

Hello Yelahanka—we're back!



Photo: KS Chopra/Vayu

Aero India's 15th edition (10–14 Feb'25) is bigger than ever. From the usual 5 halls, it grew to 7 in 2023 and this time there are 9 halls. While this is great news for the organisers and the event itself, for us the 'Official Associate Media Partners', there is exponentially more work to do—that includes from walking the tiresome long distances meeting companies in scattered/spread out halls to the distribution of our Special Issue and Show dailies. But that's what it is all about for trade magazines like us and we would not have it any other way!!

The "first" Aero India show was held at Yelahanka Air Force Station, Bengaluru, in 1996, organised by the Defence Exhibition Organisation, Department of Defence Production, Ministry of Defence. This continues to be so.

However, the "first" one was in 1993 and called 'Avia India', so as far as we are concerned, this is the 16th edition of the Show.

And just to let everyone know, we have never missed any edition of the event and infact have been "Official" media partners for the DEO ever since its inception. Plus we have been bringing out Special Issues/Show dailies every time! All this thanks to our big and dedicated team who are more than passionate about all things aviation!

Cheers all and enjoy the show.

India's MoD and its review for 2024

The year 2024 witnessed some major achievements and breakthroughs as Ministry of Defence (MoD) marched ahead with “renewed vigour to make India a strong, secure, self-reliant and prosperous nation”. Some of the major highlights of 2024 included:

India-China border consensus: India and China achieved a broad consensus to restore the ground situation in certain areas along the LAC. Both countries have been holding talks at diplomatic and military levels to resolve the differences in some areas along the LAC. As a result, a broad consensus was developed on the basis of equal and mutual security. Raksha Mantri, during the Chanakya Defence Dialogue in October 2024, described the consensus as proof that continuous dialogue brings solutions.

Positive Indigenisation List: To boost Aatmanirbharta in defence and minimise imports by DPSUs, Department of Defence Production in July, notified the fifth Positive Indigenisation List (PIL) consisting of 346 items. These included strategically important line replacement units/systems, sub-systems, assemblies, sub-assemblies, spares/components and raw materials. Earlier, four PILs comprising 4,666 items were notified by the DDP for DPSUs, of which 2,972 items, having import substitution value worth Rs 3,400 crore, have already been indigenised. These five lists for DPSUs are in addition to the five PILs of 509 items notified by the Department of Military Affairs. These lists include highly complex systems, sensors, weapons and ammunition.

Record Defence Production: MoD achieved the highest ever growth in indigenous defence production in value terms during Financial Year (FY) 2023-24, on the back of successful implementation of the policies and initiatives of the Government. The defence production went up to a record-high figure of Rs 1,26,887 crore, reflecting a growth of 16.7% over the defence production of the previous financial year. The value of defence production in FY 2022-23 was Rs 1,08,684 crore. Of the total value of production in 2023-24, about 79.2% has been contributed by DPSUs/other PSUs and 20.8% by the private sector.

Record Defence Exports: Defence exports touched a record Rs 21,083 crore (approx. US\$ 2.63 billion) in the FY 2023-24, a growth of 32.5% over the previous fiscal when the figure was Rs 15,920 crore. The figures indicated that the exports grew by 31 times in the last 10 years as compared to FY 2013-14. The defence industry, including the private sector and DPSUs, have made tremendous efforts in achieving the highest ever exports. The private sector and DPSUs contributed about 60%



and 40% respectively. Raksha Mantri has exuded confidence that the target to export defence equipment worth Rs 50,000 crore by 2029 will be met.

C-295 Tata Aircraft Complex: Prime Minister Narendra Modi and his Spanish President Mr Pedro Sanchez jointly inaugurated the Tata Aircraft Complex for manufacturing of C-295 transport aircraft at Tata advanced systems limited Campus in Vadodara, Gujarat in October 2024. In September 2021, MoD had signed a Rs 21,935-crore contract with Airbus Defence and Space SA, Spain for supply of 56 aircraft; 16 to be brought in fly away condition from Spain and 40 to be built in India by TASL. Of the 16 aircraft, six have already been inducted into IAF at 11 Sqn based at Vadodara. The last would be delivered by August 2025. The first Made-in-India C-295 is expected to be rolled out of the Final Assembly Line facility at Vadodara by September 2026 and the remaining by August 2031.

Indian Light Tank: Indian Light Tank (ILT) ‘Zorawar’ has achieved a major milestone by firing a number of rounds at different ranges at an altitude of more than 4200m (High Altitude Location) with consistently accurate results.

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SAAB

Saab's Gripen E will be the fastest delivery to IAF



As the IAF looks closely at the full package of choices available for its MRFA acquisition programme, Saab's Gripen offer is a complete package of capabilities to defeat the most advanced threats in a modern battlespace while ensuring future operational relevance.

According to Kent-Åke Molin, Head of the Gripen India campaign, "Gripen's exceptional capabilities align seamlessly with India's defence needs, offering advanced weapons, cutting-edge sensors, countermeasures systems and pilot-friendly Human-Machine Collaboration (HMC)."

What is critically important from an IAF point of view is the speed of delivery and the transfer of capabilities to Indian industry to enable them to not build the aircraft but also take them to the next level.

"The Gripen E aircraft will be the fastest delivery to IAF on signing of the contract," Kent-Åke says.

Leveraging decades of experience in fighter jet production, Saab combines state-of-the-art manufacturing technologies with highly efficient processes to ensure swift delivery of Gripen. Factors such as AI, Model-based development, additive manufacturing (AM), and 5-axis high-speed machining significantly reduce lead time.

"We offer an industrial programme that builds self-reliance and offers sustainable high-tech jobs while creating extensive business opportunities across India. Our proposal includes the transfer of Maintenance, Repair, and Overhaul (MRO) capabilities, the local production of aircraft components and engine assembly, and the establishment of a state-of-the-art Gripen Design Centre in Bangalore.

The centre will harness local engineering talent for advanced avionics and software development. It will not only allow India to develop systems tailored to its specifications, but also ensure full control over its fighter systems, including the ability to execute upgrades and modifications," Kent-Åke says.

Saab's technology transfer offer goes far beyond Gripen; it includes potentially supporting indigenous programmes like the Light Combat Aircraft (LCA) and Advanced Medium Combat Aircraft (AMCA).

Gripen's technology transfer offer also presents India with opportunities to build a global export centre. "We would like to position India as a potential export hub for Gripen E aircraft and related systems. Our proposal promises a self-reliant defence industry that supports itself and serves international markets as well," Kent-Åke concludes.

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Successful first flight of HAL's LCA Mk.1A

The first aircraft LA5033 of the Tejas Mk.1A aircraft series took to the skies from HAL facility in Bengaluru on 28 March 2024. It was a successful sortie with a flying time of 18 minutes.

“HAL achieved this significant production milestone with concurrent design and development amid major supply chain challenges in the global geo-political environment subsequent to the contract signature in February 2021”, stated Mr. C. B. Ananthakrishnan, CMD, HAL.

The aircraft was piloted by Chief Test Pilot, Gp Capt K K Venugopal (Retd).

“HAL thanks MoD, Indian Air Force, DRDO/ ADA, CEMILAC, DGAQA and the MSMEs who have contributed to the success of this programme. With the

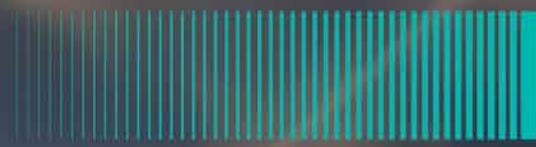


continued support of these stakeholders, the country can look forward to early induction of the Tejas Mk.1A by the IAF and more numbers through the three lines of production established at HAL”, stated the CMD.

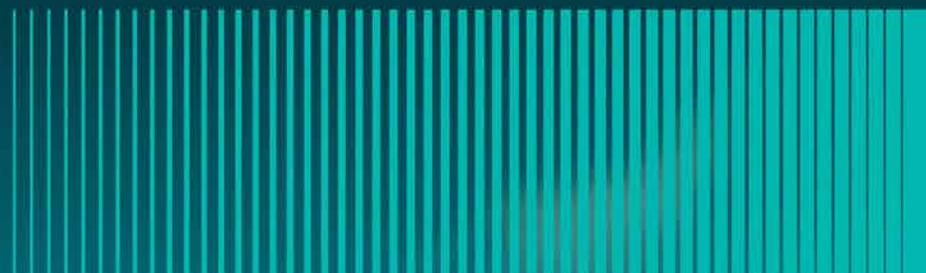
MoD contract with HAL for 12 Su-30MKIs

A contract for procurement of 12 Su-30MKI aircraft along with associated equipment was signed between Ministry of Defence and Hindustan Aeronautics Limited (HAL) on 12 December 2024, at an approximate cost of 13,500 crore inclusive of taxes and duties. The aircraft would have an indigenous content of 62.6%, enhanced due to indigenisation of many components to be manufactured by Indian defence industry.





TECHNOLOGY AND CAPABILITY
CO-CREATED IN INDIA, FOR THE WORLD



Rafael's focus at Aero India 2025

As Rafael commemorates nearly 30 years of collaboration in India, we reflect on a journey marked by shared success and deep rooted partnerships. Over the decades, we have delivered advanced, combat proven systems that continue to serve India's defence forces, a testament to the resilience and reliability of our solutions.

Our enduring commitment to India is more than just operational—it's strategic. Since 2014,



not only is designed to enhance India's defence capabilities but also contributes significantly to its economic growth and self-reliance.

At Aero India 2025, Rafael is showcasing its latest advancements in air defence, precision guided solutions and electronic warfare. Our focus remains on innovation, driven by substantial R&D investments to provide cutting edge technologies that secure critical assets while fostering local Indian partnerships.

Looking ahead, we envision India becoming a global hub for defence exports, a transformation supported by robust ecosystems we help create. The modernisation and growth of India's defence industry inspire confidence, and we at Rafael are proud to stand alongside our partners on this remarkable journey.

Rafael has fully embraced the Make in India initiative. Through our subsidiaries, Kalyani Rafael Advanced Systems (KRAS) and Astra Rafael Comsys (ARC), we have heavily invested in local manufacturing, technology transfer and knowledge sharing. This collaboration

We are deeply grateful for the trust and collaboration we have shared over the years. As we continue to innovate and grow together, Rafael remains committed to strengthening its partnerships with the Government of India, the Ministry of Defence, and our esteemed local partners.

Here's to many more years of shared success and innovation!

Text courtesy: Rafael

Images: Vayu



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BEL and IAI in JV for MRSAM support



Bharat Electronics Limited (BEL) and Israel Aerospace Industries (IAI), Israel's leading aerospace and defence company, have announced the establishment of a joint venture company (JVC), which has been incorporated in the name of BEL IAI AeroSystems Private Ltd.

The JVC with its registered office in Delhi shall be the single point of contact (SPOC) for extending long term product support to the Medium Range Surface-to-Air Missile (MRSAM) systems of India's Defence Forces.

The partnership marks another significant step in cementing the relationship between the two companies that have a long history of association for strategic programmes. BEL and IAI are collaborating in several joint programmes for the Tri-services.

The JVC has been set up for providing life cycle support, both technical and maintenance related, for MRSAM air defence systems of the country. MRSAM is an advanced, air and missile defence

system that provides protection against a variety of aerial threats. It was jointly developed by IAI and DRDO for India's Defence Forces and is currently used by the Indian Air Force, Indian Army, Indian Navy and also Israeli Defence Forces. The system includes an Advanced Phased Array Radar, Command and Control shelter, mobile launchers and interceptors with an advanced RF seeker.

The formation of the JVC is in line with the Indian Government's vision of Atmanirbhar Bharat. The JVC will leverage the capabilities of both IAI and BEL.



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METEOR

MBDA is committed to delivering to the Indian Armed Forces cutting-edge technologies and products to face today's and tomorrow's threats.



IAI launches innovation acceleration programme: NeuSPHERE

Israel Aerospace Industries (IAI) launched its NeuSPHERE Innovation Acceleration Programme in India on 25 November 2024. Rooted in IAI's commitment to promoting technological leadership, the NeuSPHERE Programme provides a platform for Indian deep-tech startups to co-create cutting-edge innovation, accelerate their growth and expand globally.

IAI's NeuSPHERE Innovation Acceleration Programme focuses on the Indian technology startup community, in particular inventive deep-tech startups focusing on big data, signal and image processing, advanced navigation systems, AI and autonomy, XR-maintenance and training, green energy, advanced production, quantum, edge computing, Human Machine Interfaces and wearable technology. It will provide the participating Indian startups access to advanced resources and technologies, including global mentorship and guidance, networking and funding, to accelerate their market-ready solutions.

Through IAI's NeuSPHERE Programme, IAI reaffirms its commitment to India's innovation ecosystem, propelling Indian startups towards global competitiveness and technological excellence.

Brig. Gen. (Res) Eytan Eshel, Executive Vice President of Technology, Chief Technology Officer (CTO), R&D and Innovation of IAI stated, "The



NeuSPHERE Innovation Acceleration Programme in India is a significant step towards fulfilling IAI's strategic vision of collaborating with India's startup ecosystem. We recognise the tremendous technology talent in India and are very excited about this programme and to work together to help these companies scale their offerings. This programme is part of our efforts to create a worldwide network of technological excellence and drive forward the future of aerospace and defence."



