for the Brazilian Navy and 6 for the Indian Navy. These successes demonstrate both Naval Group's ability to supply best-in-class submarines and to transfer technology successfully.

The final configuration of the submarine is adapted to meet the specific needs of navies and incorporate the latest innovations.

Scorpène® Evolved main characteristics:

- Surfaced displacement: 1,600 – 2,000 tons
- Length, overall: 72 m
- Submerged speed: >20 knots
- Diving depth: >300 m
- Autonomy: >78 days on a 80 days mission
- Submerged autonomy: >12 days
- Crew: 31
- Weapons total payload: 18
- Weapon tubes: 6
- SUBTICS combat management system
- Operational availability at sea: >240 days per year.

IIT KANPUR DEVELOPS SOLAR POWERED DRONE 'MARAL' FOR AERIAL SURVEILLANCE

New Delhi: A unique surveillance drone powered entirely by solar energy, named 'Maral' has been developed by the Indian Institute of Technology (IIT) Kanpur. This innovative drone Maral promises to revolutionise aerial monitoring capabilities, offering a unique solution for surveillance needs.

Developed in collaboration with IIT Kanpur, the Maral drone has remarkable surveillance capabilities and is equipped with solar panels. This cutting-edge drone harnesses sunlight to power its flight, ensuring extended operational durations without relying on traditional fuel sources and has the ability to soar to altitudes of up to 5 kilometres, providing comprehensive aerial coverage for surveillance purposes.

The innovative drone with the capability of capturing continuous images for an impressive 10 to 12 hours, offers unmatched endurance and efficiency in monitoring activities on the ground. Also, the Maral drone can be customised to accommodate various payloads, including cameras and routers, enhancing its versatility for different surveillance requirements.

The Maral drone offers a flexible solution for a wide range of scenarios – be it for disaster management or security agency surveillance. Beyond these applications, the Maral drone holds potential for various other uses, including environmental monitoring. Its ability to capture high-quality imagery from elevated vantage points makes it invaluable for assessing disaster situations and facilitating timely interventions.

With its active support to initiatives aimed at strengthening the country's defence infrastructure, IIT Kanpur has focused on enhancing national security and defence capabilities. The development of the Maral drone underscores IIT Kanpur's commitment to fostering innovation and addressing critical challenges through technological advancements.

Positioning itself at the forefront of research and development initiatives aimed at addressing societal needs, IIT Kanpur continues to nurture unique startups and innovative projects. With a track record of success in developing cutting-edge technologies, IIT Kanpur has bridged collaborations between academia and industry and helped them flourish.

APPOINTMENTS

LT GEN UPENDRA DWIVEDI TAKES CHARGE AS VICE CHIEF OF ARMY STAFF

New Delhi. Lieutenant General Upendra Dwivedi assumed charge as the Vice Chief of Army Staff, succeeding Lieutenant General MV Suchindra Kumar. Lt Gen Dwivedi, prior to taking over as Vice Chief of the Army Staff, was serving as the General Officer Commanding-in-Chief of Northern Command. He has vast operational experience along the frontiers with China and Pakistan. Lt Gen Dwivedi, an alumnus of Sainik School, Rewa was commissioned into 18 Jammu and Kashmir Rifles in 1984, a unit he later commanded. He has held command appointments in challenging operational environments, spanning the length and breadth of the country in his illustrious career spanning 39 years. He commanded his unit in Kashmir Valley as well as in Rajasthan.

Lt Gen Dwivedi was the Sector Commander and the Inspector General of Assam Rifles in an intense counter terrorism environment in the North East. He commanded the Rising Star Corps with an operational role along the western borders.He was also involved in modernisation and equipping of the largest Army command of the Indian Army, where he steered the induction of indigenous equipment as part of Atmanirbhar Bharat (self-reliant India).

Besides the challenging command assignments, Lt Gen Dwivedi has tenanted important staff appointments in headquarters Armoured Brigade, Mountain Division, Strike Corps and Integrated HQ (Army). As Deputy Chief of the Army Staff (Information System and Coordination), the General officer gave impetus to automation and absorption of niche technologies in the Indian Army.

The General officer has attended the Defence Services Staff College, Wellington, and Higher Command Course at Army War College, Mhow. He was conferred 'Distinguished Fellow' in the coveted NDC equivalent course at US Army War College (USAWC) Carlisle. He has an M. Phil in Defence and Management Studies in addition to the two Master's Degrees in Strategic Studies and Military Science including one from USAWC.

General Atomics Electromagnetic Systems Names Alec Gordon Chief Operating Officer

San Diego, Australia and New Delhi. General Atomics Electromagnetic Systems announced that it has promoted Alec Gordon to the position of Vice President and Chief Operating Officer of GA-EMS. Gordon will have responsibilities to advance business opportunities and strengthen operational resources in support of GA-EMS' extensive product and service portfolio. Gordon joined GA-EMS in September 2017, and has held leadership roles as Director of Aftermarket Sales and Services and Managing Director of GA-EMS Product Lines. As COO, Gordon is responsible for operations supporting all programs and product lines, including the organisation's electromagnetic aircraft launch system and advanced arresting gear, advanced weapon systems, space systems, satellites and payloads, advanced sensors, laser systems, nuclear technologies and advanced materials, and high power and energy technologies.

Gordon holds a Mechanical Engineering degree from Carleton University in Ottawa, Canada and completed a Masters for Architecture-based Enterprise Systems Engineering at the University of California, San Diego.

Boeing Names Amy List as Boeing Defence Australia Leader

Brisbane, Australia. Boeing has named Amy List as managing director of Boeing Defence Australia (BDA). She succeeds Scott Carpendale who served as both vice president & managing director of BDA and vice president of Government Services for the Asia-Pacific region since 2022. Carpendale will now focus entirely on the Asia-Pacific portfolio. List will be based at Boeing Defence Australia's head office in Brisbane and report to Carpendale. She will also serve as a board member of Boeing Australia Holdings and a member of the Boeing Australia leadership team led by Boeing Australia, New Zealand & South Pacific president Maria Fernandez.

Nikhil Joshi to Lead Boeing Defence India

New Delhi. Boeing has announced the appointment of Nikhil Joshi as managing director of Boeing Defence India (BDI), in a move to strengthen the company's operations and accelerated growth strategy for India.

Based in New Delhi, Joshi will lead current and future programs for BDI to enhance the mission readiness and modernisation of India's defence forces. Reporting to Salil Gupte, president, Boeing India and South Asia, Joshi will work in close collaboration with Boeing Defense, Space & Security (BDS) and Boeing Global Services (BGS).

Joshi has more than 25 years of aerospace and defence industry experience, including over two decades of service with the Indian armed forces in the aviation branch of the Indian Navy. Prior to joining Boeing, Joshi served as the country manager for Eaton Aerospace where he was responsible for growing the business footprint for Eaton in India. He has more than 4,000 hours of flying experience on various Maritime Reconnaissance aircraft and has commanded both frontline ships and air squadrons.

Boeing's commitment to India includes a heritage spanning over eight decades. Presently, India operates 11 C-17s, 22 AH-64 Apaches (with six more on order), 15 CH-47 Chinooks, 12 P-8Is, 3 VVIP aircraft (737 airframe), and two Head of State aircraft (777 airframe), all of which are Boeing platforms. India is at the front and centre of Boeing's business plans and is one of the largest defence markets for Boeing. BDI serves as a local entity, offering comprehensive lifecycle solutions for government and defence customers in India.

EDGE Appoints Saif Al Dahbashi as President of its Missiles & Weapons Cluster

Abu Dhabi, UAE. EDGE, one of the world's leading advanced technology and defence groups, announced the appointment of Saif Ali Al Dahbashi to the position of President of the Missiles & Weapons Cluster. Previously CEO of EDGE entity AL TAIF, Al Dahbashi brings with him over 18 years of experience in shaping and implementing large-scale transformational programmes across major commercial organisations.In his new position, Al Dahbashi will provide oversight and strategic direction on the development and business functions of four companies within the cluster, which includes Al TARIQ, CARACAL, HALCON, and LAHAB.

The Missiles & Weapons Cluster is one of five clusters within EDGE, with a dedicated focus to the design, development, and manufacturing of industry-leading smart weapons, firearms, and munitions.

Boeing Appoints Uma Amuluru Human Resources Leader

Arlington, Virginia. Boeing announced recently Uma Amuluru as the company's Chief Human Resources Officer and executive vice president, Human Resources, effective April 1. Amuluru succeeds Michael D'Ambrose who announced his plans to retire this July. In her new role, Amuluru will be responsible for Boeing's talent planning, global talent acquisition, learning and development, compensation and benefits, employee and labour relations, and diversity and inclusion initiatives. She will report to Boeing President and CEO David Calhoun and serve on the company's Executive Council. Amuluru currently serves as vice present and general counsel to Boeing Defense, Space & Security, a position she has held since early 2023. Prior to that, Amuluru served as Boeing's first chief compliance officer, where she stood up the company's Global Compliance organization, and served on Boeing's Executive Council. Before joining Boeing in 2017, Amuluru, who is a former federal prosecutor, held senior positions in the US government, including serving as counselor to the US Attorney General and Associate White House Counsel to President Barack Obama.