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THALES
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Interview with Ludovic Dumont, General Delegate, MBDA India Pvt Ltd



VAYU: *Can you briefly highlight the salient features of the MBDA Missiles Package for the Rafale Omni-Role Fighter and Rafale-Marine Variant, including the ‘game-changing’ Meteor BVRAAM, MICA Variants, Scalp Cruise Missile and the air launched Exocet AM39, and elaborate on their specific combat roles?*

India’s Dassault Rafale combat aircraft provide the Indian Air Force not just with a fast and agile modern fighter but one that comes armed with a highly potent set of weapons from MBDA that are unrivalled by any of India’s neighbours. The most famous of these weapons is the Meteor beyond visual range air-to-air missile, which is widely recognised as a game changer for air combat. The Meteor is powered by a unique rocket ramjet motor that gives Meteor far more engine power, for much longer than any other missile. This means it can fly faster, fly longer, and manoeuvre more than any other missile – giving Meteor the ability to chase down and destroy agile hostile fighters at even the furthest of ranges. As a result, Meteor has a no-escape zone many times greater than any other air-to-air missile. India’s Rafale are also be equipped with the Scalp deep strike cruise missile from MBDA to strike hardened and protected targets deep inside hostile territory. The IAF’s Rafale are also be equipped with MICA, a missile

the Indian Air Force knows very well as it is also part of the upgrade package for the IAF’s Mirage 2000 aircraft. MBDA is also proposing these weapons and the famous Exocet AM39 anti-ship missile for the Rafale M for the new Indian aircraft carrier.



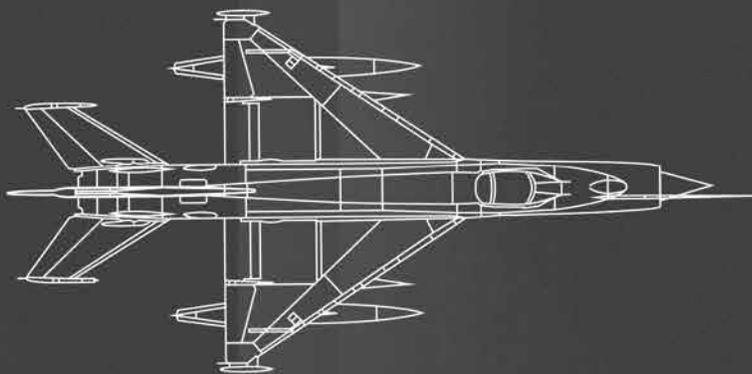
VAYU: *Can you update us on the integration for Wing-Top launch of the ASRAAM for the IAF’s Jaguar Upgrade programme and the MICA Missiles for the upgraded Mirage 2000 weapons package?*

Alongside delivery for new IAF platforms, MBDA is also able to delivery major capability enhancements to the existing platforms of the Indian Air Force. The Mirage 2000 upgrade and the Jaguar upgrade programme are two notable examples of this. Here MBDA has delivered MICA air combat missiles for the Mirage 2000 upgrade, and has delivered ASRAAM missiles to upgrade the air combat capabilities of the Jaguar fighter fleet. These also boost the IAF’s inventory and stockpile management, for MICA is now used across both the Mirage 2000 and Rafale fleet; while ASRAAM is to be used on Jaguar, Tejas and potentially further platforms in the future.

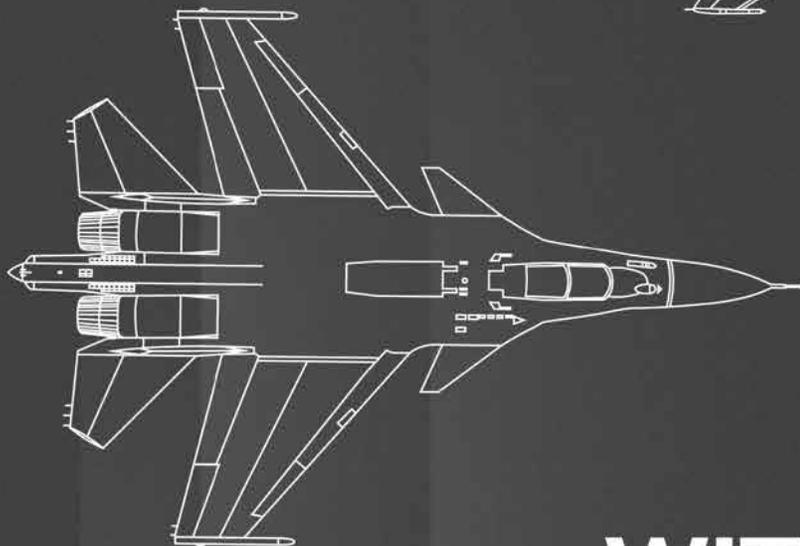


VAYU: *Please update us on the collaborations with BDL, briefly tell us about the progress*

3rd generation

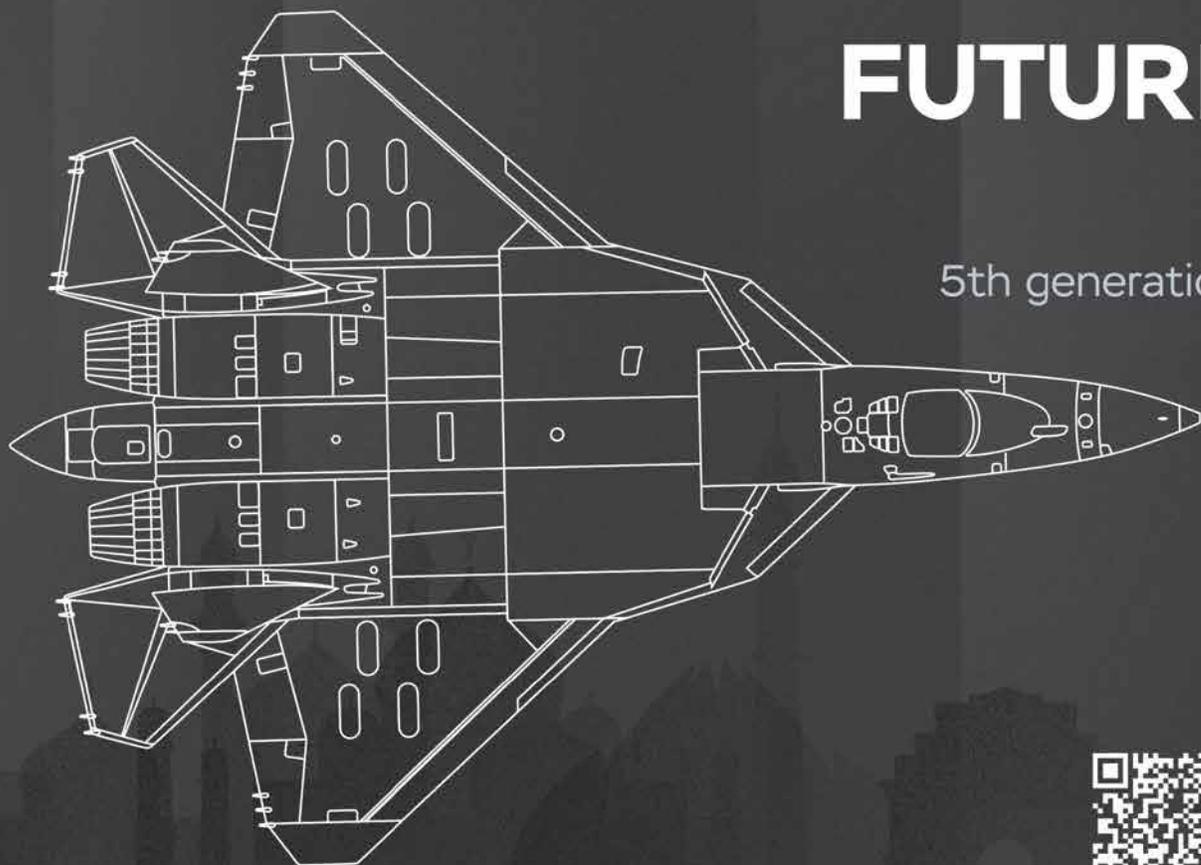


4th generation



LONG HISTORY
**WITH A BRIGHT
FUTURE**

5th generation



achieved with the BDL and MBDA Agreement signed earlier to establish a facility in India for the Final Assembly, Integration & Test (FAIT) of the Advanced Short Range Air-to-Air Missile (ASRAAM), which is slated to be integrated on the Tejas LCA Mk.1A?

MBDA and BDL have worked together for more than fifty years and produced more than 50,000 missiles together in India for the Indian military. Co-operation with BDL forms a key pillar of MBDA's strategy and commitment to Atmanirbhar Bharat in partnership with Indian Defence Public Sector Undertakings (DPSUs) and industry. MBDA and BDL are making very good progress on our joint undertaking to establish facilities for the assembly, integration and test (FAIT) of ASRAAM air-to-air combat missiles in India for the Indian Air Force.

VAYU: *Elaborate on MBDA's Next Generation Missiles being developed for Futuristic Programmes?*

MBDA is a recognised world-leader in the field of missile technologies and we are constantly conducting research and development to enhance the capabilities of our customers' systems. This we are doing across the full spectrum of products, from lightweight anti-tank systems, to next generation naval and air systems, and we look forward to discussing them with our Indian partners.

VAYU: *Tell us about the Mistral ATAM launcher integrated on the Prachanda LCH and ALH Rudra WSI helicopters, covering the firing of the Mistral missile from the Light Combat Helicopter (LCH) and its collaboration with BDL?*

The Mistral ATAM air-to-air missile launcher has been delivered to India to equip the ALH and LCH. The system is based on two launchers each deploying two MBDA air-to-air Mistral missiles. Given the wide range of roles that these helicopters will have to undertake, Mistral will provide the helicopter's crew with a weapon that is not only easy to use but one that can be operated in the whole flight envelope from nap of the earth to 15,000ft and at flight speeds from hovering to up to 200 knots. The system has already been successfully integrated on the LCH and ALH platforms manufactured by HAL. Mistral has proven itself a major success story with a 96% success rate in all firings.

VAYU: *Briefly tell us about the CAMM/Sea Ceptor Missile offered by L&T-MBDA to the Indian Navy, and also about the SCALP Naval and VL MICA NG Missiles?*

The Sea Ceptor naval air defence is being offered to the Indian Navy for its SRSAM requirement by our Indian joint venture, L&T MBDA Missile Systems Ltd in accordance with our support of Atmanirbhar Bharat. Sea Ceptor is a highly advanced naval weapon system that features futuristic technologies such as high levels of autonomy and intelligence through both the missile and the wider system. These features enable the Sea Ceptor system to autonomously prioritise threats and intelligently optimise the allocation of missiles within an engagement to maximise operational

effectiveness – and so provide the very highest level of protection from air attack for Indian sailors.

VAYU: *Update us on the 5th Gen ATGM5 offered by the MBDA-L&T Joint Venture in India?*

L&T MBDA Missile Systems Limited (LTMMSL) has a clear vision regarding the development and manufacture of

ATGM5 in India, as this fifth generation weapon or family of weapons matches the requirements and specifications of the Indian Armed Forces. LTMMSL is committed to the Government of India's drive towards the indigenisation of the defence sector under the Make in India initiative, and to create a robust industrial eco system for the integration of ATGMS in India, across a wide spectrum of advanced technologies. The LTMMSL is committed to ensuring that India will have the highest level of operational independence in the use of an ITAR-free missile.

VAYU: *What are MBDA's future expansion plans in India and its engagement with Indian vendors to expand the supplier base?*

MBDA have a wide base of suppliers and partners in the Indian defence ecosystem and is proud of our long history of Make in India in support of the Indian Armed Forces. Aligned with our support of Atmanirbhar Bharat, MBDA is always looking to strengthen and deepen our footprint in India.

VAYU: *Which MBDA Missile Systems exhibits are going to be displayed at Aero India 2025 at Bengaluru?*

MBDA will be displaying its full range of the newest complex weapon systems to meet the requirements of the Indian Armed Forces. Befitting Aero India, a particular focus will be on MBDA designed weaponry for the needs of the Indian Air Force – including famous systems such as the Meteor beyond visual range air-to-air missile or the Scalp air launched deep strike missile.



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U.S. Marine Corps photo by Sgt. Luke Kuennen

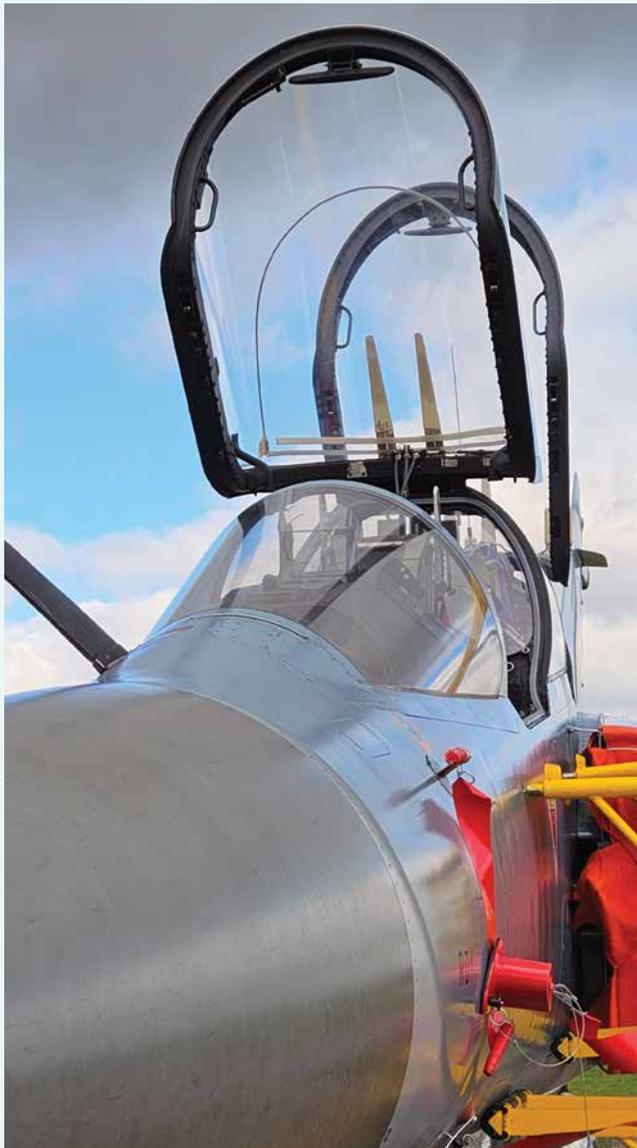
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Dassault Aviation to create company for military MRO in India

Dassault Aviation has decided to create a company dedicated exclusively to maintenance, repair and overall (MRO) of its military activities.

This company, Dassault Aviation MRO India (DAMROI), incorporated in India and based in Noida (Uttar Pradesh), is a subsidiary of Dassault Aviation. It is committed to meeting the needs of the Indian Air Force by offering tailor made products and services to support its Mirage 2000 fleet and, more broadly, the fighter aircraft supplied by Dassault Aviation in India, in



order to guarantee the best possible responsiveness and efficiency in fulfilling its requirements.

Created under the “Atmanirbhar Bharat” policy to contribute to India’s self-reliance and promote indigenous value added services, DAMROI will benefit from Dassault Aviation’s technological expertise and offer new opportunities for cooperation and collaboration with the aim of becoming a key player in participating to a full-fledged aero defence ecosystem in India.

Alongside a significant industrial input to positioning India as an international aerospace supplier under the “Make in India” policy and a full commitment to the “Skill India” initiative through the implementation of training and education programmes, this new step shows Dassault Aviation’s determination to make its presence in India a success and to contribute to India’s strategic vision for its future.

Photos of IAF Mirage 2000s and Rafales: VAYU



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Manufactured over 4300 Aircraft & 5500 engines. Overhauled over 12400 Aircraft & 36650 engines



Hindustan Turbo Trainer -40



Advanced Light Helicopter



Light Utility Helicopter



Hindustan-228

HAL/Safran SAFHAL engines for IMRH and DBMRH



Hindustan Aeronautics Limited (HAL) and SAFHAL Helicopter Engines Pvt Ltd (SAFHAL) signed an airframer contract, to commence joint design, development, manufacture, supply and support of a new generation high power engine named 'Aravalli' for the 13 ton medium lift class, Indian Multi-Role Helicopter (IMRH) and the Deck-Based Multi-Role Helicopter (DBMRH), being designed and developed by HAL.

Mr. Cedric GOUBET, CEO of Safran Helicopter Engines stated, "We are extremely proud to collaborate with HAL on this strategic project, capitalising on 25 years of successful partnership between Safran and HAL. With this project, we are enriching the collaboration with HAL as well as the strategic relationship between India and France. Our combined expertise and resources will ensure the success of the IMRH and DBMRH programmes, while contributing to the growth of India's aerospace and defence sector. Together we remain fully dedicated to our customers in India. We look forward to designing, producing and supporting those new efficient helicopter engines".

SAFHAL, a joint venture between Safran Helicopter Engines SAS and HAL, is dedicated to the design, development, production, sales and support of new generation helicopter engines in India, marks a significant milestone in India's aerospace and defence

sector, aiming to enhance the nation's Aatmanirbharta in helicopter engine technology.

Under this strategic contract, SAFHAL will work with its parent companies on cutting edge engine technologies, ensuring superior performance, reliability and operational efficiency. This collaboration involves state-of-the-art design, advanced manufacturing processes and rigorous testing protocols to meet the highest global standards.

IMRH is a new 13 ton multi-role helicopter designed by HAL to meet the requirements of the Indian Armed Forces. A naval version, the 12.5 ton DBMRH is also being developed for the Indian Navy. The engines will be designed to operate in diverse and challenging environments in which these helicopters get deployed. Future extension to the civil market for offshore operations, utility, VVIP transport etc., is also planned followed by MRO activities.

Safran Helicopter Engines has been HAL's partner of choice for powering its helicopters, starting with the Artouste engines used in Cheetah and Chetak, followed by Shakti engine and its variants powering the ALH, LCH and LUH. The present collaboration elevates this time tested relationship to the next level through the joint design and development of modern state-of-the-art helicopter engines intended for application in medium lift helicopters.

Interview with Ryan Weir

Vice President of Commercial Sales and Marketing for India & South Asia, Boeing Commercial Airplanes



VAYU: *As India's aviation sector expands, how is Boeing positioning itself to support the country's ambitious plans for fleet expansion and airport infrastructure development? Specifically, how does Boeing plan to address the growing demand for new aircraft, as well as contribute to initiatives like the India Distribution Centre and Hyderabad's Boeing Converted Freighter line?*

RW: India's aviation market has grown rapidly over the past decade, establishing itself as the world's third largest civil aviation market. By 2041, India's commercial fleet is projected to nearly quadruple from its size in 2019, accounting for over 90% of South Asia's airplane deliveries and adding more than 2,500 new aircraft to the country's fleet. Additionally, India's cargo fleet is projected to expand from 15 to 80 airplanes by 2042. Boeing's 2024 Pilot and Technician Outlook also highlights the region's need for 40,000 pilots, 40,000 maintenance technicians, and 49,000 cabin crew over the next two decades, driven by India's growing aviation sector.

With a legacy of over eight decades in India, Boeing's extensive investments in supply chain partnerships, engineering, R&D, training, co-production, and co-development, uniquely position us as a trusted partner to support the country's growing aviation sector. Boeing has

committed \$100 million to developing infrastructure and programmes aimed at training pilots in India to meet the country's demand for new pilots over the next 20 years. This investment includes advanced full-flight simulators, competency based training programmes, and partnerships with local institutions to prepare the next generation of aviation professionals. In 2023, Boeing supported the setup of India's first Boeing Converted Freighter (BCF) line, while establishing a Global Support Centre in Gurgaon to provide customised operational efficiency and safety improvement projects for airline customers, regulatory bodies, and other stakeholders. Boeing's India Distribution Center in Khurja, Uttar Pradesh, a first in the country, provides efficient and cost effective service solutions to regional customers, ensuring higher fleet utilisation and mission readiness rates.

Additionally, in alignment with the Honorable Prime Minister's vision, Boeing has launched the Boeing Sukanya Programme aimed at further fostering women's participation in the aviation sector. This initiative spans the multiple stages of a woman's professional career, nurturing future leaders, and fostering a more inclusive industry.

Our team of over 6,500 engineers and technologists at the Boeing India Engineering and Technology Centre (BIETC) in Bengaluru and Chenani are also playing a pivotal role in enabling cutting edge R&D, not only for Boeing platforms in India but also globally. These initiatives highlight Boeing's commitment to innovation and support for India's vision of becoming a global aviation leader. We remain focused on further enhancing capabilities and strengthening local partnerships to drive the sector's growth.



(Photo: Durgesh Singh)

VAYU: *What factors have contributed to the increase in manufacturing and commissioning of freighters by airlines in recent years?*

RW: E-commerce growth has been a major driver of freighter demand in recent years, with the portion of the freighter fleet dedicated to e-commerce increasing by more than 20% to meet strong market demand during the COVID-19 pandemic. Operators have also started replacing older freighters with newer, more efficient models, such as the 737-800 Boeing Converted Freighter, replacing older 737 and 757 freighters to enhance business performance. These newer airplanes offer significant efficiency gains, with fuel and emissions reductions of up to 20% compared to the previous generation. Boeing's new and converted freighters are ready to meet global demand and address the versatile needs of customers in India and worldwide, offering unmatched capability and superior economics. Key factors driving the induction of more freighters in India include robust economic growth, as measured by GDP resilience, the rise of the middle class, and manufacturing and supply chain redesigns that benefit India's growing economy. E-commerce continues to grow rapidly in emerging India, and pharmaceutical exports remain a strength for the country's industry.

VAYU: *What is the current outlook for air cargo and freighters in India, and what factors are driving demand?*

RW: Approximately half of the global demand for conversions is expected to come from the regions Asia and Africa, including India. This is driven by the rapid expansion of e-commerce and the electronics manufacturing industry, which has revolutionised customer expectations and supply chain needs. Global e-commerce revenues are projected to reach more than double pre-pandemic levels by 2026, relying heavily on air cargo in emerging markets without well-established ground and postal networks. The rise of high end electronics manufacturing in India, such as smartphones and wearables, along with other high value added manufacturing, like semiconductors, is creating opportunities for air cargo growth in the future.

India's domestic air cargo trade is forecasted to continue rapid growth at 6.9% per year over the next two decades. The growth is driven by various factors, including the overall growth of the Indian economy and increased demand for air cargo transportation. Furthermore, the expansion of India's e-commerce sector is contributing to the demand for efficient and reliable logistics and transportation solutions. This has led to the entry of cargo carriers into the Indian market that are operating a range of freighters, including the Boeing 737-800 Boeing Converted Freighter, to cater to the growing air cargo services demand.

VAYU: *How does your company collaborate with Indian airlines and air cargo operators to understand their unique challenges and tailor solutions accordingly?*

RW: The Boeing family of freighters provides operators with flexible solutions to meet the needs of their specific markets. Boeing's teams work closely with all customers in India and air cargo operators to understand their unique requirements, their market imperatives and help provide them with our freighter products and services solutions that facilitate a gain in their competitive advantage.



(Photo: Rishav Gupta)

VAYU: *Sustainability is a pressing global concern. How is Boeing supporting India's aviation sector in achieving its decarbonisation goals?*

RW: Boeing is actively working toward making its commercial airplanes capable of flying on 100% Sustainable Aviation Fuels (SAF) by 2030. In India, we have collaborated with SpiceJet and the Council of Scientific and Industrial Research – Indian Institute of Petroleum (CSIR-IIP) aimed at leveraging SAF supply from CSIR-IIP and its production partners and licensees to help SpiceJet decarbonise its fleet. This initiative builds on Boeing's long term industry leadership and investment to develop SAF around the world in partnership with airlines, fuel companies, governments and research institutions, to expand SAF supply and reduce its cost. Boeing is presently helping review and support the certification process for SAF samples being developed by CSIR-IIP. Boeing also contributed to the World Economic Forum's Clean Skies for Tomorrow initiative, which determined that 10% of India's SAF needs by 2030 can be met through domestic production. Through this initiative, WEF has convened an Indian SAF community of private and public institutions with the shared vision of transporting 100 million domestic passengers in India on SAF by 2030 on a 10% blend (360,000 metric tons). India's total expected domestic need for jet fuel is estimated to be approximately 8 million tons by 2030, flying an estimated 190 million domestic passengers a year.



(Photo: Boeing)



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Boeing completes F/A-18 Super Hornet upgrade



Boeing has completed the upgrade and life extension of the first two service life modification (SLM) F/A-18 Block III Super Hornets, delivering them to the US Navy one month ahead of schedule from St. Louis and two months ahead of schedule from San Antonio. The upgraded jets have the same capabilities as Super Hornets being delivered from Boeing's new-build production line.

"Our success in meeting the accelerated timeline is proof our service life modification game plan is working," stated Faye Dixon, Boeing SLM director.

"Thanks to our years of learning on the programme and our partnership with the Navy, the F/A-18 Super Hornet remains at the forefront of defence technology with renewed years of service to support the fleet."

In partnership with the Navy, Boeing has improved productivity and is completing Block III upgrades ahead of the 15 month contract requirement.



This was made possible by establishing a baseline for the condition of Block II F/A-18s received at Boeing, and the Navy's work to prepare the jets in advance plus sharing information and best practices across multiple SLM sites to improve efficiency, manage workload distribution and optimise resource allocations.

"Great measures were taken by the Boeing and Navy teams to ensure these are the safest and most capable Block III F/A-18s we can give our warfighters," stated Mark Sears, Boeing Fighters vice president. "These are just the first of many deliveries, with around 15 years of

SLM deliveries to go. Our warfighters are counting on us to get this right every time."

Block III upgrades include a large area display and more powerful computing through Tactical Targeting Network Technology and a Distributed Targeting Processor Networked open mission systems processor. The work is being done at Boeing sites in St. Louis and San Antonio, and at the Navy's Fleet Readiness Centre Southwest in San Diego.

Boeing and the Fleet Readiness Centre Southwest signed a Public-Private Partnership agreement in March to expand the work scope at the command, paving the way for the readiness centre to now perform the same Block III SLM work done in St. Louis and San Antonio.

"These first deliveries of Block III SLM jets are a major milestone in our continued efforts to ensure capability, reliability, availability and maintainability of the Super Hornet aircraft," stated Capt. Michael Burks, programme manager for the F/A-18 and EA-18G Programme Office. "We look forward to our continued partnership with Boeing to deliver this critical warfighting capability to the fleet."