SHOWTIME

INTERNATIONAL POLICE EXPO 2024

The 9th International Police Expo 2024, the 8th India Homeland Security Expo 2024 and the 5th Drone International Expo 2024 will be organised at Pragati Maidan, New Delhi on July 4 and 5, 2024

New Delhi–based Nexgen Exhibitions Pvt. Ltd. has been organising India's only longest running exhibitions and conferences for Army, Police, Forensic, Defence, Firearms, Homeland Security experts, besides Drone & Anti-Drone Systems manufacturers and suppliers. In addition to these exhibitions, the 8th Annual Police Technology Conference will also be organised along with these exhibitions, this year.

The last editions of these exhibitions were well attended by senior officials from Ministry of Home Affairs, Ministry of Communication & IT and Ministry of Defence, India. More than 6,000 delegates from Ministry of Home Affairs, Ministry of Defence, Army, Navy, and Air Force personnel, Police, Central Armed Police forces, Special

AERODEF INDIA 2024

The AeroDef India 2024 is slated to serve as a convenient meeting point for both manufacturers and suppliers of Aero and Defence equipments, with Indian and international industry professionals and purchasers to engage mutually and chart out a succesful path for the AeroDef industry in India

The 4th edition of AeroDef India will be held in New Delhi from April 18 to 20, 2024 at Yashobhoomi Convention Centre. The three-days long business expo will bring together exhibitors and visitors from public and private defence entities, besides offering them an opportunity to network and hold meetings with various manufacturers and suppliers of AeroDef sector. Around 150 exhibitors are expected to participate at AeroDef India, along with showcasing 100+ live demonstrations.

AeroDef India is an exclusive platform for Indian and international aerospace and defence equipment manufacturers to source raw materials, components, sub-assemblies and finished products and sub contract essential manufacturing processes like forging, machining, moulding, finishing, material development etc. to Indian MSME's.

The event will also serve as an opportunity for the MSME's to showcase their capabilities, abilities, and manufacturing prowess to OEM's, strategic partners, and DPSUs.

The exhibitors at the expo would includes suppliers of surface finishing processes for aerospace applications; subcontracted product development for DPSUs; welding technology for aerospace and defence manufacturing; advanced precision forging; quality assurance; casting and powder metallurgy process and

Forces, Security organisations and industry stakeholders attended the events.

As these are the only exhibitions for the Police, Central Armed Forces & Homeland Security personnel specifically, respective stakeholders attended in a larger number, along with the three forces representatives.

Ambassadors, Military, Defence and Police attachés from various embassies in New Delhi, in addition to battalion purchasing agents, procurement departments, defence and security industry executives, civilian and military police personnel, besides top-level international delegations comprising CEOs, business development and R&D executives etc. from defence and private security agencies, detectives, banks' cash logistics personnel, research and development arms of defence and police establishments, criminology and forensic sciences experts, agencies and institutes, industrial establishments and PSU's executives, airports and seaports security personnel, private protection agencies and security consultants, security system installers and surveillance authorities are expected to attend these exhibitions in large numbers. These exhibitions will provide a convenient opportunity to the various manufacturers and suppliers of latest technologies to engage with the right audience conveniently at one place.

heat treatment; developing and manufacturing of special metals for aerospace industry; software applications in aerospace manufacturing with CAD/CAM software; automation, fasteners and tools; sensors, controls and instrumentation; design engineering and IT solutions; electronics components, semiconductors and deep electronics solutions; maintenance repair and overhaul (MRO); automation and robotics testing; simulation and prototyping; engineering and processing including casting, forging; sheet metal and forming, besides manufacturers and suppliers of industry specific tools and technologies and suppliers of specailaised fabric and glass components and many more industry specific applications and processes.

Professionals associated with procurement, supply chain, materials, production and subcontracting heads from DPSU's like HAL, BEML, DRDO, Indian Armed Forces, Ministry of Defence, R&D Labs, ADA, ISRO etc., Indian Private defence sector players like Tata Advanced Systems, Aditya Birla Group, Kalyani Group, Godrej, L&T, Reliance etc. and international majors like Lockheed Martin, Raytheon etc. are expected to be part of the vistors to the exhibition.

THE COUNTDOWN BEGINS: FIRST EDITION OF AVIATION INDIA SUMMIT & EXHIBITION 2024 TO DEBUT IN JUNE

New Delhi. The inaugural edition of the Aviation India Summit & Exhibition 2024 will take place in June 2024 in New Delhi. Being held for the first time in India, the aviation summits have been successful across Africa and the Middle East markets.

On June 12-13, Aviation India Summit and Exhibition 2024 will make it's debut opening at the J W Marriott Aerocity close to New Delhi International Airport, in association with India's Ministry of Civil Aviation. Under the theme - New India Rising - the summit looks at how India's aviation renaissance can achieve global ambitions. Aimed at the whole sub-continent, delegates and speakers from India's neighbours will look at how the region can shake off recent histories and truly develop into a global aviation powerhouse. Government officials, regulators, airline and airport CEOs, major manufacturers, the training industry and others across the whole supply chain will be in attendance – and participating in the two-day discussions.

The event will deliberate on How India's aviation renaissance can achieve global. Led by a revived national carrier spending $70 billion on a new fleet and $400 million on cabin refits, opportunities are immense. The two-day Aviation INDIA Summit & Exhibition in New Delhi will bring together leaders from the region's airlines, the regulators, airports, OEMs and companies large and small across the whole support and supply chain.

Summary plenary sessions along with symposia and targeted workshops will look at the strategies being adopted across the region and consider the tough questions, while a show hall will welcome exhibitors and displays from companies across the sector ready to showcase their products and ideas. Aviation India 2024 will also focus on some of the challenges and bring together speakers and participants to identify the issues and offer solutions.

The proposed key sessions include:

- Regulating for growth as India drives to achieve its potential
- Airline CEOs on the big issues from sustainability to safety, from regional competition and cooperation
- Navigating the landscape of South Asia airport development from infrastructure to digital transformation
- Services and support - the key to national prosperity
- What's the outlook for foreign investment in the India aftermarket? What barriers still exist? Is now the right time to invest?
- Market overview and forecast for India & region
- South Asia's part in solving global aviation sustainability challenge
- Will Make in India work? - what are the roadblocks to technology transfer and industrialisation
- The pivotal role of India's airports in bridging the gap between airline services and customer expectations.

NEWS ROUND UP

ROHDE & SCHWARZ EXPANDS FOOTPRINT IN INDIA BY OPENING A FUTURISTIC FACILITY IN DELHI

Rohde & Schwarz, the technology leader, inaugurated state-of-the-art facility in New Delhi, as part of company's long-term vision for India. Rohde & Schwarz, is making significant strides in India with recent expansions and strategic initiatives, from fortifying its facilities to venturing direct entry into Defence projects. With global to local approach, Rohde & Schwarz keeps emphasis to increase local value additions by production, Research & Development, Application Development, customisation for India specific needs, system integration, all well fitting into 'Make In India' initiative.

New Delhi/Munich. Rohde & Schwarz India, the Indian subsidiary of the German-based, global technology company Rohde & Schwarz, on March 4 celebrated the grand opening of its new facility located at Mohan Cooperative Industrial Estate, in New Delhi.

While inaugurating the new facility, Dr Alexander Orellano, Executive Vice President, Technology Systems of Rohde & Schwarz, said, "We are proud to expand our presence in New Delhi. The new facility, marks a significant step forward in the company's commitment to enhancing local production, software development, system integration, and assembly in line with the Indian government's objective of 'Make in India'. For Rohde & Schwarz, India is not merely a growth market but a vital component of our global strategy".

Yatish Mohan, Managing Director of Rohde & Schwarz India, expressed his pride in the company's contribution to India's defence, aviation, and surveillance capabilities, stating, "As a leading ecosystem partner in the Indian technology industry, Rohde & Schwarz India is proud to contribute to the nation's defence, aviation, and surveillance capabilities. Our focus on innovation, collaboration, and local value addition underscores our commitment to driving positive change and shaping the future of India's technological landscape. The new facility aims to further enhance these capabilities and serve as a centre of competence for surveillance solutions".

Rohde & Schwarz India has been a pivotal ecosystem partner in India's technology industry, catering to critical sectors such as defence, civil aviation, and surveillance. The company plays a significant role in providing cutting-edge technological solutions and services to key sectors like defence, civil aviation, surveillance, and more. Highlighting Rohde & Schwarz India's successful implementations, such as the deployment of state-of-the-art Milli Meter Wave Full Body Scanners at Bengaluru airport, the company has been at the forefront of innovation in defence and aviation, developing advanced systems and solutions tailored to the unique requirements of these sectors.

"We are proud to expand our presence in New Delhi. The new facility, marks a significant step forward in the company's commitment to enhancing local production, software development, system integration, and assembly in line with the Indian government's objective of 'Make in India'. For Rohde & Schwarz, India is not merely a growth market but a vital component of our global strategy."