Text courtesy: Boeing
Photos: The Vayu Team



Lockheed Martin brings

‘Vast Experience System’ to Aero India 2025



Lockheed Martin is unveiling its immersive ‘Vast’ experience system in India for the first time at the 15th biennial edition of Aero India taking place at Yelahanka. The company is highlighting its vision for 21st Century Security solutions with a focus on integrated capabilities on offer to the Indian Armed Forces.

The immersive Vast experience is the prime attraction at the Lockheed Martin booth, providing visitors with access to a system that brings multi-domain missions to life through interactive 3D visualisations.

The company’s exhibit also showcases its most innovative capabilities, including the C-130J Super Hercules tactical airlifter, F-21 fighter aircraft, MH-60R “Romeo” multi-mission helicopter, Javelin weapon system and S-92 multi-role helicopter among others.

“Aero India has been a leading platform for Lockheed Martin and the aerospace and defence sector for many years, and we look forward to our participation this year with the Vast Experience System,” stated William L. Blair, vice president

and regional chief executive, Asia and India, Lockheed Martin. “Building on our deep partnerships with the Indian industry, we look forward to showcasing some of our advanced capabilities that address our customers’ biggest challenges for the 21st Century and grow our presence and partnerships that support greater self-reliance in the defence sector.”

Boosting Lockheed Martin’s presence at the show is the C-130J Super Hercules aircraft model which represents a strong legacy of partnership with the Indian defence industry. The Indian Air Force operates 12 C-130Js to support a variety of tactical airlift missions. India also is connected to the C-130J through Tata Lockheed Martin Aerostructures Limited, a joint venture that has the distinction of being the single global source of C-130J empennage assemblies included on all new Super Hercules aircraft.

In 2024, the company expanded its commitment to India through a teaming agreement with Tata Advanced Systems Limited to expand upon the companies’ business relationship through the C-130J Super Hercules tactical airlifter on future potential business opportunities to include: Establishing a Maintenance, Repair and Overhaul (MRO) facility in India to support the IAF’s existing fleet of 12 C-130Js as well as other global Super Hercules fleets; Expanding C-130J manufacturing and assembly in India to produce aircraft for the IAF’s MTA programme, subject to US and Indian government approvals.

An F-21 fighter aircraft model, which is on offer to the Indian Air Force (IAF) for the Multi-Role Fighter





Aircraft competition, is configured with the latest sensors and mission avionic systems that couple on-board and off-board data information into an effective,



easy to manage combat situation display. F-21 is the ideal solution to meet India's fighter force structure, affordability, and 'Make in India' and "Skill India" requirements.

The MH-60R "Romeo" SEAHAWK helicopter occupies a prominent place at Lockheed Martin's Aero India display. The MH-60R is the most capable and mature Anti-Submarine (ASW)/Anti-Surface Warfare (ASuW) multi-mission helicopter available in the world today. Ten MH-60R helicopters are presently available to the Indian Navy for operations. A total of 24 MH-60Rs will be delivered to India over the next year.

Javelin, the world's most versatile, one-man-portable and multi-purpose weapon system, is also part of Lockheed Martin's exhibit at Aero India. The anti-tank weapon system can be deployed by its traditional man portable manner as well as from multiple platforms and used during the day, at night and in any kind of weather. Using fire-and-forget technology, Javelin provides operational flexibility so that operators can rapidly engage and then move on to a new firing position, affording the highest level of survivability to the user.

The S-92 multi-role helicopter is connected to India through the Tata Sikorsky Aerospace Limited, a joint venture that has the distinction of being fully integrated into Lockheed Martin's global supply chain for manufacturing aerostructure components for the S-92 helicopter.

Lockheed Martin continues to build upon more than three decades of partnerships and seven decades of association with India by nurturing and expanding collaborations with local industry to support the foundation of indigenous defence manufacturing ecosystem. Today, the company's presence has moved beyond defence systems to provide technical support, apprenticeships, fostering positive change and inspiring the next generation from under-represented communities to build sovereign capabilities through industrial partnerships and human capital development.

Text courtesy: LM



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Lockheed Martin and TASL in C-130J Agreement



(LM photo)

Lockheed Martin and Tata Advanced Systems Limited have entered into a teaming agreement to expand upon the companies' business relationship through the C-130J Super Hercules tactical airlifter. This announcement marks a significant step in enhancing India's defence and aerospace capabilities while also deepening India-US strategic ties.

This agreement provides a framework for collaboration on future potential business opportunities to include establishing a Maintenance, Repair and Overhaul (MRO) facility in India to support the Indian Air Force's (IAF) existing fleet of 12 C-130Js as well as other global Super Hercules fleets plus expanding C-130J manufacturing and assembly in India to produce aircraft for the IAF's Medium Transport Aircraft (MTA) programme, subject to US and Indian government approvals.

"The C-130J is known as the world's workhorse, not just

for its large global presence, but also for its international supply chain partners including the single source provider of empennages — Tata Lockheed Martin Aerostructures Limited in Hyderabad," stated Rod McLean, vice president and general manager of the Air Mobility and Maritime Missions line of business at Lockheed Martin. "This teaming agreement between Lockheed Martin and Tata Advanced Systems further demonstrates Lockheed Martin's commitment to a self-reliant India and the degree of confidence that exists in our relationships with our partners in India and the Indian industry at large."

The IAF is actively seeking to acquire up to 80 medium transport aircraft and issued a request for information (RFI) last year. Lockheed Martin responded to the RFI as the C-130J-30 Super Hercules is ideally suited to meet the requirements.

Lockheed Martin and Tata Advanced Systems Limited have a long standing partnership through the Tata Lockheed Martin Aerostructures Ltd, (TLMAL) joint venture. Established in 2010, TLMAL exemplifies the government of India's "Make in India" objectives and has the distinction of being the single global source of C-130J empennage assemblies included on all new Super Hercules aircraft produced in the United States. To date, TLMAL has manufactured more than 220 C-130J empennages.



HAL continues to shine



Strategic autonomy and security

When HAL started off in 1940 as an MRO for allied forces, very few would have predicted that it would produce the first indigenous supersonic fighter, the Hindustan Fighter-24 (Marut), in the early 1960s. However, in the 1970s and 1980s, the country's focus shifted towards licensed manufacturing due to the geopolitical pressures of the time. The design of the LCA Tejas and ALH Dhruv in the 1990s further pushed the country towards indigenisation. The next significant

boost for the development of indigenous capacity and capability came in 2014 through the Make in India initiative.

The Make in India initiative has helped HAL transform itself from being a production agency for licensed/ToT manufacturing into an integrated provider of advanced technology solutions through indigenous design, development and production for both fixed and rotary wing platforms. The initiative mandates increasing domestic content in defence projects, and HAL has responded by developing new platforms with higher levels of indigenisation, including the Light Combat Aircraft Tejas, Hindustan Turbo Trainer-40, Light Combat Helicopter Prachand, Light Utility Helicopter and Advanced Light Helicopter Dhruv.

Self-reliance and indigenous capability building

The initiative has significantly boosted India's defence production capabilities. In the fiscal year 2023-

The Make in India (Atmanirbhar) initiative, launched by the Prime Minister of India, is aimed at transforming India into a global manufacturing hub. The defence sector, a key pillar of this initiative, has witnessed significant changes in the past decade and catalysed a shift in approach, particularly in the case of Hindustan Aeronautics Limited (HAL). Since its inception in the 1940s, HAL has played a pivotal role in enhancing India's defence capabilities by manufacturing aircraft, helicopters and other aviation systems crucial to the Indian defence forces. Over the years, HAL has transformed itself from a producer of high-tech assets into a technology company credited with an array of indigenous products such as the ALH Dhruv, Rudra, and LCA Tejas.

Policy changes

The government has taken several policy initiatives in recent years and introduced reforms to encourage the indigenous design, development and manufacture of defence equipment, thereby promoting self-reliance in defence manufacturing and technology in the country. These initiatives, inter alia, include prioritising the procurement of capital items from domestic sources under the Defence Acquisition Procedure (DAP) 2020, which has led to a reversal of the 70:30 import-export ratio; the announcement of 18 major defence platforms for industry-led design and development in March 2022; and the notification of 'Positive Indigenisation Lists' for the Services and Defence Public Sector Undertakings (DPSUs), imposing an embargo on imports beyond specified timelines.



24, the defence production value reached approximately Rs. 1.27 lakh crore, marking a 16.7 per cent growth over the previous year. In the last five years, an increase of 60 per cent has been achieved.

Increased foreign direct investment (FDI) and technology transfer

The initiative has opened up the sector to Foreign Direct Investment (FDI), with up to 74 per cent allowed through the automatic route and 100 per cent with government approval in specific cases. This has led to joint ventures, partnerships and technology transfers between Indian companies and global aerospace and defence giants, enabling Indian manufacturers to adopt advanced technologies.

HAL signed an MoU with General Electric, USA, in June 2023 for ToT and Manufacturing of GE-414 aero-engine in India for LCA Mk.2 aircraft with 80 per cent technology transfer.

A 50:50 Joint Venture “SAFHAL Helicopter Engines Pvt Ltd” was formed with Safran Helicopter Engines, France, in November 2023, for indigenous design and development of engines for Indian Multi Role Helicopter and Deck Based Multi Role Helicopter.

This is the first instance where a high performance aero-engine will be jointly developed for an Indian platform with access to core engine technologies.

Both the projects will result in acquiring core engine design and manufacturing technologies and transform the Indian aero engine manufacturing ecosystem.

Boost in defence exports

The focus on indigenous manufacturing has also enhanced export opportunities for Indian made defence and aerospace products. Defence exports have seen a remarkable rise, reaching Rs. 21,083 crore in 2023–24, which is a 32.5 per cent increase from the last financial year. Over the last decade, defence exports have grown 21 times, indicating India’s strengthening position in the global defence market.

This growth not only enhances India’s economic stature but also strengthens diplomatic ties with importing countries.

HAL exported two Hindustan 228 aircraft to Guyana Defence Forces and set up a new regional marketing office in Kuala Lumpur, Malaysia, in July 2023 to promote indigenous platforms in the export market.

This regional office will serve as a hub for HAL’s engagement with other South East Asian Countries and also act as a window for other Indian Defence PSUs.

Economic benefits and growth of small and medium enterprises (SMEs)

The aerospace and defence sector, under Make in India, has fostered the growth of SMEs. With the emergence of the manufacturing ecosystem, HAL’s efforts have resulted in industry partners graduating from Tier III to Tier I.

HAL aims to be a lead aerospace integrator, primarily through robust private partnerships. HAL has been supporting the private industries (including MSMEs), with more than 2,000 registered sub-contractors, by extending technical support and handholding. HAL has uploaded around 26,000 imported items in Srijan Portal to invite private vendors for indigenous development. HAL is also utilising private vendors in the design and development of systems; examples include Multi Function Display and Solid State Flight Data Recorder.

Job creation and skill development

Make in India initiative has created numerous job opportunities across the aerospace and defence sector. The demand for skilled labour in the aerospace sector has increased for production and assembly lines to high-end R&D.

HAL has formed an Aerospace and Aviation Sector Skill Council (AASSC) to address the need for the development of a specialised workforce through skill development programmes and bridge the gap between demand and supply of skilled man power in areas like design and development, manufacturing, MRO, Airline Operations and Airports.



By Dr DK Sunil, Chairman and Managing Director, HAL

(This first appeared in The Times of India, 28 September 2024)

5 Hindustan Aeronautics Ltd (HAL) highlights for 2024

A contract was signed for 240 AL-31FP engines for Su-30MKI at a cost of Rs 26,000 crore.

A contract for procurement of 12 Su-30MKI along with associated equipment signed for Rs 13,500 crore.

Two contracts for a combined value of Rs 8,073 crore were signed for 34 Advanced Light Helicopters (ALH) Dhruv Mk III for Indian Army (25 ALHs) and Indian Coast Guard (9 ALHs).

A contract for RD-33 engines for MiG-29s signed for Rs 5,249 crore; to be produced by Koraput Division of HAL.

A contract was signed for Mid Life Upgrade of 25 Dorniers along with associated equipment for Indian Navy at a cost of Rs 2,890 crore.



UAC's Sukhoi Su-57 (Part-1)

Russia's crown jewel soars to global prominence



(Photo: Vayu)

Making its debut on Indian soil at Aero India 2025, the Su-57, flagship of Sukhoi and Russia's combat aviation engineering, is set to capture the spotlight at one of the world's most prestigious airshows. The aircraft's arrival marks a historic moment, as it will be the first time the type will perform live demonstrations in India. Already gaining attention for its aerobatics and combat capabilities, the Su-57 earned recognition with a standout performance at the Zhuhai Air Show 2024 in China. These milestones signal Russia's intention to cement its position in the global defence industry, showcasing the Su-57's growing potential. As the aircraft continues to evolve with cutting edge technological upgrades and operational successes, let's explore how each development contributes to its increasing potential as a formidable fighter on the global stage.

The international debut

It was no less than a historic moment when Sukhoi's Chief Test Pilot, Sergey Bogdan flew the T-50-4, the fourth prototype of the Su-57, to Zhuhai in November 2024. This captured the attention of not just the spotters but also the military watchers around the world. The aircraft made its maiden international appearance for an aerial demonstration, 14 years after its first flight, instantly elevating its status to that of a "celebrity" throughout the entire event. Previously, the aircraft

had regularly participated in Russia's own International Aviation and Space Show (MAKS), last held in 2021.

Beyond its impressive aerial performance, the Su-57 was a highlight in the static displays, giving attendees an opportunity to closely examine its design features. This historic appearance was also symbolic, signalling Russia's intent to maintain its foothold in the global



New flat nozzle of the Su-57 (Source: X/Russia)

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defence industry despite facing significant economic and geopolitical challenges.

The Su-57 in combat: Lessons from Ukraine

It is well known that Moscow has dedicated significant resources to its “Special Military Operations” in Ukraine. The air wing has also been actively engaged in a wide range of missions, utilising nearly all available aircraft, including the Su-57. Both the Russian and Ukrainian sides have confirmed the involvement of the fifth generation fighter in multiple air-to-air and air-to-ground strikes against Kyiv’s strategic assets. In 2022, one media report indicated that the aircraft used an R-37M air-to-air missile to shoot down a Ukrainian Su-27 over the Poltava region, at a range exceeding 200 kilometres. Such an engagement would mark the longest air-to-air kill ever recorded in the history of warfare and the first ever kill achieved by a fifth generation fighter. Successful execution of missions is instrumental in promoting the platform as a capable battle system, adept at conducting standoff missions and deploying advanced weapons like the R-37 for air-to-air engagements and the KH-59MK2 (exclusive to the Su-57) for air-to-ground strikes, which are included in its diverse range of armament.



Helmet of the Future (Source: X/Russia)

Russia-Ukraine theatre is one of the most contested airspaces in the world today, with high risks of being painted by sophisticated air defence systems. Employing a sensitive platform like a fifth generation fighter without incurring a single loss is remarkable. However, in June 2024, a Su-57 airframe sustained minor damage while on the ground from a Ukrainian drone strike at Akhtubinsk State Flight Test Centre in southern Russia. Visuals confirmed a crater near the ramp where the aircraft was parked, indicating the damage was limited, likely from shrapnel. However, there has been no visual confirmation of any Su-57 lost in combat as of December 2024. The aircraft continues to play a pivotal role in Russian Air Force (VVS), with ongoing efforts to expand production and meet increasing demand. The Komsomolsk-on-Amur Aviation Plant (KnAAZ)

is in the process of delivering fresh batches of aircraft amid the war. In 2024, three batches have reportedly been delivered, with batch sizes undisclosed. A contract to acquire a total of 76 aircraft was signed in 2019, with deliveries aimed to be completed by 2027. Taking account of the last delivery that occurred in December 2024, 25 aircraft have been reportedly added to the fleet of VVS. The country is actively ramping up Su-57 production to meet increasing domestic and international demand. In August 2024, KnAAZ expanded itself with a fuel systems production centre and avionics testing hangars. These efforts aim to address production challenges and ensure timely delivery of the fifth generation fighter, bolstering the VVS capabilities while meeting procurement goals.



Export success: A new chapter for Russia

Unlike the US and China, who chose to limit the export of their first fifth generation fighters (F-22 and J-20 respectively), Russia has taken a more inclusive approach by offering Su-57 to allies in export configurations. Interestingly, it also achieved its first success! The official announcement was made during the Zhuhai Air Show, but without disclosing the identity of the buyer. It has long been believed that Algeria could be the first foreign client to acquire the Su-57E, however, it is still unconfirmed. With this, Russia has become the third country, after the US and China, to secure an international customer for a fifth generation fighter. America’s Lockheed Martin F-35 has so far secured 20 customers, while in January 2024, the Pakistan Air Force announced plans to acquire China’s Shenyang J-35.



By: Rishav Gupta
 (Twitter/X: @connect_rishav)



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India–Russia and Military–Technical Cooperation

The fourth meeting of the Working Group on Military Cooperation under the India–Russia Inter Governmental Commission on Military and Military–Technical Cooperation (IRIGC–M&MTC), concluded successfully in Moscow, Russia end November 2024. The meeting marked a significant milestone in advancing the long standing Strategic Partnership between the two countries.

The meeting was co–chaired by Lieutenant General JP Mathew, Chief of Integrated Defence Staff representing India and Lieutenant General Dylevsky Igor Nikolaevich, Deputy Chief of the Main Operational Directorate of the General Staff of the Russian Federation Armed Forces. The Working Group emphasised the importance of continued knowledge–sharing and collaboration in areas of strategic interest. It also agreed upon expanding joint exercises to further solidifying the operational synergy between the two forces. Both nations have conducted

numerous joint exercises across land, air and sea domains. Exercises such as Indra, Avia Indra and Indra Navy, have served as vital platforms for sharing best practices, refining joint operational tactics drills and procedures, and deepening mutual understanding.



BEML in order for 50–ton trailer from MoD

BEML Limited, a leading Public Sector Undertaking under the Ministry of Defence, Government of India, has secured a contract from the Ministry of Defence for supplying of a 50–ton trailer valued at INR 83.51 crore. This order “highlights BEML’s strength and capability in delivering advanced, indigenous products to enhance India’s defence infrastructure”.

The 50–ton heavy–duty trailer is specifically designed for the transportation of battle tanks and features 12 twin–wheels for durability and stability in challenging



terrains. With a payload capacity of 50 tonnes, the trailer is engineered to be towed by the BEML HMV 8x8 vehicle. Notably, it includes advanced features such as a steerable turntable for 55–degree rotation in both directions, a twin–line air brake system, emergency brakes and mechanically operated parking brakes. The rear chassis frame is equipped with a combination of fixed, hinged, and loose ramps to ensure the efficient loading of tanks.

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Rosoboronexport unveils Lancet-E

The Lancet-E system is an export version of the well-known Lancet loitering munition system that has proven to be effective on the battlefield. It consists of the Z-16-E reconnaissance drone and two kamikaze drones (loitering munitions), Item 51-E and Item 52-E, with different characteristics, in particular, in terms of range and maximum takeoff weight.

“The presentation of the Lancet-E at Army 2024 marked the beginning of Rosoboronexport’s global marketing campaign for this advanced weapon system. The system demonstrated the highest effectiveness on the battlefield and capability to engage a wide range of targets, from any type of armoured vehicles and fortifications to surface targets. As a result, today the Lancet-E has great export potential, which we estimate at 1,000+ systems. I’m sure that once the needs of the Russian Armed Forces are met, the available production capacities will enable us to successfully deliver the system abroad. In addition, we actively offer partners cooperation in the format of license and joint production on the customer’s premises within the framework of technology partnerships”, stated Alexander Mikheev, Director General of Rosoboronexport.

In addition to the Lancet-E, the company is successfully marketing the Kub-E loitering munition



developed and manufactured by Rostec’s Kalashnikov Group. The Orlan-10E, Orlan-30 and Orion-E reconnaissance and reconnaissance/strike unmanned aerial systems are in strong demand among foreign partners.



Interview with Abhishek Singh

SVP – India and SE Asia, BD & Future Programmes (Defence), Rolls–Royce



VAYU: *How is Rolls–Royce contributing to India’s aspirations of expanding manufacturing and defence exports?*

Rolls–Royce sees India as a significant opportunity for growth and expansion of its global supply chain, specifically in the A&D sector. We work with a large set of supply chain partners, with a sharp focus on enhancing manufacturing capabilities and integrating them into the global supply chain ecosystem. We continue to strengthen and grow these partnerships, in line with the ‘Make in India’ initiative.

Ours is the original ‘Make in India’ story which started 68 years ago when we partnered with Hindustan Aeronautics Limited (HAL) for licensed production of our engines within the country. We have a strong joint venture with HAL called International Aerospace Manufacturing Pvt. Ltd. (IAMPL), which manufactures aero–engine components for defence, civil and business jets. Our other joint venture with Force Motors, called Force mtu Power Systems, produces mtu Series 1600 engines and complete generator sets at the Export Oriented Unit in Chakan near Pune, for both Indian and global markets.

We are also proud of our engineering capabilities in India, with 2000 high skilled engineers working in–house and through outsourcing agreements on various global

development programmes. Overall, more than 3000 people work across the Rolls–Royce ecosystem in India, including our own businesses, supply chain partners and JVs.

VAYU: *Tell us about Rolls–Royce’s proposal for India’s AMCA programme?*

Our presence in India spans over 90 years, and we have continued to support the Indian Armed Forces with complex power and propulsion solutions. Rolls–Royce has also successfully transferred combat jet engine technology in India, enabling manufacturing, assembly and testing capabilities in–country. Today, we are well positioned in the region with a strong ecosystem of strategic partnerships, skilled talent, digital solutions, service delivery, robust supply chain and manufacturing.

We are keen to participate in co–development opportunities that will create both technology and capability in India, and help accelerate India’s vision of self–reliance in defence. Our proposed combat aircraft engine co–development model will offer India an opportunity to create and own intellectual property (IP) for critical combat engine technology, allowing future upgrades and exports. Such a partnership will ensure the transfer of both know–how and know–why that will support and facilitate future development programmes. This will also enable the supply chain ecosystem and defence production capabilities for combat engines in India including aftermarket support, with significant potential to generate job opportunities.

This is in contrast with the license–to–build approach where IP is owned by the OEM (Original Equipment Manufacturer) resulting in limited or no in–country capability





development for India. We are offering a collaborative model for bespoke combat engine, development and lifetime support to suit India's requirements.

Such a programme, with the full support of the UK Government, would deepen defence cooperation between India and the UK. The UK is a strong and natural ally for India in pursuing the co-development of combat engines. The recent 2+2 dialogue and other engagement between the two nations further underscore the commitment to a comprehensive and strategic India-UK partnership.

The time is opportune to take this partnership to the next level through co-creation of critical technologies that the UK is well placed to offer. Rolls-Royce, with its long standing relationship with the Indian Armed Forces, stands ready to be the industry partner of choice to collaborate with Indian partners to deliver this vision.

VAYU: How is Rolls-Royce supporting the Adour engines in service with the Indian Air Force?

As the Indian Air Force undertakes its modernisation programme, Rolls-Royce is committed to providing it with the best value, and highest quality products possible. The Adour Mk 804/ Mk 811 was made, and continues to be supported in India by Hindustan Aeronautics Limited (HAL), with Rolls-Royce support. We are committed to this partnership and will continue to support today's fleet, including the Adour Mk 804/ Mk 811 through diligent planning and mutual cooperation of IAF, HAL and Rolls-Royce.

Rolls-Royce and HAL have partnered to 'Make in India' engine parts for Adour engines, supporting their long-term sustainment for both Indian and global customers. Additionally, we also manufacture Adour engine components with various partners in India. This further underscores

our efforts to expand indigenous production capabilities while ensuring the operational readiness and performance of the Adour engine fleet, ensuring the highest level of support for these engines until the end of their service.

VAYU: Tell us about the partnership that Rolls-Royce announced with TCS for hydrogen fuel systems for sustainable aviation?

Rolls-Royce is committed to becoming a net zero company by 2050 and supporting our customers to do the same. We are improving the efficiency of our products, proving compatibility of our engines to alternate fuels and

collaborating with partners to enable the energy transition journey.

Our partnership with Tata Consultancy Services (TCS) involves research into hydrogen fuel system technology, continuing to prove hydrogen could be a zero carbon aviation fuel of the future. With the support of TCS, we want to address three key challenges in the journey to enabling hydrogen for use in aviation: fuel combustion, fuel delivery and fuel systems integration with an engine. Additionally, Rolls-Royce and TCS have been working together since 2010 in the areas of design, manufacturing engineering, control systems and software, after-market services as well as IT services.

This partnership with TCS highlights Rolls-Royce's commitment to driving sustainable transformation across industries and supports the broader mission of using advanced technologies to make a positive societal impact. It is a crucial step in advancing these sustainability goals, positioning the company at the forefront of the industry's efforts to reduce environmental impact and contribute to a sustainable future in aviation.



GE Aerospace: Empowering India's defence industry with strategic collaboration



GE's F404 powers the Tejas LCA (Photo: Vayu)

Strategic partnerships are key drivers of success in the aerospace ecosystem. The right partner network is critical not only to provide access to technology, expertise and resources but also brings greater efficiency to the manufacturing process.

GE Aerospace has focused on building effective strategic partnerships to help address some of India's unique challenges. Over the last 10 years, we have worked with several large and small Indian companies to establish an aerospace supplier community in India. 13 Indian companies manufacture and supply commercial engine parts to our global factories. In addition, more than 200 local suppliers and partners provide small parts and materials to our Pune factory.

Strategic partnerships and collaboration

GE Aerospace's association with Hindustan Aeronautics Limited (HAL), the country's pre-eminent aerospace and defence manufacturer, goes back to the year 1986. As a partner to India's military aviation sector, the company has helped to adapt our engines and turbines—F404, F414, T700, LM2500, and LM500—for Indian defence projects.

Starting with working together on the Tejas programme to powering the first operational squadron of light combat aircraft (LCA) Tejas for the Indian Air Force, the

partnership was extended in 2021 to power the Tejas LCA Mk1A. And with the MoU to produce F414 in India, we are further expanding the collaboration.

GE Aerospace has also been instrumental in considerably expanding HAL's capabilities in maintenance, repair and overhaul (MRO) services. As an example, GE Aerospace entered a 30 year contract in 2010 for the license to implement repairs and overhauls of avionics suite of LRUs for the Hawk Mk.132 aircraft, which are the advanced jet trainers operated by the Indian Navy and Air Force.