Rohde & Schwarz is striving for a safer and connected world with its Test & Measurement, Technology Systems and Networks & Cybersecurity Divisions. For 90 years, the global technology group has pushed technical boundaries with developments in cutting-edge technologies. The company's leading-edge products and solutions empower industrial, regulatory and government customers to attain technological and digital sovereignty. Rohde & Schwarz generated a net revenue of EUR 2.78 billion in the 2022/2023 fiscal year (July to June).

Rohde & Schwarz India Pvt. Ltd is 100% owned subsidiary of Rohde & Schwarz GmbH & Co KG. The head office is located in New Delhi and branch offices in Bengaluru, Hyderabad and Mumbai. The company has invested heavily to increase the local support capability as well as to provide a fully automated calibration facility for most of the products sold. Rohde & Schwarz India has ISO 9001:2015 certified Quality Management Systems. The company continuously invests in training its service and sales personnel regularly to maintain a high level of technical competence in pre and post-sales support and outstanding quality in services viz. repairs, calibration, product support & project management.

ELBIT SYSTEMS SUBSIDIARY TO SUPPLY SHOT-SPOTTING SENSORS TO US ARMY'S AFRICA COMMAND

Washington. A subsidiary of Elbit Systems of America will supply the US Army shot-spotting sensors that can be mounted to watch towers, surveillance aerostats, unmanned vehicles and more.

Logos Technologies announced a $19.4 million deal for its Serenity hostile fire detectors late last month. The five-year arrangement also accounts for maintenance and operation costs across US Africa Command.

Serenity combines electro-optical and acoustic sensors to pinpoint the origin of weapons fire and explosions as far as 6 miles away. It can be paired with a wide-area motion imagery, or WAMI, device to document swaths of land over extended periods of time.

The Army Research Laboratory is also looking into a smaller version of Serenity that can be mounted on a gyrocopter, according to the company.

Counterterrorism missions across the African continent involve multiple countries and their forces. The region has been plagued by violent organisations affiliated with al-Qaida and the Islamic State group. In addition, coups in Mali in 2020, Burkina Faso in 2022 and Niger in 2023 have complicated US Defence Department operations and assistance programs there.

HENSOLDT SUPPLIES ALL-ROUND VISION SYSTEM FOR KNDS' SELF-PROPELLED WHEELED HOWITZER

Oberkochen / Germany. The sensor solution provider HENSOLDT has sold its all-round vision system SETAS (See Through Armour System) to KNDS in Germany. The order comprises a total of 54 units. The order value is in the double-digit million range. SETAS will be integrated into the customer's RCH 155 self-propelled artillery gun.

SETAS is a high-performance day and night observation system for armoured vehicles of all kinds. The high-resolution electro-optical vision system gives every crew member the opportunity to obtain full visual situational awareness 360 degrees around the vehicle from inside the vehicle. Threats within their radius of action can be reliably identified and classified at an early stage. The modular system comprises two high-performance sensor systems: high-resolution colour daylight cameras and uncooled thermal imaging cameras.

In a further configuration step, the observation capabilities of SETAS can be enhanced with integrated automatic image processing functions such as Moving Target Indication (MTI), object tracking and other modes. This makes it easier for the crew to cope with the large amount of image data for personal 360-degree situational awareness. Thanks to its modularity and open interface architecture (NGVA-compliant), this observation system can be easily integrated into any new or existing vehicle. The interface allows full integration or standalone operation by supporting any type of HMI (standard or smart display, smart glasses, tablet, etc.).

Using a helmet-mounted display as an HMI, a crew member inside the vehicle can practically see through the armour and thus achieve the same orientation as when observing "from above". Intelligent software algorithms automatically warn the crew if a potentially threatening movement is detected in the vicinity of the vehicle. SETAS can be installed as a stand-alone system, providing crews of both legacy platforms and new systems with significantly increased situational awareness.

NEWS ROUND UP

MINISTRY OF DEFENCE SIGNS CONTRACTS WORTH RS 8073 CRORE WITH HAL FOR ACQUISITION OF 34 DHRUV MK-III HELICOPTERS

New Delhi. The Ministry of Defence on March 13 signed two contracts with a combined value of Rs 8073 crore with the Hindustan Aeronautics Ltd for acquisition of 34 advanced light helicopters and associated equipment for the Indian Army and the Coast Guard.

According to the ministry, out of 34 Dhruv Mk-III helicopters, the Army will get 25 and the Coast Guard will receive nine. The Cabinet Committee on Security (CCS) had cleared the two procurement projects last week. The defence ministry in a statement said, "Consequent upon approval of the Cabinet Committee on Security (CCS), the Ministry of Defence signed two contracts for a combined value of Rs 8073.17 crore with the HAL on March 13 for acquisition of 34 Advanced Light Helicopters (ALH) Dhruv Mk III along with operational role equipment for Indian Army (25 ALHs) and Indian Coast Guard (09 ALHs) under Buy (Indian-IDDM) category."

Describing the acquisition under the Indian-IDDM (Indigenously Designed, Developed and Manufactured) category as a significant move towards indigenisation in defence manufacturing, the defence ministry stated that the ALH Dhruv Mk III UT (Utility) - the Indian Army version - is designed for search and rescue, transportation of troops and casualty evacuation among other roles. It has proved its performance in high altitude regions like Siachen Glacier and Ladakh.

The ALH Mk III MR (Maritime Role), the ICG version, is designed for maritime surveillance, search and rescue, rappelling operations and also for transportation of troops. It has proved its mettle even in adverse atmospheric conditions over sea and land, the ministry said.

NEWSPACE RESEARCH & TECHNOLOGIES RAISES $52 MILLION, LARGEST EQUITY INFUSION FOR AN INDIAN DEFENCE STARTUP

New Delhi. A leading drone manufacturer in India's defence domain, NewSpace Research & Technologies (NRT) has secured a substantial $52 million in a bridge round. A remarkable milestone, by an Indian startup in the Indian defence and aerospace sector.

The company has raised a notable $33 million equity infusion from prominent investors and $19 million in debt facilities from SBI's startup hub and SIDBI. Known for its expertise in swarm drone technology, NRT has actively engaged with the Ministry of Defence and demonstrated its capabilities on a global stage, particularly in Japan.

NewSpace Research & Technologies, founded with a vision to revolutionise the defence and aerospace sector, has established itself as a leader in swarm drone technology. The company has been pivotal in delivering cutting-edge solutions to the Ministry of Defence, achieving global records in altitude flight, and pioneering solar-powered UAV flights. NRT is currently delivering advanced systems to the Indian Army, showcasing its commitment to pushing technological boundaries.

The current funding round, a mix of equity and debt, represents a significant financial boost for NRT. The $33 million equity infusion comes from a mix of existing and new investors, including Cornerstone Venture Partners, 360 ONE Asset, and Volrado Venture Partners. Over 40% of the investment is reported to be from existing backers. NRT's valuation remains undisclosed, maintaining an air of anticipation in the investment landscape.

NRT has positioned itself as a frontrunner in the Indian defence startup ecosystem with this monumental equity raise underscoring the growing significance of indigenous technologies in the global defence and aerospace industry. The infusion of funds, backed by marquee investors, solidifies NRT's position to drive innovation and contribute significantly to the Indian government's Make in India initiative.

Harbouring global ambitions beyond its success in the Indian market, NRT has showcased its swarm drone operations in Japan, particularly in disaster management scenarios. Showcasing its potential to become a key player on the international stage, NRT is eyeing expansion in Japan, the Middle East, Europe, and the US.

The record-breaking equity raise by NewSpace Research & Technologies not only cements its standing in the Indian defence and aerospace sector but also signals a broader transformation in the industry. NRT is poised to play a pivotal role in shaping the future of defence technology with its commitment to disruptive technologies, global expansion, and contributions to national security. The government's initiatives, combined with investors' confidence, propels NRT towards fulfilling its vision of being among the top players globally.

DHRUVA SPACE AND SWEDISH SPACE CORPORATION EXPAND GROUND STATION NETWORK SYNERGIES, INDICATIVE OF THE LONG-STANDING INDO-SWEDISH BILATERAL COOPERATION

Hyderabad. Dhruva Space and Swedish Space Corporation (SSC) have taken a step further in their long-standing partnership, indicating a commitment to further collaboration in the realm of satellite ground station networks, to help accelerate the growth of Swedish and Indian new space industries initiatives. Dhruva Space will be leveraging the SSC network of Ground Stations for LEAP-1, an upcoming hosted payload satellite mission, which is slated for launch later in 2024.

This engagement marks a significant milestone in the existing collaboration between Dhruva Space and SSC in fuelling the goal of ease of access to space through Dhruva Space's full stack space engineering solutions offering through a Hosted Payload Mission.

This engagement builds on Dhruva Space's expertise in full-stack space solutions, encompassing satellite manufacturing, launch services, and mission operations, augmented by SSC's decades-long experience in establishment and operations of Ground Station operations and satellite communication services. Having a network of ground stations for the Launch Early Orbit Phase (LEOP) is essential for ensuring the success, safety, and operational integrity of satellite missions. These stations play a critical role in facilitating communication, data transfer, tracking, and control during the crucial early stages of a satellite's journey to orbit.