GE Aerospace has the license to implement repairs and overhauls of avionics suite of LRUs for the Hawk Mk.132 (Photo: Vayu)

Naval advancements

INS Vikrant is India's first indigenously built P-71 aircraft carrier, with 76% indigenous content. The Vikrant is equipped with GE Aerospace's propulsion equipment—



Indian Navy's IAC R11 Vikrant is equipped with GE Aerospace's LM2500 marine gas turbines (Photo: Indian Navy)



F404 front view

LM2500 marine gas turbines—a critical component for the Indian Navy, well known for its lightweight design, fuel efficiency, durability, reliability and performance. Through a strategic collaboration, HAL assembles, inspects and tests these

turbines. Our gas turbine module kits shipped to HAL also power the Navy’s three P17 frigates—Shivalik, Satpura, and Sahyadri.

In 2023, we announced an MoU with HAL to mutually explore expansion of manufacturing capabilities for the LM500 marine gas turbine.

Developing skill-led manufacturing

To develop local manufacturing and assembly skills, we partner with local engineering academic institutions and

help their students with knowledge and lab equipment. From time to time, we have invested in training technicians who were placed in our partner’s factories. At our Pune factory, we have trained over 5,000 people in the last 10 years and equipped them with aero-engine and hi-tech manufacturing skills.

As the aerospace industry in India aspires for growth and excellence, GE Aerospace is committed to bring our best technology and training to our partners here.



By Rita Flaherty, Vice President, Global Defence Sales and Marketing, GE Aerospace

Rosoboronexport and technology partnership contracts

JSC Rosoboronexport (part of Rostec State Corporation) takes into account the pressing challenges facing the Russian defence industry and the system of military-technical cooperation. The company actively offers its partners new formats of cooperation within the global arms market trends in today’s environment. “One of the key current tendencies in military-technical cooperation is a rising global interest in technology partnership. According to our estimates, the share of such projects will double by 2030 and occupy 40% of the entire global arms market,” Alexander Mikheev stated. “Rosoboronexport has strong competencies in launching licensed production, setting up joint ventures and conducting joint R&Ds with foreign customers. We have an impressive portfolio of completed and current projects for all services of the Armed Forces.”

Rosoboronexport has been fulfilling technology partnership contracts with foreign customers since the first year of its establishment. In 2000, the company signed a major contract with India’s HAL Corporation

to organise licensed production of Su-30MKI aircraft in India. As early as next year, in 2001 another contract was signed with India for the licensed production of Russian MBTs. Production of Russian BMP-2 IFVs, 125mm Mango APFSDS rounds and Invar gun-launched ATGMs was also launched in India through Rosoboronexport.



Sukhoi Su-30MKI

Thales: Catalyzing India's Vision of Aatmanirbhar Bharat in Defence



The Indian defence and aerospace sector in India is witnessing a paradigm shift with an increased focus on indigenisation, marching towards the 'Aatmanirbhar Bharat' vision. Government policies and industrial collaborations are enabling the country to build on manufacturing and export capabilities in the country.

With a 70+ year presence in India, Thales is fully committed to the government's objective of 'Make in India and for the world'. By leveraging our strong technological capabilities across defence, aerospace, cyber and digital markets, Thales has been contributing to the incredible growth story of India.

We are actively supporting the Indian defence industry to play a greater role in world markets and build advanced in-country capabilities across critical systems, manufacturing and services through local teams and collaborations.

Strengthening India's Armed Forces with Versatile Solutions

Thales offers a wide range of capabilities to help India's armed forces achieve and sustain operational superiority. With our global expertise and technological prowess, Thales is supporting the Indian army with air defence radars, optronics and electronic warfare systems, alongside providing the IAF with cutting-edge

technologies, including avionics, radars, reconnaissance pods, Identification friend or foe, as well as the Inertial Navigation to Global Positioning System.

In addition to this, Thales provides trusted intelligence for Indian Navy with breakthrough technologies embedded in our combat-proven naval solutions such as electronic warfare, communications and sonar systems for submarines, surface ships and airborne platforms, long range surveillance radar as well as mine hunting solutions, among others.

Thales is also a major player of trusted AI in these complex environments, devoting massive efforts to research and development, both in-house and through academic and industry partnerships. These investments enable the Group to equip armed forces with greater efficiency in data analysis and decision-making, while taking into account the specific constraints, such as cybersecurity, embeddability and frugality, associated with critical environments.

Adding wings to the Indian Aerospace Industry's strength

Thales has been contributing to India's aerospace sector for decades. In 2024, Air India selected Thales' AVANTUp IFE entertainment for 51 of its wide body aircraft to elevate experience for its passengers. In the area of airport security, Thales has deployed its Fly to

Gate biometric solution for DigiYatra at seven airports in India.

In addition, we have been selected to deploy the Airport Operation Control Centre (APOC) to optimise overall airport management and enhance passenger experience securely at these airports.

Moreover, Thales has partnered with Garuda Aerospace to promote the development of the drone ecosystem in India. This collaboration seeks to support India in realising its ambition to become a major global hub for drones by 2030.

Additionally, our investments in the upcoming avionics Maintenance, Repair and Overhaul (MRO) facility in India, set to be operational this year, underscores our commitment to delivering world class services to Indian airline customers while supporting the local industry.

Showcasing our commitment to India's growth story at Aero India 2025

The 'Aatmanirbhar Bharat' vision is at the heart of our growth story in India. Thales is proud to have steadily built advanced manufacturing capabilities,

critical systems, and services in India through local teams and collaborations.

Our objective is not just 'Make in India' but also 'export from India', enabling the local industry to play a greater role in global markets. Over the years, we have established a team of over 2,200 employees who are working with Thales and its joint ventures in the country.

Moreover, Thales has formed various partnerships with public and private sector industries such as with Bharat Electronics Ltd, dedicated to radars among others. Additionally, we have also joined hands with Bharat Dynamics Limited, Kalyani Group and MKU.

With a growing network of over 75 qualified Indian suppliers, engaged in our global supply chain across defence and civil markets, generating more than 2,000 indirect jobs in India, Thales remains a trusted partner promoting sustainable manufacturing in the country for both India and the world.

As India progresses towards the vision of Viksit Bharat by 2047, Thales will continue to invest in our Indian growth story, bolstering our local teams, collaborations, and innovations for the future.

By Pascale Sourisse, President & CEO, Thales International

Bharat Forge participates in contract negotiations for ATAGS

In March 2023, the Ministry of Defence, Government of India, had accorded the Acceptance of Necessity (AoN) for procurement of the 155mm/52cal Advanced Towed Artillery Gun System (ATAGS) along with the Gun Towing Vehicles (GTVs) for the Indian Army. After completion of due technical evaluation process and commercial bids opening, the contract negotiation procedure between Bharat Forge Ltd and the Indian Ministry of Defence is currently underway as of November 2024.



Interview with Air Chief Marshal AP Singh, Chief of the Air Staff, Indian Air Force



The Mi-26 seen here at Chandigarh in December 2008

VAYU: *Could you update us on the status of LCH Prachand with respect to the ordered numbers and deliveries?*

CAS: IAF has inducted and operationalised ten Prachand Light Combat Helicopters (LCHs). The aircraft had participated in the recently concluded international exercise Tarang Shakti. A case for procurement of 156 LCH SP (IAF-66 and IA-90) is under progress.



VAYU: *What is the status of the Mi-26 helicopters: we hear they are being refurbished and modernised. Is that correct?*

CAS: Deliberations are underway with JSC Russian Helicopters on refurbishing of Mi-26 helicopters. JSC RH specialists had invited India to assess local facilities to work out a plan of action.

VAYU: *Are there delays in the LCA Mk.1A deliveries? What is the total order envisaged by the IAF?*

CAS: The deliveries of LCA Tejas Mk.1A were supposed to commence from February 2024 onwards. Tejas Mk.1A programme has been delayed due to engine and a few more issues. The IAF has been proactive in its approach and we are hopeful that the engine delivery will start soon. HAL has also been asked to increase the production of Tejas and they have been forthcoming about it. Case for procurement of additional 97 LCA Mk.1A is under progress. Eventually IAF will have 220 LCAs.

VAYU: *For over 2 decades now we have been tracking the MMRCA/MRFA programme: could you give us its status please?*

CAS: An RFI for procurement of 114 MRFA was issued on 6 April 2018. Responses have been received for eight aircraft types. It is planned to integrate indigenously developed weapons on



LCA Mk.1 at Aero India 2023

the aircraft being manufactured in India by an Indian Production Agency (IPA). The case is being pursued as per the provisions of DAP-2020. The timelines can be ascertained after accord of AoN for the MRFA project.



IAF C-130J-30 at Exercise Tarang Shakti
 (Photo: Mayyank Kaul)



MQ-9B SkyGuardian

VAYU: Besides the MQ-9B UAS, what are the other UAV/UAS the IAF is currently evaluating or planning to induct (including the Heron Mk.II and Drishti 10) etc?

CAS: The IAF is tirelessly working on roadmap for acquisition of Unmanned Air Systems to meet both the short term and long term operational requirements. The plan includes the procurement of various types of UAS systems ranging from small drones and counter drone systems to the MALE and HALE class of UAS along with the combat capability.

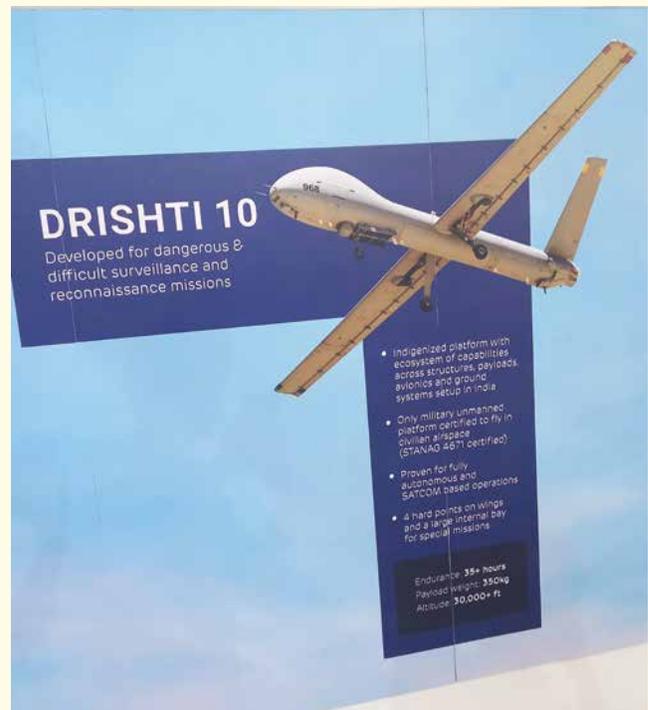
A combined case for procurement of 31 Sky/Sea Guardian (MQ-9B Predator) HALE UAS has been approved by DAC on 15 June 2023 from General Atomics, USA (Qty 16 RPAs are for IAF and IA) with Indian Navy as the lead service.

VAYU: After the success of Exercise Tarang Shakti, will the IAF have more on the same lines every year?

CAS: The exercise is the maiden edition with participation of a large number of Friendly Foreign Countries (FFCs).

It is also the biggest multinational exercise hosted by India. Hosting an exercise of this scale takes a lot of planning and preparation. Although our engagement with FFCs will continue, decision on the periodicity of such a large scale exercise

would be taken in due course of time. As of now, we plan to hold Ex-Tarang Shakti once in two years.



DRDO highlights in 2024

DRDO conducted a successful test of the New Generation AKASH (AKASH-NG) missile from the Integrated Test Range (ITR), Chandipur off the coast of Odisha in January 2024.

Four flight trials of High-speed Expendable Aerial Target (HEAT)-ABHYAS were successfully carried out by DRDO from the Integrated Test Range, Chandipur in Odisha during 30 January to 2 February 2024.

DRDO conducted two successful tests of Very Short-Range Air Defence System (VSHORADS) missile on 28-29 February 2024 from a ground based portable launcher off the coast of Odisha from Integrated Test Range, Chandipur. VSHORADS is a Man Portable Air Defence System (MANPAD).

DRDO conducted first successful test of indigenously developed Agni-5 missile with Multiple Independently Targetable Re-Entry Vehicle (MIRV) technology. The flight test named Mission Divyastra was carried out from Dr APJ Abdul Kalam Island in Odisha.

Strategic Forces Command, along with DRDO, conducted the successful test of New Generation Ballistic Missile Agni-Prime from Dr APJ Abdul Kalam Island off the coast of Odisha in April 2024.

Man Portable Anti-tank Guided Missile Weapon System, indigenously designed and developed by DRDO, was field evaluated in different flight configurations several times with the objective of proving the technology with high superiority.

DRDO, along with researchers of IIT Delhi developed Light Weight Bullet Proof Jackets named ABHED (Advanced Ballistics for High Energy Defeat) in the country for protection against 7.62 x 54 R API (Level 6 of BIS 17051) ammunition.

Supersonic Missile-Assisted Release of Torpedo (SMART) system was successfully flight-tested in May 2024 from Dr APJ Abdul Kalam Island off the coast of Odisha. SMART is a next generation missile

based light weight torpedo delivery system to enhance the anti-submarine warfare capability of the Indian Navy far beyond the conventional range of lightweight torpedo.

DRDO successfully tested RudraM-II air-to-surface missile from a Su-30MKI platform of IAF off the coast of Odisha in May 2024.

DRDO handed over the Medium Range-Microwave Obscurant Chaff Rocket to the Indian Navy at a ceremony held in New Delhi in June 2024. Microwave Obscurant Chaff, a niche technology developed by DRDO's Defence Laboratory, Jodhpur, obscures radar signals and creates a microwave shield around platforms and assets, thus reducing radar detection.