This agreement is a stepping stone aiming at future collaborations including collaborative Ground Station operations, the sharing of resources, expertise, and infrastructure to optimise Ground Station operations for both India and Sweden, as well as potential collaboration in joint research projects and development initiatives that leverage the strengths of both nations.

The ongoing collaboration between SSC and Dhruva Space stands as a testament to the enduring partnership between India and Sweden. The Indo-Sweden Space cooperation date back to 1986; this partnership has progressed over the years, examples of such synergies include Swedish payload SARA, designed by Institute of Space Physics, having travelled onboard India's first lunar mission Chandrayaan-1; India having become an Observer at the Arctic Council during the 2013 Kiruna Ministerial meeting; and the continued interactions and business across both Government and Industry levels.

Marking an exciting new phase in the evolution of Dhruva Space and SSC's relationship, the agreement was signed at the first ever India-Sweden Space and Geospatial Business Summit in Stockholm, Sweden, coordinated by the Geospatial World Chamber of Commerce (GWCC) and the Sweden-India Business Council (SIBC). This landmark agreement marks a significant step in further fostering international collaboration and advancing Ground Station activities worldwide.

BEL RECEIVES ORDERS WORTH RS 1,940.35 CRORE

Bengaluru. Defence PSU Bharat Electronics Limited (BEL) March 14 entered into a contract valued at Rs 847.70 crore plus taxes with Larsen & Toubro Limited (L&T) for the supply of 14 cutting-edge Communication and Electronic Warfare (EW) sensors and systems. These state-of-the-art systems, manufactured domestically by BEL, will be installed on three Cadet Training Ships for the Indian Navy. This collaboration between BEL and L&T exemplifies the strong partnership between the two companies and underscores the broader co-operation within the Indian Industry. The successful execution of this contract will involve the participation of numerous Micro, Small and Medium Enterprises (MSMEs) and represents a significant stride towards achieving the vision of Atmanirbhar Bharat. Additionally, BEL has secured other orders valued at Rs 1,092.65 crore following the last disclosure on February 13, 2024. These orders encompass the supply of LRUs for T-70 & T-90 Tanks, Communication Systems for the Indian Navy, as well as other Spares and Services.

ELBIT SYSTEMS' ADVANCED C4I SOLUTION SELECTED FOR EUROPEAN ARTILLERY UPGRADE

Haifa, Israel. Elbit Systems' solution for Artillery Command, Control, Communications, Computers, and Intelligence (C4I) has been selected by a European country. Under the agreement, Elbit Systems will enhance 155mm howitzer battalions with advanced Digital Fires capabilities, by seamlessly integrating its C4ISR Artillery Suite including the Torch-X Fires application and E-LynX Software Defined Radio (SDR) radios. Torch-X Fires is a multi-layer, integrated solution that incorporates industry-standard mature technology, based on Elbit Systems' state-of-the art C4ISR platform. It enables highly effective cross-force coordination, quick and precise planning and execution with quick and effective sensor-to-shooter capabilities. Complementing Torch-X Fires to a full digital solution, E-LynX™ family of SDR radios is the latest generation of tactical communication solutions, supporting the operational requirements of the modern battlespace, these radios ensure fast, resilient and secure communications for simultaneous voice, date and video capabilities in any terrain.

NEWS ROUND UP

HISTORIC ACHIEVEMENT: GRSE SIMULTANEOUSLY LAUNCHES TWO ASW SWC WARSHIPS FOR INDIAN NAVY

Kolkata. Garden Reach Shipbuilders and Engineers (GRSE) Ltd reached yet another significant milestone by simultaneously launching two ASW SWC warships for the Indian Navy on March 13, 2024.

The ships have been rechristened as Agray (5th) and Akshay (6th), named after erstwhile Abhay Class Corvettes Agray and Akshay of Indian Navy. While the original INS Agray was decommissioned in 2017, INS Akshay was decommissioned in 2022. The launch ceremony was presided over by Air Chief Marshal V R Chaudhari, Chief of the Air staff. In keeping with maritime tradition and the ships were launched by Neeta Chaudhari, President AFFWA and wife of Air Chief. Among the others present were Lt Gen R. C. Tiwari, Army Commander, Eastern Command, Cmde P R Hari, IN (Retd), Chairman and Managing Director, GRSE, RK Dash, Director (Finance), GRSE, Cdr S Bose, Director (Shipbuilding), GRSE, DIG Subrato Ghosh, ICG (Retd), Director (Personnel), GRSE & other senior officials of Indian Armed Forces, MoD & GRSE.

These two vessels were 5th and 6th in a series of 8 Anti-Submarine Warfare Shallow Water Crafts (ASW SWCs) being built by GRSE. The twin launches were significant as they came in less than four months after the launch of the 4th warship of this class, highlighting GRSE's commitment towards delivering warships well within schedule to Indian maritime forces.

The contract for building eight ASW SWC ships was signed between Ministry of Defence and Garden Reach Shipbuilders & Engineers (GRSE), Kolkata on April 29, 2019. Arnala class of ships will replace the in-service Abhay class ASW Corvettes of Indian Navy and are designed to undertake anti-submarine operations in coastal waters, Low Intensity Maritime Operations (LIMO) and mine laying operations. These 77.6-metre-long and 105-metre-wide extremely potent warships with a displacement of 900 tons and endurance of over 1800 NM are also capable of full-scale sub-surface surveillance of coastal waters, various surface platforms and coordinated anti-submarine operations with aircraft.

The ASW SWCs are compact waterjet-propelled ships capable of reaching maximum speeds of 25 Knots. These ships pack a lethal anti-submarine suite comprising light weight torpedoes, ASW rockets and mines. They are also armed with 30 mm Close-in Weapon System (30 mm) and 12.7 mm Stabilised Remote-Control Guns. The platforms are fitted with a Hull Mounted Sonar and a Low-Frequency Variable Depth Sonar.

In the last one year, three (3) indigenously built warships/ submarine for Indian Navy have been delivered and a total of nine (9) warships were launched. The launch of two more ships of the project highlights the nation's resolve towards 'Aatmanirbhar Bharat' in shipbuilding.

HENSOLDT SHOWCASES NEW-GENERATION RADAR TO SOUTH AFRICAN NAVY

Cape Town. HENSOLDT, a global pioneer of technology and innovation in the aerospace, defence, and security sectors, hosted a delegation of officers from the South African Navy to demonstrate the new-generation Quadome 3D surface and surveillance radar. Developed in collaboration with the Council for Scientific and Industrial Research (CSIR), this radar represents a significant advancement in naval surveillance technology. The demonstration not only highlights local innovation but also underscores HENSOLDT's commitment to partnering with local and international experts to drive innovation. The Quadome is the latest addition to the HENSOLDT Group's extensive radar portfolio, featuring new-generation technology that offers advanced situational awareness and extremely short reaction times at a competitive price. This multi-mission surveillance and target-acquisition radar features dual-mode operation and active electronically-steered antenna (AESA) technology, enabling rapid detection and tracking of

small, slow, and fast targets, thus providing a reliable air picture. The Quadome streamlines operator interaction and reduces workload, enhancing overall operational efficiency. The system's compact size and excellent price-performance ratio make it ideally suited for offshore patrol vessels (OPVs), corvettes, light frigates and support vessels. Its affordability and performance make it a compelling choice for maritime security operations, providing 3D air surveillance and air defence capabilities to vessels that may otherwise only have been fitted with 2D target-detection capability. Quadome is software-defined, allowing adaptation to the changing operational environment, and offers a predictive maintenance approach by synchronising maintenance activities with port visits, thus extending its operational lifetime.

The Quadome radar development programme, undertaken in South Africa since 2019, has brought together a significant number of engineers from HENSOLDT South Africa, the CSIR and strategic local partners. It is currently the largest defence radar development programme in South Africa and positions HENSOLDT South Africa as a key player in radar technology globally. Quadome is developed using only local IP and is not subject to foreign export control. The demonstration aimed to strengthen partnerships and foster a collaborative approach to addressing the evolving challenges in local maritime security. The advanced surveillance capabilities of the Quadome can play a pivotal role in enhancing maritime security and safeguarding critical interests, aligning with the SA Navy's vision of being unchallenged at sea and using information to achieve mission success.

EXPANDING INDIA FOOTPRINT: ISRAEL AEROSPACE INDUSTRIES LAUNCHES AEROSPACE SERVICES INDIA (ASI) IN NEW DELHI

Mumbai. Israel Aerospace Industries (IAI), a world-class aerospace and defence company, has opened AeroSpace Services India (ASI), its Indian subsidiary in New Delhi. The opening of ASI is a strong demonstration of IAI's strong collaboration with the Indian government's 'Aatmanirbhar Bharat'- 'Make in India' vision. This also shows the commitment to the strong partnership between IAI and DRDO in developing and supporting advanced systems for the Indian armed forces.

ASI trades in Indian Rupees and is the sole authorised OEM's Technical Representative for the entire Medium Range Surface-to-Air Missile (MRSAM) system. MRSAM is an advanced and innovative air and missile defense system that provides ultimate protection against a variety of aerial platforms. It is used by the Indian army, air force and navy. The system includes an advanced phased array radar, command and control, mobile launchers, and interceptors with advanced RF seeker. MRSAM is jointly developed by IAI and DRDO for the Indian forces. ASI boasts a workforce of approximately 50 employees, with 97% being Indian nationals. Headquartered in Delhi, ASI's strategically located branches extend its services across the entirety of the Indian subcontinent, reaffirming its commitment to nationwide coverage and customer satisfaction.

With its new facilities on the ground, ASI can significantly reduce turnaround times for repairs and service operations, ensuring swift and efficient support to our esteemed customers. Additionally, by operating locally, ASI is committed to reducing the cost of services and repairs, thereby providing tangible benefits to its valued customers.

AeroSpace Services India (ASI) is the Indian subsidiary of Israel Aerospace Industries (IAI), a world-class aerospace and defence company. ASI, a leader in defence innovation for Aatmanirbhar Bharat, enhances Indian Armed Forces with unmatched tech support. ASI offers tailored solutions that combine system maintenance expertise and advanced technology to keep India's Defence assets optimally operational and battle-ready.

ASI strives to be the preferred services partner by continually exceeding customer expectations, allowing end users to focus on their mission at hand. As a reliable and recognised service provider, Aerospace Services India has joined the Make in India - Aatmanirbhar Bharat project, giving India access to cutting-edge technology to meet consumer expectations.

GA-ASI TESTS SONOBUOY DISPENSING SYSTEM WITH MQ-9B SEAGUARDIAN

San Diego. On February 27, 2024, General Atomics Aeronautical Systems, Inc. (GA-ASI), in cooperation with the Naval Air Systems Command (NAVAIR), conducted a series of tests on GA-ASI's Sonobuoy Dispensing System (SDS) using the MQ-9B SeaGuardian® Unmanned Aircraft System (UAS) on the US Navy's W-291 test range in southern California.

GA-ASI's SeaGuardian flew the full test flight event configured with the SDS pod and SeaVue multi-role radar from Raytheon, an RTX business. During the test, the SDS pod dropped eight AN/SSQ-53 and two AN/SSQ-62 sonobuoys. Upon

dispensing, the sonobuoys were successfully monitored by the SeaGuardian's onboard Sonobuoy Monitoring and Control System (SMCS).

The SeaGuardian was flown under a NAVAIR Interim Flight Clearance. The SDS pod is fitted with an advanced pneumatic ejection system developed, designed, and manufactured by AEREA in Italy. AEREA also supplies the internal structure assembly. MQ-9B SeaGuardian is a medium-altitude, long-endurance RPA system. Its multi-domain capabilities allow it to flex from mission to mission. SeaGuardian has been used by the U.S. in several recent demonstrations, including Northern Edge, Integrated Battle Problem and Group Sail. The aircraft is currently being operated by the Japan Coast Guard (JCG) and the Japan Maritime Self-Defense Force (JMSDF).

NEWS ROUND UP

NEWSPACE RESEARCH AND TECHNOLOGIES AWARDED DESIGN, DEVELOPMENT CONTRACT BY IDEX-DIO FOR HAPS UAS FOR INDIAN NAVY

New Delhi. NewSpace Research and Technologies (NRT) has been awarded a contract by iDEX - DIO for design and development of a stratospheric High Altitude Pseudo Satellite (HAPS) UAS for the Indian Navy.

Largely geared towards the Indian naval needs in the IOR, this program is one of the path breaking contracts awarded under the Aatmanirbhar Bharat initiative and the DAP2020, with assured MOQs and a direct procurement post realisation of TRL 7-9. It is also one of the only few real world commitment for a HAPS class UAS product development effort across the world.

As one of the only two organisations in India carrying our indigenous development of a HAPS UAV from the ground up (arguably one of most difficult aerospace platform to realise); NRT will leverage its experience gained from successfully developing and flight testing the technology demonstrator as part of the previous iDEX - DIO sub scale aircraft development with the Indian Air Force.

NRT expects to develop this cutting edge dual use platform in the years ahead, focussing on persistent ISR, communication, ELINT missions of the Indian military and the communication needs, including beaming down of WiFi and 5G networks, as well as disaster monitoring applications from the stratosphere for civilian use cases.

HII RECEIVES ORDER FOR REMUS 620 – UNMANNED UNDERWATER VEHICLE

Mclean (Virginia). HII, a global all-domain defence provider, has received an order for a REMUS 620 unmanned underwater vehicle (UUV) from an international customer in the Indo-Pacific Region. The customised, medium-class REMUS 620 UUV will be built and delivered in 2024 by HII's Mission Technologies division and will be used for monitoring and data collection missions. Unveiled in 2022, the REMUS 620 has a battery life of up to 110 hours and a range of 275 nautical miles, providing unmatched mission capabilities for mine countermeasures, hydrographic surveys, intelligence collection, surveillance and electronic warfare. The REMUS 620 achieved two significant development milestones in 2023 with a successful in-water test in October and first sea test in December. This is the second REMUS 620 order. In August 2023, the US National Oceanic and Atmospheric Administration (NOAA) announced the order of two REMUS 620 UUVs for higher-resolution mapping of the Gulf of Mexico and NOAA's effort to restore the seafloor habitats damaged by the 2010 Deepwater Horizon oil spill.

FIREARMS PRODUCTION STARTS AT JD TAURUS' MANUFACTURING PLANT IN HISAR

New Delhi. In a bid to make India Aatmanirbhar in the critical areas of defence and security, Jindal Defence Systems Private Limited (JDSPL) has begun production at its state-of-the-art firearms manufacturing plant in Hisar as part of a joint venture with Brazil-based global leader Taurus Armas S.A. Under the brand name J D Taurus, JDSPL is poised to transform the landscape of firearms manufacturing in India and reduce India's reliance on imports, the company said in a statement on March 15.

The facility, spanning over two acres, represents a fusion of world-class expertise and cutting-edge technology. The manufacturing plant has an annual production capacity of up to 2,50,000 weapons, strategically positioning JD Taurus to address the growing demand in the country, it said.

In the next financial year, the company aims to manufacture between 25,000 to 30,000 weapons. Engineered for rapid scalability and product diversification, JDSPL has obtained all necessary regulatory approvals and clearances, including from the Ministry of Home Affairs, according to the company.

The trials and tests have been carried out with stringent quality control measures that have been mirrored from Taurus Armas. The entire process, from design to integration, testing and firing checks, is being supervised meticulously, the company said.

As per the company, it has secured certification for a range of products, with a notable 50-100 percent value addition in India for different products, such as rifles, carbines, submachine guns, machine pistols and revolvers.

The facility includes a dedicated shooting range for rigorous testing, ensuring the reliability of each firearm and adherence to stringent quality control measures, quality labs for metallographic and meteorological testing, and an assembling area managed by an access control system.

DEFENCE MINISTRY SIGNS OVER RS 200 CRORE DEAL WITH BIG BANG BOOM FOR INDIGENOUS ANTI-DRONE TECHNOLOGY

Chennai. Big Bang Boom Solutions Pvt. Ltd. (BBBS), India's fastest-growing defence sector start-up, has secured a significant order worth more than Rs 200 Crores from the Indian Air Force and the Indian Army, for its cutting-edge anti-drone technology. This historic contract, the largest under the Indian Defence Exhibition (iDEX) initiative, and one of the largest signed by the Indian MOD with an Indian startup is a testament to BBBS's unmatched expertise in deep tech products especially, anti-drone solutions. The Indian Defence Ministry's decision to place this order underscores the country's commitment to strengthening its security infrastructure and investing in Aatmanirbhar cutting-edge defence technology. Specifically, the anti-drone technology provides a game-changing response to the mounting threat posed by drones and unmanned aircraft systems (UAS).

BBBS's Vajra Sentinel System is a state-of-the-art solution designed to detect, track, and neutralise drones at extraordinary ranges. It utilises passive RF sensor technology to eliminate false alarms, and its sensor and jammer combination meets stringent mil standard specifications for durability and reliability. It has a number of state-of-the-art tech improvements such as AESA radar and kamikaze drones which can be upgraded on demand by the user.

The system's core sensor built around artificial intelligence (AI) and computer vision algorithms enables precise identification, classification and location identification of drones. Additionally, its sophisticated decision making matrix enables autonomous decision-making for countermeasures such as signal jamming and other counter measures.

BBBS will commence execution of the order immediately, with a focus on timely delivery, comprehensive training, and unwavering support to the Indian Air Force and Indian Army to ensure seamless integration of this vital technology into their defence strategies. The contract was handed over to Dr R. Shivaraman, Director and CTO, BBBS by AVM George Thomas, ACAS Plans, on behalf of Indian Air Force and Col Mahesh, Col CD – 7, on behalf of Indian Army in the presence of Defence Minister Rajnath Singh, Minister of State for Defence Ajay Bhatt, Defence Secretary Giridhar Aramane, Additional Secretary of Defence Production and CEO DIO Anurag Bajpai, Chief of the Defence Staff General Anil Chauhan and the Chief of the Air Staff, Air Chief Marshal VR Chaudhary.