DRDO successfully tested Phase-II Ballistic Missile Defence System in July 2024. The flight test fully met all the trial objectives.

DRDO carried out successful maiden flight test of Long Range Glide Bomb, Gaurav from Su-30MKI platform of IAF. Gaurav is an air launched 1,000 kg class glide bomb capable of hitting targets at long distance.

DRDO and the Indian Navy conducted back-to-back successful flight tests of the Vertical Launch Short Range Surface to Air Missile.

DRDO conducted the maiden flight-test of Long Range Land Attack Cruise Missile from the Integrated Test Range, Chandipur off the coast of Odisha in November 2024 from a mobile articulated launcher.

DRDO successfully completed the Flight Tests of Guided Pinaka Weapon System as part of Provisional Staff Qualitative Requirements Validation Trials. The flight tests were conducted in three phases at different field firing ranges.

DRDO conducted a successful flight-trial of India's first long-range hypersonic missile; it is designed to carry various payloads for ranges greater than 1,500 kms for the Armed Forces.



News from DRDO

LRLACM test conducted

Defence Research and Development Organisation (DRDO) conducted the maiden flight test of Long Range Land Attack Cruise Missile (LRLACM) from the Integrated Test Range (ITR), Chandipur off the coast of Odisha on 12 November 2024 from a mobile articulated launcher. During the test, all sub-systems performed as per expectation and met the primary mission objectives. The missile performance was monitored by several range sensors like radar, electro optical tracking system and telemetry deployed by ITR at different locations to ensure complete coverage of the flight path.

LRLACM has been developed by the Aeronautical Development Establishment, Bengaluru along with contribution from other DRDO laboratories and Indian industries. Bharat Dynamics Limited, Hyderabad and Bharat Electronics Limited, Bengaluru are the two Development-Cum-Production-Partners for LRLACM and they are engaged in the missile development and integration. LRLACM is a Defence Acquisition Council approved, Acceptance of Necessity sanctioned, Mission Mode Project. It is configured to launch from ground using mobile articulated launcher and also from frontline ships using universal vertical launch module system.



is designed to carry various payloads for ranges greater than 1,500 kms for the Armed Forces. The missile was tracked by various range systems, deployed in multiple domains. The flight data obtained from down range ship stations confirmed the successful terminal maneuvers and impact with high degree of accuracy. This missile has been indigenously developed by the laboratories of Dr APJ Abdul Kalam Missile complex, Hyderabad along with various other DRDO laboratories and industry partners.

Tests of Guided Pinaka Weapon System

DRDO, on 14 November 2024, successfully completed the Flight Tests of Guided Pinaka Weapon System as part of Provisional Staff Qualitative Requirements (PSQR) Validation Trials. The flight tests have been conducted in three phases at different field firing ranges. During these tests, the PSQR parameters viz., ranging, accuracy, consistency and rate of fire for multiple target engagement in a salvo mode have been assessed by extensive testing of rockets. Twelve (12) rockets from each production agency from two in-service Pinaka launchers upgraded by the launcher production agencies have been tested.

The precision strike variant for Pinaka Multiple Launch Rocket System is a totally indigenous weapon system designed and developed by Armament Research and Development Establishment in association with Research Centre Imarat, Defence Research and Development Laboratory, High Energy Materials Research Laboratory and Proof & Experimental Establishment with Munitions India Limited and Economic Explosives Limited as production agencies for ammunition and Tata Advanced Systems Limited and Larsen & Toubro for Pinaka launcher and Battery Command Post.



Trial of long range hypersonic missile

Defence Research and Development Organisation (DRDO) conducted a successful flight trial of India's first long range hypersonic missile from Dr APJ Abdul Kalam Island off the coast of Odisha late on 16 November 2024. This hypersonic missile

DRDO hands over AHSP of P-7 Parachute System

The Authority Holding Sealed Particulars (AHSP) of P-7 Parachute System was handed over to the Directorate General of Quality Assurance (DGQA) by the Aerial Delivery Research and Development Establishment (ADRDE), Agra, a DRDO laboratory on 12 November 2024. ADRDE has successfully designed, developed and qualified the P-7 Parachute System. Gliders India Limited (Ordnance Parachute Factory), GIL (OPF), Kanpur has fabricated the parachute system, which is capable of safely dropping payloads of up to 9.5 ton from Il-76 aircraft at an altitude of up to four kms.



Indian Army can rapidly deploy their Light Field Gun and Jeep at the border and conflict areas by air dropping with this system. Army has placed an indent

from the Integrated Test Range (ITR), Chandipur, Odisha. The missile intercepted a high speed aerial target, flying at a very low altitude and simulating a sea skimming threat, which showcased its precision and capability to neutralise targets.



DRDO tests VSHORADS

DRDO successfully conducted three flight tests of the 4th generation, technically advanced miniaturised Very Short Range Air Defence System (VSHORADS) at the Pokhran Field Firing Ranges in Rajasthan on 3 and 4 October 2024. The tests were carried out against high speed target, demonstrating very critical parameters of maximum range and maximum altitude interception.

on GIL (OPF), Kanpur for supply of 146 P-7 Heavy Drop Parachute System. The system has successfully completed General Staff Evaluation and been inducted into the services.

DRDO/IN in 2nd test of VLSRSAM

DRDO and the Indian Navy conducted back-to-back successful flight tests of the Vertical Launch Short Range Surface to Air Missile (VLSRSAM). The second consecutive test was conducted on 13 September 2024,



Embraer looking at enhancing supply chain base in India



A high level delegation from Embraer concluded a visit to India mid-September 2024 as it evaluates the expansion of its supply chain into the country. Embraer foresees potential suppliers across its defence, commercial aviation and executive jets businesses for areas such as aerostructures, machining, sheet metal, composites, forgings, wire harness, and hardware and software development, recognising that aerospace engineering capabilities are clearly present and available in the country. The visit comes amidst burgeoning relations between Brazil and India.

India is a strategic market for Embraer in all its business segments. The Embraer footprint in the country surpasses 44 aircraft, including customers in Commercial Aviation, Executive Jets and Defense & Security. In particular, the Indian Government and Indian Air Force operate a fleet of 5 Embraer VIP jets and 3 EMB 145 AEW “Netra” military aircraft, respectively.

One of Embraer’s key future opportunities in India is the Indian Air Force MTA (Medium Transport Aircraft) programme, in which Embraer is well positioned to offer the best in class, modern C-390 Millennium transport aircraft in partnership with the very reputed Indian company Mahindra. The two companies announced their partnership back in February 2024.

Embraer sees India as a key partner in the region and expects, together with Mahindra, to implement an extensive local supply chain programme. This initiative may include an assembly line for the C-390 in India, when selected for this programme. Tied with a local long term support programme offer, Embraer and Mahindra aim to fulfill the expectations of the “Make in India” initiative of the Indian Government.

Courtesy: Embraer



TASL and Airbus inaugurate C295 FAL in India



L–R: Rémi Maillard, President and Managing Director at Airbus India & South Asia; Noel Tata, Chairman, Tata Trusts; Mr. Bhupendrabhai Patel, CM, Gujarat; Pedro Sanchez Perez–Castejon, President of the Government of Spain; Mr. Narendra Modi, PM, India; Mr. Rajnath Singh, Defence Minister, India; N. Chandrasekaran, Chairman, Tata Sons and Sukaran Singh, CEO & MD, Tata Advanced Systems Ltd.

As a major milestone for India’s aerospace and defence industry, Tata Advanced Systems Limited (TASL) and Airbus inaugurated the Final Assembly Line (FAL) complex for the Airbus C295 aircraft in Vadodara, Gujarat in India on 28 October 2024. TASL and Airbus are partnering for the pioneering ‘Make in India’ project to deliver 56 C295 aircraft to the Indian Air Force (IAF). The state-of-the-art facility was inaugurated by the Prime Minister of India, Mr. Narendra Modi and the President of the Government of Spain, Pedro Sanchez Perez–Castejon in the presence of N. Chandrasekaran, Chairman of Tata Sons and Michael Schoellhorn, CEO of Airbus Defence and Space.

Providing a major boost to the Government of India’s ‘AatmaNirbhar Bharat’ (self-reliant India) programme, this is the first instance of the private sector setting up an aircraft FAL in India. The inauguration comes three years after the Indian Air Force (IAF) formalised the acquisition of 56 Airbus C295 aircraft to replace their legacy Avro fleet. As per the contract, 40 units will be manufactured and assembled in partnership with TASL at this FAL, while 16 will be delivered to the IAF in ‘fly-away’ condition from Airbus’ final assembly line in Seville, Spain. To date (end–October 2024), a total of six aircraft have already been delivered.

The FAL will integrate manufacturing of detail parts and related tooling, sub-assemblies, major component assemblies, tools, jigs and testers. The production of components of the C295 aircraft have already started in the Main Component Assembly (MCA) facility in Hyderabad.

The parts for the first C295 aircraft to be made in India have been shipped to the Vadodara FAL, where the aircraft will be assembled and then delivered to the IAF.

The first ‘Make in India’ C295 will roll out of the Vadodara FAL in September 2026, which will be a milestone for the Indian aerospace industry; and shall ramp-up to deliver 40 aircraft to the IAF by August 2031, as required by the IAF contract.



DRDO's successful trials of Ghatak/SWIFT UCAV

Defence Research and Development Organisation (DRDO) successfully carried out flight trials of Autonomous Flying Wing Technology Demonstrator, an indigenous high speed flying wing Unmanned Aerial Vehicle (UAV) from the Aeronautical Test Range, Chitradurga in Karnataka. "The successful flying demonstration of this autonomous stealth UAV is a testimony to maturity in the technology readiness levels in the country. With this flight in the tailless configuration, India has joined the elite club of countries to have mastered the controls for the flying wing technology", stated DRDO.

This UAV is designed and developed by DRDO's Aeronautical Development Establishment. The maiden flight of this aircraft was demonstrated in July 2022, followed by many flight trials in various developmental configurations using two inhouse manufactured prototypes. These flight tests led to achievements in development of robust aerodynamic

and control system; integrated real time and hardware in loop simulation, and state of the art Ground Control Station. The team had optimised the avionic systems, integration and flight operations towards the successful seventh flight in final configuration.



Dynamatic Technologies and Aequs for Airbus A220 door components

Dynamatic Technologies Limited and Aequs Private Limited announced a contract for the supply of complex structural parts for the Airbus A220 Door Programme. As part of the contract, awarded by Dynamatic Technologies for the manufacture and supply of components, Aequs will leverage its end-to-end capabilities to manufacture and deliver over 200 detailed parts requiring complex tool design, forgings,

machining, and surface treatment. This contract for the supply of these critical parts over a period of five years strengthens the strategic partnership between the two companies, which are prominent players in the global aerospace supply chain.

Udayant Malhoutra, CEO & Managing Director of Dynamatic Technologies, stated, "This is a significant milestone in our enduring partnership with Aequs, aligning with our commitment to deliver world class aerospace assemblies. By leveraging Aequs' diversified capabilities for complex component manufacture, we are further strengthening India's aerospace ecosystem and advancing our ability to seamlessly meet global standards in precision, quality, and reliability. The synergy between our two organisations ensures that we continue to raise the bar in delivering cutting edge aerostructures for Airbus' A220 programme, marking a new chapter of collaborative innovation and value creation in the global supply chain."





MKU Ltd: Pioneering excellence in defence manufacturing and global reach

Emerged as M Kumar Udyog in 1985, it did not take long for the company to put their boots on the ground in the defence manufacturing industry. In 20 years of existence till its rebranding as “MKU Ltd” in 2005, the company had made its reputation within the Indian Army, as it supplied critical protection systems like fibreglass helmets, from 1989 itself. In 2003, the company also secured its first international order from the Spanish Army for body armour. Heading all the way to present, MKU has so far catered to nearly 250 forces (end customer is military and law enforcement), in both the domestic and international markets, with more than 100 nations involved. Furthermore, it also has a presence beyond Indian boundaries, with two international dedicated production facilities, one in Germany and while other in UAE. Along with it, it has established contacts with approximately 50+ channel partners and empowered 3 million soldiers and 3000+ platforms with their smart solutions.

In terms of services and products offered, they have more than 25+ products in the Netro (optronics) segment only, and for other segment i.e Kavro (self-protection), they have 4 different verticals (Body armour, Armour insert, Ballistic shield, Ballistic helmet).



in processing the raw materials into a finished product, involving complex machinery and serious focus by human brains until the product becomes ready for delivery. The company has successfully manufactured key solutions at much more affordable costs than leading entities in the industry, by also maintaining the quality and finish, as proved by the international certifications it received from agencies, like NATO AQAP, ISO 9001:2015 and more. We also observed the Research & Development (R&D) activities, which aims at testing new designs as well as improving the existing ones, by fixing tweaks or introducing upgrades.

We were also briefed on certain products in the final stages of testing as well as in the development stage. The



Vayu’s Nitin Konde and Rishav Gupta were invited for a special visit to MKU’s state-of-the-art facilities present near Kanpur, Uttar Pradesh, each with its dedicated role in the development/manufacturing process of the products offered by the firm, which are planned to be launched soon. The demonstrations also ensured the quality, feasibility and suitability as promised to customers. We closely witnessed the processes involved

former includes Aviation Night Vision Goggles (ANVGs) for helicopter pilots, SCH-111T for protection of Sikh soldiers, while latter includes driver night sight system for T-90 tanks of the Indian Army. The ANVGs have been ordered by the Indian Air Force to equip the Mi-17 helicopter pilots. Since years, the monocular and binocular range of Night Vision Goggles are also being supplied to the Army,

where they ensure 10,000 hours of life cycle before the tube gets burned, making the system ineffective. The Sikh helmet is world’s first initiative by any company to offer protective headgear specially designed for Sikh soldiers, who haven’t been able to use the latest ballistic protection helmets being designed worldwide.