Big Bang Boom Solutions is India's fastest growing startup in the Defence Sector. Founded by Dr Shiva and Praveen Dwarakanath, serial entrepreneurs in Deep Tech, it aims to co-create intellectual property that can be used by Indian Armed forces to counter asymmetric emerging threats. The founders have great network in the research space which helps them develop technology faster and at a rate that is far more frugal compared to their peers.

In addition to anti-drone system, the company has won 5 iDEX challenges announced by the Ministry of Defence and has successfully completed 3 of them in diverse field of drones, advanced chemical engineering, computer vision and cyber security. The company has also managed to setup channels for sales to friendly foreign nations through the Export Promotion Cell, DDP, MoD and is expecting their first export order in next few months.

GOVERNMENT APPROVES PROJECT TO DEVELOP AMCA - 5TH GENERATION STEALTH FIGHTER JET

New Delhi. In a significant development, the project to design and develop the Advanced Medium Combat Aircraft (AMCA) fifth generation stealth fighter jet was approved by the Cabinet Committee on Security (CCS) on March 7, 2024. According to sources, under the project estimated around Rs 15,000 crore, Defence Research and Development Organisation's Aeronautical Development Agency would develop the stealth fighter jet and its technologies in partnership with various private and public sector agencies and build around five prototypes in around five years. The project would see the prototype manufactured by industry including the public sector unit HAL.

The indigenous fighter aircraft projects have received a major boost from the Indian Air Force as the government has ordered over 200 Light Combat Aircraft along with clearance for engines for the LCA Mark-2 project. The government has been working towards the development of indigenous technologies and the military industry. The Defence Ministry envisages that the fifth generation aircraft project would generate jobs on mass scale and the Indian Air Force orders can generate business worth lakhs of crores for Indian entities. The Advanced Multirole Combat Aircraft (AMCA), a fifth-generation fighter jet, is slated to take flight by 2028, featuring cutting-edge technologies like stealth capabilities, AI integration, long-range targeting, and compatibility with unmanned systems. The aircraft is planned to be inducted into operational roles after 2030 and could potentially lead to the development of future generations of fighter jets in India. There are only four operational fifth generation fighters in the world currently, with the Americans having two — F-22 Raptor and F-35A Lightning II. The Russians boasting the Su-57 and the Chinese have the J-20, though their stealth technology is not fully recognised. Similarly, the fifth generation credentials of Chinese J-31 fighters are questionable so far. Expected to start getting inducted in operational roles beyond 2030, AMCA's first two squadrons are planned to be powered by the GE-414 engines while discussions are still on to co-develop more powerful engines for the remaining squadrons. India is likely to induct over 200 of these powerful fifth-generation fighters and the planes would also help India to develop future generations of fighter jets within the country.

IN NEWS

SPANISH ALPHA A900 HELICOPTER UAV TESTED BY INDONESIA FOR ARTILLERY AND COASTAL DEFENCE

New Delhi. The Indonesian Government on March 18, 2024, proceeded with trials of the Spanish Alpha A900 fuel-powered helicopter unmanned aerial vehicle (UAV) at Husein Sastranegara International Airport in West Java. The focus of these trials was to assess the UAV's performance in target detection and its potential role in supporting field artillery operations.

These trials saw participation from the Chief of the Army Artillery Centre, along with the Directors of Equipment, Training, and Material and Equipment, as part of an ongoing assessment regarding the potential use of the Alpha A900 UAVs by the Indonesian Coast Guard to monitor maritime sectors and identify anomalies within Indonesian territorial waters. This aligns with the UAV's potential role in the Indonesian Medan Artillery System, enhancing target identification and location for forward observers.

The application of UAVs like the Alpha A900 by Indonesian maritime services, including the Indonesian Maritime Security Agency (BAKAMLA), reflects a shift towards using unmanned systems for maritime surveillance and interdiction tasks. The use of UAVs is expected to affect the allocation of maritime security resources and the operational engagement of Indonesian Navy vessels, particularly in relation to the nation's territorial waters and exclusive economic zones. Aimed at evaluating its comparative effectiveness and technical capabilities against existing UAVs previously developed by the Army Artillery Centre's R&D division, the integration of the Alpha A900 into the Indonesian military's resources is part of a broader effort to review and potentially upgrade the current artillery systems in line with modern operational requirements.

Alpha Unmanned Systems' A900, set to be assembled in Indonesia in partnership with local companies PT. Global Defense and PT. MS Tech, is under scrutiny for several technical specifications that are deemed important for its intended operational role. It is equipped to handle operations in challenging maritime conditions, capable of performing automatic landings on moving vessels. The UAV is designed with autorotation and flotation devices for emergency scenarios. The A900 features protection against electromagnetic interference, an onboard generator supplying up to 150W for payloads, a laser altimeter, and navigation lights. Furthermore, it includes technology for operating in GPS-denied environments, while its control station ensures encrypted communications.

The A900 offers autonomous Vertical Take-Off and Landing (VTOL) from moving vessels, more than two and a half hours of autonomous hovering, and is powered by heavy fuel for extended usage. The UAV maintains a minimal logistical footprint and is equipped with four payload bays, each supporting a 4kg capacity.

For safety and operational reliability, it features autorotation, a maximum takeoff weight (MTOW) of less than 25 kg, a cruising speed between 60 and 100 km/h, emergency flotation devices, a Boxer low vibration engine, and redundant systems for critical operations. These characteristics make the A900 adaptable for varied missions, including Intelligence, Surveillance, Reconnaissance (ISR), border control, maritime security, search and rescue operations, infrastructure inspection, communications relays, and forward observation.

GA-ASI MAKES FIRST FLIGHT OF XQ-67A OBSS

San Diego. General Atomics Aeronautical Systems, Inc. flew the XQ-67A Off-Board Sensing Station (OBSS) for the first time on February 28, 2024. OBSS is an Air Force Research Laboratory (AFRL) program and GA-ASI was selected in 2021 to design, build and fly the new aircraft. With flight of the AFRL-funded XQ-67A, GA-ASI has validated the "genus/species" concept first developed with AFRL as part of the Low-Cost Attritable Aircraft Platform Sharing (LCAAPS) program focused on building several aircraft variants from a common core chassis. Under LCAAPS, AFRL and GA-ASI explored development of a chassis, termed a "genus", as the foundational core architecture from which several "species" of aircraft can be built. "This provides an alternative acquisition approach for military aircraft that enables faster development, lower costs and more opportunities for frequent technology refresh," said Trenton White, OBSS Program Manager and aerospace engineer in AFRL's Aerospace Systems Directorate. "XQ-67A is the first "species" to be designed and built from this shared platform. Flight demonstration of this system is a major first step toward showing the ability to produce affordable combat mass."

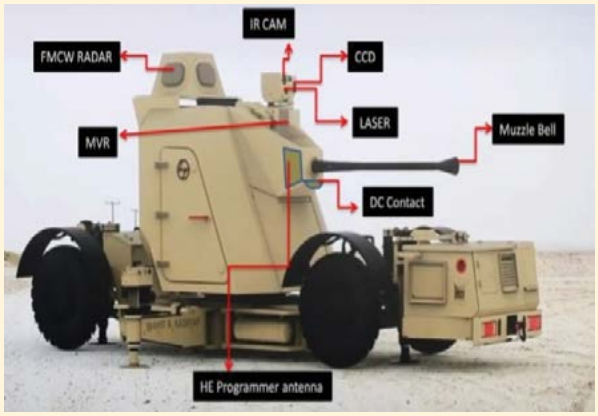
ANTI-TANK GUIDED MISSILE FIELD FIRING TEST CONDUCTED BY INDIAN ARMY AT TEESTA RANGE

New Delhi. The Indian Army conducted the week long annual Eastern Command Anti-Tank Guided Missile (ATGM) field firing at Teesta Field Firing Range in West Bengal from February 20-28. The exercise, conducted under the aegis of Trishakti Corps, focused on tactical scenarios where tanks are crucial. It included firing from various vehicles, including indigenous light strike vehicles, and by ground-based detachments. Engagement of targets by detachments inserted by helicopters was also practiced. More than 1500 personnel from various units of the Infantry and Mechanised Infantry Battalion participated in the command-level training exercise. The firing saw more than 260 missiles being fired to achieve the target of One Missile and Tank, according to the defence release. The firing was witnessed by the GOC, Trishakti Corps. He applauded the troops for their professional excellence and operational readiness and exhorted them to gain excellence in this important weapon, the release said.

INDIGENOUS VSHORADS MISSILE SUCCESSFULLY FLIGHT TESTED

New Delhi. India conducted two successful flight tests of a very short-range air defence missile off the coast of Odisha on February 28 and 29, 2024. According to the defence ministry, the DRDO conducted two successful flight tests of Very Short-Range Air Defence System (VSHORADS) missiles on February 28 and 29 from a ground-based portable launcher off the coast of Odisha from integrated test range, Chandipur. "During all the test flights, the targets were intercepted and destroyed by the missiles, meeting the mission objectives," the ministry said. It said the tests were carried out against high-speed unmanned aerial targets under different interception scenarios. Designed and developed indigenously by Research Centre Imarat (RCI) in collaboration with other Defence Research and Development Organisation (DRDO) laboratories and Indian industry partners, VSHORADS is a man-portable air-defence system and incorporates many novel technologies, including a miniaturised reaction control system (RCS) and integrated avionics, which have been successfully proven during the tests, the ministry said in a statement. It added, "The missile is propelled by a dual-thrust solid motor and meant for neutralising low-altitude aerial threats at short ranges. The design of the missile including launcher has been highly optimised to ensure easy portability."

LARSEN & TOUBRO SIGNS MAJOR CONTRACT FOR HIGH POWER RADARS



Mumbai.The Ministry of Defence has awarded a major contract to Larsen & Toubro (L&T), for the supply of High Power Radars (HPR) to the Indian Air Force (IAF). Under the project classification, the value of the contract is in the range of Rs 5,000 – Rs 10,000 crore. HPR is a static sensor for long range aerial surveillance with higher uptime. Equipped with multiple next- gen features and capable of remote operations, they will augment IAF's capabilities for monitoring special zones of interest, designating and tracking adversaries with optimal accuracy. The project is turnkey in nature and is to be executed across multiple locations. Larsen & Toubro also signed a contract, for an earlier won major order, for the supply of indigenously developed Close-In Weapon Systems (CIWS) to the IAF. CIWS is planned for deployment at various locations across India to protect vital assets from all types of low flying, low signature aerial threats including Unmanned Aerial Vehicles. CIWS comprises Air Defence Guns, Tracking Radars and a Search Radar linked to a Command & Control Shelter along with associated simulators and communication equipment. CIWS and HPR shall be realised at L&T's state-of-the-art manufacturing facilities, in close collaboration with industrial ecosystem partners comprising MSMEs across India.

SAAB STARTS CONSTRUCTION OF NEW CARL-GUSTAF FACTORY IN INDIA

New Delhi. Saab marked the start of the construction of its new Carl-Gustaf® manufacturing facility in India with a ground breaking ceremony on March 4, 2024. After receiving approval of 100% foreign direct investment, Saab has established a new company, Saab FFVO India Pvt Ltd, which will fully own the new manufacturing facility and produce the Carl-Gustaf M4 weapon. The facility is being built in the state of Haryana at the MET City at Jhajjar. The state has a strong industrial base of good potential partners and skilled employees. Saab will partner with Indian suppliers and will fully meet the requirements of "Make in India" for the systems manufactured in the facility. At the new factory, Saab will deploy complex technologies including the latest sighting technology and advanced carbon fibre winding to manufacture Carl-Gustaf M4 for the Indian armed forces, and components which may be included in other users' systems. The Carl-Gustaf system has been in service with the Indian Army since 1976 and is established as the main shoulder launched weapon in the Indian Armed Forces.

MOD TO PROCURE ARMAMENT UPGRADES OF ICV BMP 2, SIGNS CONTRACT WITH AVNL

New Delhi. The Ministry of Defence (MoD) will procure 693 armament upgrades of infantry combat vehicle BMP2. The defence ministry on March 13 signed a contract with Armoured Vehicles Nigam Limited (AVNL) for the procurement of 693 Armament Upgrades of Infantry Combat Vehicle BMP2 to BMP2M", according to an official statement. The ministry in a statement said, "This upgrade includes night enablement, gunner main sight, commander panoramic sight and fire control system (FCS) with automatic target tracker under Buy (Indian-Indigenously Designed Developed and Manufactured) Category." The AVNL has developed an "indigenised solution for providing existing BMP 2/2K with night fighting capabilities and FCS based on the integration of Defence Research and Development Organisation (DRDO) and Bharat Electronics Limited (BEL), Chennai-developed sight and FCS," it said. The AVNL will produce the "armament upgrades with equipment and sub-systems sourced from indigenous manufacturers", this will further strengthen the indigenous defence manufacturing ecosystem and accrue the benefits of the increasing self-reliance in this field, the ministry said.

IN NEWS

EDGE GROUP LEAPS INTO THE GLOBAL ADVANCED RADAR DOMAIN THROUGH MAJOR JOINT VENTURE WITH SPAIN'S TECHNOLOGY LEADER INDRA

Abu Dhabi, UAE / Madrid, Spain. EDGE Group has formalised a new Joint Venture (JV) agreement with Spain's Indra Sistemas (Indra), a world-leading information technology and defence systems company, and a significant player in major European programs such as the Eurofighter and the Future Combat Air System (FCAS), among others.

The agreement, signed in Madrid by EDGE Managing Director & CEO, Hamad Al Marar, and Jose Vicente de los Mozos, CEO of Indra, will see the new Abu Dhabi-based JV develop and manufacture next-generation radar systems in the UAE, opening a pipeline of orders for approximately 300 advanced radar solutions. The new business will be granted prime rights for current and future non-NATO and non-EU orders awarded to Indra.

The JV will place a strategic focus on the continued development of sophisticated technologies, innovation, and global market expansion by targeting untapped and fragmented non-NATO markets outside of the European Union. EDGE will bring its commercial strength and technology building blocks, while Indra will enhance the new company's capabilities by transferring technology, and shifting some engineering, commercial, and manufacturing capabilities to the JV.

The JV will also focus on building a team of highly-qualified personnel in the UAE, particularly in sales and engineering roles, by leveraging local Emirati, as well as global talent, ensuring sustainable operational excellence and innovative output.

GOVERNMENT LAUNCHES ADITI SCHEME TO PROMOTE DEFENCE INNOVATION, ACHIEVE SELF-RELIANCE

New Delhi. Unveiled during DefConnect 2024 in New Delhi, the Indian government has launched the Acing Development of Innovative Technologies with iDEX (ADITI) scheme to bolster defence capabilities and reduce dependency on foreign imports.

The scheme ADITI aims to promote innovation in critical and strategic defence technologies by providing grants of up to Rs 25 crore to eligible start-ups for research, development, and innovation endeavours in defence technology.

The ADITI scheme has been allocated a budget of Rs 750 crore for the period 2023-24 to 2025-26. Its primary objective is to develop approximately 30 deep-tech critical and strategic technologies, thereby enhancing India's defence capabilities and reducing dependence on foreign imports.

The ADITI scheme, under the broader framework of the Innovations for Defence Excellence (iDEX) program, administered by the Department of Defence Production (DDP), Ministry of Defence, encompasses collaboration between the government and the armed forces, with specific challenges identified by the Indian Army, Navy, Air Force, and Defence Space Agency. By leveraging the expertise of start-ups and the creativity of young innovators, ADITI aims to accelerate the development and deployment of indigenous defence solutions, thereby bolstering India's defence preparedness and resilience.

Initiatives like the Defence India Start-up Challenge (DISC) and the iDEX internship program play a crucial role in nurturing talent, fostering innovation, and bridging the gap between academia, industry, and the defence establishment. DISC introduces problem statements aimed at addressing critical defence challenges, inviting innovators to propose solutions that enhance defence capabilities and contribute to national security. The launch of initiatives like the ADITI scheme underscores the government's commitment to promoting innovation, entrepreneurship, and self-reliance in defence production.

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IN NEWS

ROBUST PERFORMANCE: GRSE ANNUAL TURNOVER FOR FY 2023-24 RECORDS YOY GROWTH OF 33 PERCENT

Kolkata. Garden Reach Shipbuilders & Engineers Limited (GRSE), one of the leading warship builders in the country, continues to maintain an upward financial growth and has achieved an annual turnover to the tune of Rs 3,400 crore (provisional & unaudited) for FY 2023-24, the highest ever in the history of the company. The robust financial performance has been achieved by the company through effective management of resources and improved internal efficiencies. The company had also declared an interim dividend @ 79% of paid-up share capital against 55% of previous year. In addition to being a leader in the shipbuilding sector in India, GRSE is a fully diversified company with products ranging from "Warships to Weapons".

SKYROOT AEROSPACE SUCCESSFULLY TEST-FIRES VIKRAM-1 STAGE-2 PROPULSION SYSTEM

New Delhi. Skyroot Aerospace conducted a crucial test of Stage-2 for its Vikram-1 rocket on March 27, 2024 in a significant endeavour towards reaching space. The test, conducted at the Indian Space Research Organisation (ISRO)'s test site in Sriharikota, marks a pivotal moment as it signifies the first private company in India gearing up to send a rocket into space. Previously in November 2022, Skyroot Aerospace had achieved a milestone with the launch of a smaller rocket, the Vikram-S. Lasting 85 seconds, the test demonstrated the rocket's capability to generate substantial power, measuring around 186 kilonewtons (kN) at sea level, with an expected increase to approximately 235kN in the vacuum of space.

The Kalam-250 rocket employs advanced materials and specialized systems for thermal protection, alongside a precision nozzle and control mechanisms to ensure accurate trajectory adjustments. The Vikram Sarabhai Space Centre played a crucial role in providing safety equipment for the test, while Solar Industries in Nagpur supplied the rocket's fuel. Prior to this, Skyroot had successfully tested another component, Kalam-100, in June 2021. Stage-2 is instrumental in transitioning the rocket from the Earth's atmosphere to outer space.

SIA-INDIA, ABRASAT PARTNERSHIP TO FOSTER INDIA-BRAZIL SPACE COLLABORATION

New Delhi. India's leading space association, SIA-India and Brazil's prominent Satellite Communications Association, ABRASAT forged a partnership through a memorandum of understanding (MoU) on March 28. This collaboration aims to enhance cooperation and progress in the space sector of both countries. The mutual commitment of both associations signifies the strengthening of their strategic collaboration in space. It lays the groundwork for innovative projects and technological collaboration. This partnership is anticipated to facilitate business expansion and mutual cooperation between India and Brazil across various domains such as satellite communication, rocket launches, payload development, and ground instrumentation. Highlighting the longstanding alliance between India and Brazil, Dr Subba Rao Pavuluri, President of SIA-India, stated the potential for deeper cooperation in satellite communication, encompassing a wide range of technologies and services, from broadband connectivity to emergency response systems. Acknowledging the successful history of space collaboration between Brazil and India, exemplified by the launch of the Amazonia 1 satellite, Mauro Wajnberg, President of ABRASAT, viewed the MoU as a significant step forward in strengthening ties and unlocking new opportunities for collaboration. Commending India's progressive FDI policy in the space sector, which allows 100 percent FDI, Anil Prakash, DG of SIA-India sees it as a catalyst for job creation, technological advancement, and self-reliance, aligning with India's initiatives for innovation and economic empowerment. Head of international business development at ABRASAT, Fábio Alencar highlighted the successful policies of the Brazilian government in digital inclusion and satellite technology promotion that has led to a positive environment for the development of satellite services, including the exploration of Brazilian orbital slots. Offering vast commercial opportunities, the growing space sectors of India and Brazil with private-driven activities and satellite deployments is witnessing a surge. The MoU between SIA-India and ABRASAT aims to explore new market dynamics, infrastructure development, and private investments, providing a platform for industry players to capitalise on emerging prospects.

US SUBSIDIARY OF UVISION AND SAIC SIGN AGREEMENT TO MANUFACTURE HERO 120 LOITERING WEAPON SYSTEMS IN US

Tel Aviv. The US subsidiary of Israeli company UVision and US company SAIC have signed an agreement for the manufacture of UVision's Hero 120 loitering weapon systems in the United States. The Hero 120 loitering weapon systems will be produced in Charleston, South Carolina, USA, significantly enhancing rapid response capabilities for all UVision clients in the United States. The collaboration with SAIC is aimed at establishing a fully independent domestic supply chain, ensuring that UVision's USA clients benefit from reduced dependency on international supply chains, faster delivery times, local training by expert teams, and comprehensive post-sale support and maintenance. The Hero 120 loitering munition system is a state-of-the-art, mid-range, anti-tank system designed to address the complexities of the modern battlefield. It offers high-precision strikes against anti-armour, anti-material, and anti-personnel targets, including tanks, vehicles, and soft targets in urban environments. With its ability to cause minimal collateral damage and equipped with a range of multi-purpose warheads, the Hero 120 provides operational users with an unparalleled effective engagement solution.

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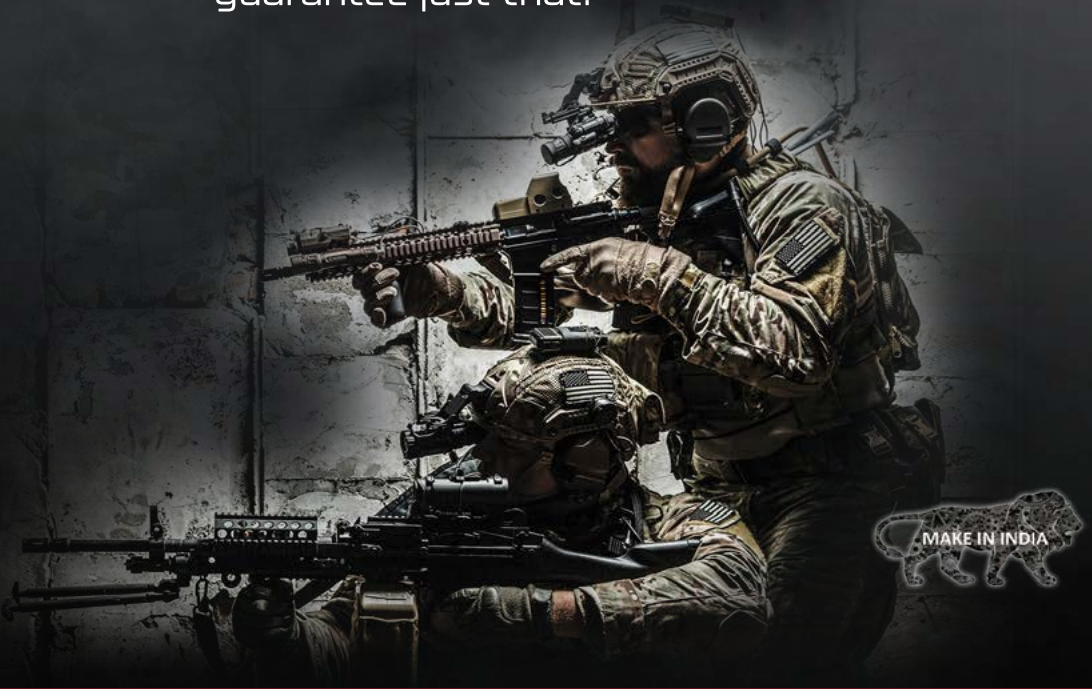

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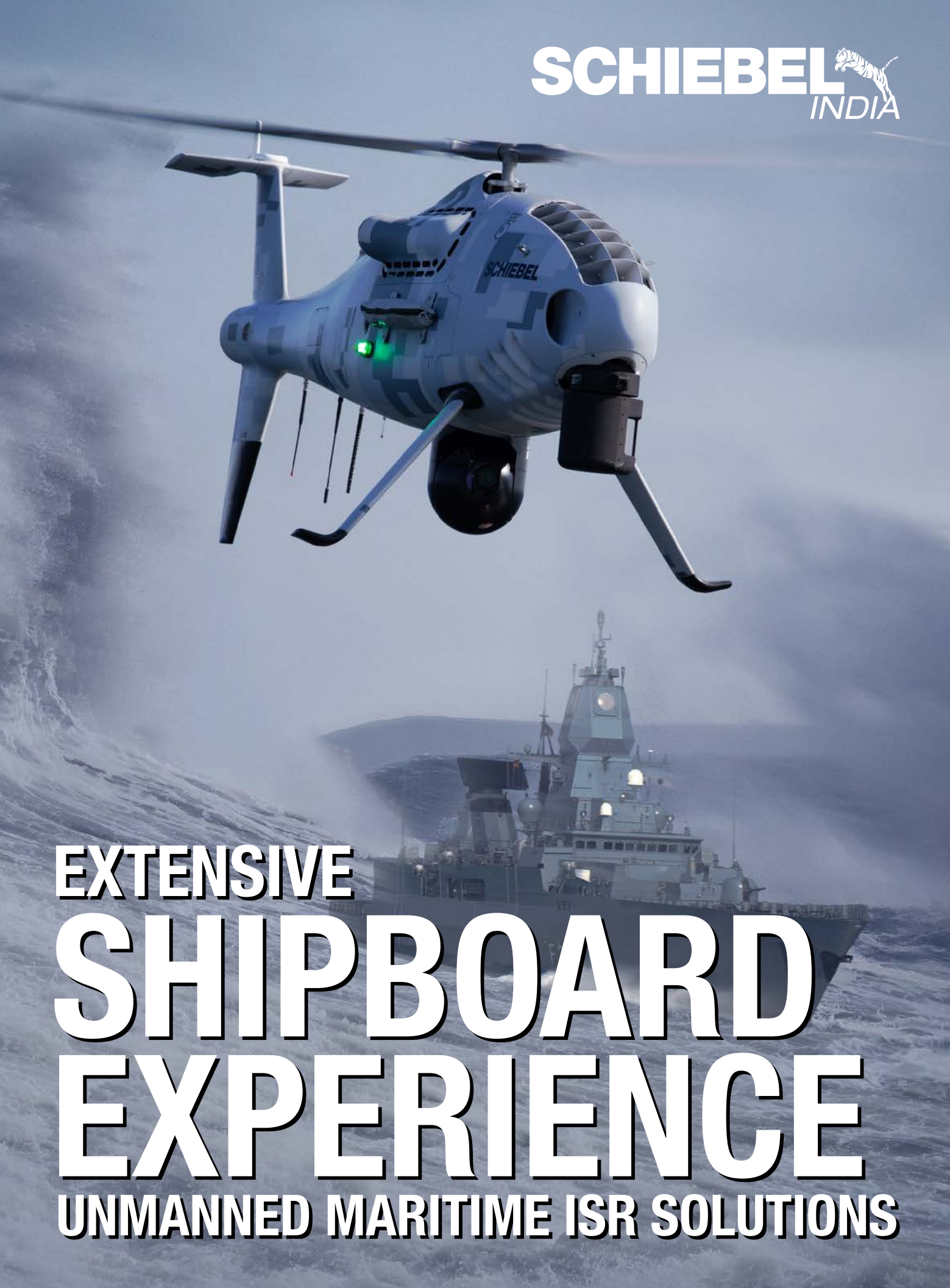

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