Text: Nitin Konde and Rishav Gupta

GE Aerospace's GENx milestone with South Asian airlines



(Photos: GE and Vistara)

GE Aerospace announced on 25 September 2024 that its GENx commercial aviation engine family achieved a milestone of two million flight hours with South Asian airlines. The first GENx was delivered in the region in 2012 with 90 GENx engines now powering Air India, Vistara and Biman Bangladesh flights.

“The GENx engine has been instrumental in supporting South Asia’s aviation growth. This milestone is a testament to its engineering excellence and technology maturity,” stated Mahendra Nair, Group Vice President for Commercial Programme at GE Aerospace, during a visit to New Delhi. “We continue to support our customers’ business goals, with our best technology and services offerings.”

“We are proud of our long relationships with the South Asian airlines, including most recently Air India as it plans expansion of operations with 20 new widebody aircraft that will be powered by 40 GENx engines,” stated Vikram Rai, South Asia Chief Executive Officer, GE Aerospace.

Reliable and sustainable technology

As a preferred choice for airlines worldwide, powering Boeing’s 787 Dreamliner and the 747–8, the GENx engine showcases a leap forward in propulsion technology. The engine’s superior performance contributes to reduced operating costs and a lower carbon footprint, aligning with the global aviation industry’s sustainability goals by making it 15% more fuel efficient and emitting up to 15% less CO₂ than its predecessor, the CF6 engine. The GENx engine is a product of decades of operational knowledge and experience, derived from the GE90 engine. With its innovative twin-annular pre-swirl (TAPS) combustor, the engine significantly reduces

nitrogen oxide (NO_x) emissions by up to 60% below current regulatory limits. Researchers and engineers at GE Aerospace’s technology centre in Bengaluru worked closely with regional customers and implemented various performance improvement solutions and deployed various innovative on-wing technologies like foam wash, advance blade inspection and operational data based insights to improve engine’s time-on-wing and reduce maintenance burden.

To further enhance the engine’s efficiency and sustainability, GE Aerospace introduced 360 Foam Wash, a cutting edge alternative to traditional water washing methods. This advanced cleaning process helps maintain optimal engine performance by removing dirt and debris, improving fuel efficiency, and extending the time between maintenance cycles. The 360 Foam Wash has already been implemented by seven airlines including Air India, Emirates, Etihad Airways, Japan Airlines, Qatar Airways, Royal Jordanian, Saudi Arabian Airlines and SkyWest.

GE Aerospace has been a partner to India’s aviation industry for over forty years. Thirteen hundred GE Aerospace and partner engines are in service, powering major Indian airlines. GE Aerospace’s defence engines and systems power Indian Airforce’s Light Combat Aircraft Tejas Mk.1, helicopters and Indian Navy’s aircraft carrier, battleships and frigates. Its Pune manufacturing facility and thirteen local Indian partners are part of the company’s global supply chain. Researchers and engineers at the company’s John F Welch Technology centre in Bengaluru are building the latest aviation technologies.

Courtesy: GE

BEML and Balmer Lawrie & Company Ltd sign Strategic MoU

BEML Limited and Balmer Lawrie & Company Limited have entered into a strategic Memorandum of Understanding (MoU) to collaborate and leverage Balmer Lawrie’s extensive logistics expertise to support BEML’s operations. The MoU was officially exchanged between Mr. Shantanu Roy, Chairman and Managing Director (CMD) of BEML Ltd, and Mr. Adhipnath Pal Chaudhuri, CMD of Balmer Lawrie in the presence of Commodore A Madhav Rao, CMD of Bharat Dynamics Limited and Directors of BEML Limited, in a ceremony held at BEML’s headquarters, attended by senior officers from both companies.

The primary objective of this partnership is to enhance BEML’s business activities in the areas of sea and air shipments for the import and export of engineering goods, custom clearance, domestic transportation—including metro transportation—and providing operational support for BEML’s Special Economic Zone (SEZ) warehouse in Bangalore.

Mr. Shantanu Roy, CMD of BEML Ltd, stated, “This MoU with Balmer Lawrie is a significant step toward streamlining our sea shipments for various business verticals, ensuring timely and efficient transportation of goods and aggregates required for our products. With over 150 years of proven expertise in logistics, Balmer

Lawrie will undoubtedly play a crucial role in supporting our expanding business operations.”

BEML regularly manages sea shipments for engineering goods, components, and CKDs, alongside other aggregates for its sectors, including mining and construction, railways, metro, and defence equipment. The agreement will also help in easing out air shipments for critical components, transportation of goods and equipment across India, and the export of earth-moving machinery to international markets.

This collaboration represents a significant milestone in BEML’s commitment to enhancing its supply chain capabilities, ensuring smooth and efficient logistics solutions for its wide-ranging industrial and defense sectors.

BEML Limited is a leading multi-technology ‘Schedule A’ company under the Ministry of Defence, plays a pivotal role in serving India’s core sectors like defence, rail, power, mining and construction by offering world class products. BEML operates in three verticals viz. Defence & Aerospace, Mining & Construction and Rail & Metro and has state-of-the-art manufacturing facilities located at Bangalore, Kolar Gold Fields (KGF), Mysore, Palakkad, with having very strong R&D infrastructure and nationwide network of sales and services.



Saab starts construction of new Carl-Gustaf M4 factory in India



Ground breaking ceremony on 4 March 2024 and render of what the facility will look like.

Saab has marked the start of the construction of its new Carl-Gustaf M4 manufacturing facility in India with a ground breaking ceremony. The factory will be located in the state of Haryana. 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.

“I am proud to start constructing our first facility outside Sweden for Carl-Gustaf, a product that has a long history with the Indian Armed Forces. We look forward to starting production of our excellent product, now engineered and made in India”, stated Görgen Johansson, Senior Vice President and Head of Saab’s business area Dynamics. “Today is an important milestone for Sweden and India. Saab’s factory will be the first foreign fully owned defence production facility in India. It is a testament to the strong bilateral relationship between our countries,” stated Håkan Jevrell, State Secretary for Foreign Trade, Sweden.



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.



Saab India Chairman and Managing Director, Mats Palmberg (Left) and Senior Vice President Saab AB Görgen Johansson (Right) at the press conference at New Delhi post the ground breaking ceremony.

News from Rafael

Rafael and its Digital Shark Naval ECM

Rafael Advanced Defense Systems announced a contract to supply vessels of a NATO country with the latest generation of its Digital Shark Naval Electronic Countermeasure (ECM) Systems. This advanced, system will provide NATO fleets with capabilities to dominate the electromagnetic spectrum for both defensive and offensive operations. Rafael's Digital Shark system represents the forefront of naval Electronic Warfare (EW) technology, engineered to identify and neutralise complex radar threats autonomously. With its digital receiver, the system can detect a wide range of radar threats, from missile seekers to designation radars. Once a threat is detected, Digital Shark can respond autonomously and instantaneously by directing high-power electromagnetic beams to disrupt the radar's function, rendering it ineffective.



Rafael's high-power laser intercept system development

The Israel Ministry of Defence has signed a landmark deal worth approximately NIS 2 billion (over \$500 million) to expand serial production of Israel's first domestically developed laser weapon system, the IRON BEAM, with lead developers Rafael Advanced Defense Systems and Elbit Systems..

IRON BEAM is a ground-based high-power laser air defence system designed to counter aerial threats, including rockets, mortars, unmanned aerial vehicles (UAVs), and cruise missiles. The Ministry of Defence's (IMod) DDR&D's R&D Unit leads the project with primary developers Rafael and Elbit Systems. The Iron Beam system represents a global technological breakthrough, with its interception capabilities demonstrated through a series of successful trials.

USMC in live fire exercises with IRON DOME

The US Marine Corps has successfully completed

its first live fire training exercise using an air defence system that integrates the IRON DOME interceptor. The system is based on an American radar and command and control centre, combined with the Iron Dome (Tamir) interceptor and



a mobile launcher developed by Rafael, with Raytheon as the prime contractor. During the exercise, Marines operated the system fully, leading to successful target interceptions. Additionally, the continuous launch capability of Iron Dome interceptors from a mobile launcher developed for the Marines was evaluated.

1st Leopard MBT with TROPHY APS

At a ceremony, attended by Viceadmiral Carsten Stawitzki, National Armaments Director in the German Ministry of Defence, highlighted the deepening defence ties between Germany and Israel. This milestone adds to a series of recent high value defence agreements, including Germany's purchase of Israel's Arrow missile defence system, reflecting a "shared commitment to advancing defence capabilities".



ideaForge surpasses 550,000 successful UAV flights

In a landmark achievement for India's drone industry in November 2024, ideaForge, a leading drone technology and manufacturing company, surpassed 550,000 successful UAV flights, with an ideaForge UAV taking off every 4 minutes. This pivotal milestone not only cements ideaForge's leadership in the Indian UAV sector but also underscores its commitment to indigenous drone manufacturing.

The deployment of ideaForge drones spans across border security, perimeter surveillance, forest monitoring, wildlife conservation, disaster response, volumetric surveys in mining and industrial mapping applications. Recently, ideaForge introduced

innovative solutions such as the FLYGHT Drone-as-a-Service model for traffic monitoring and public safety, as well as specialised UAVs for volumetric estimation in mining and surveillance drones for critical infrastructure protection.



Cyient partnership with Deutsche Aircraft

Cyient, a global Intelligent Engineering services company, announced that it has expanded its strategic partnership with Deutsche Aircraft, a leading German regional aircraft manufacturer.

Cyient has been awarded a multi-year contract to manage the advanced technical documentation to support the product lifecycle of safety critical aviation systems for the 40 seater regional turboprop the D328eco. The solution will support Deutsche Aircraft's global customer base with a modular and scalable architecture, personalised user experience, faster time to market, and worldwide access through any device. It will take advantage of Cyient AI products embedded in the solution.



(From left to right): Krishna Bodanapu, Executive Vice Chairman and Managing Director of Cyient and Nico Neumann, Co-CEO of Deutsche Aircraft.

BonV Aero Joins UK Defence Framework to Boost Global Heavy-Lift Drone Capabilities

BonV Aero, India's first indigenous deep tech eVTOL and drone manufacturing startup, has been selected to join the Unmanned Aerial Systems Heavy Lift Capability (UASHLC) Framework. This initiative, led by the UK Ministry of Defence (MOD) under its Future Capability Innovation division, facilitates collaboration between global innovators and suppliers in the Unmanned Aerial Systems (UAS) sector, focusing on heavy-lift capabilities.

This selection provides BonV Aero a platform to engage with the UK and other NATO countries, expanding its presence in the global defence ecosystem. As part of the framework, BonV Aero will be eligible to bid on tasking requirements and participate in mini-competitions for UAS solutions.

“Being part of the UASHLC Framework underscores the relevance of our heavy-lift eVTOL technology in meeting the evolving needs of defence forces around the world. We look forward to collaborating with NATO countries and allied defence organisations.” stated Satyabrata Satapathy, Founder and CEO of BonV Aero.

BonV Aero designs and manufactures high payload eVTOLs with applications in defence, logistics and emergency response. Its Air Orca eVTOL, capable

of transporting heavy cargo over long distances has already been deployed by the Indian Army. Participation in the UASHLC Framework validates BonV Aero's technology and enhances its visibility in international markets. The company aims to collaborate with defence innovators and pursue long-term contracts and partnerships.

BonV Aero's inclusion in the UASHLC Framework highlights the growing capabilities of Indian startups and their spirit of innovation. The company is committed to advancing unmanned aerial capabilities and fostering international partnerships.



(From left) Abinash Sahoo, Satyabrata Satapathy, Umang Rathi, Sultan Khan, Gaurav Accha and Rahul Kumar.

JSW Defence to set up facility for UAS manufacturing

The Government of Telangana has entered into a Memorandum of Understanding (MoU) with JSW UAV Limited, a wholly-owned subsidiary of JSW Defence, to establish a state-of-the-art manufacturing facility to make Unmanned Aerial Systems (UAS) in the state.

As part of this strategic initiative, JSW UAV is set to invest approximately Rs. 800 crores in the project, through a technology arrangement with a leading US based defence technology company. The MoU was signed in the presence of the Chief Minister of Telegana, Shri Revant Reddy and Parth Jindal of JSW Group in the presence of senior dignitaries from the state on the side lines of the ongoing World Economic Forum (WEF) at Davos.



HAL CATS progress

The flagship programme of HAL, Combat Air Teaming System achieved a significant milestone on 11 January 2025 by successfully conducting the engine



ground run of a full scale demonstrator, CATS-Warrior. Image of first reveal in 2021 vs the modified version can be seen clearly. (Photo courtesy: X/ @lca_tejas_)



LM's MH-60R multi-mission equipment for IN

India (for the Indian Navy) has requested to buy thirty (30) Multifunctional Information Distribution System-Joint Tactical Radio Systems (MIDS-JTRS). The following non-MDE items will also be included: advanced data transfer systems; external fuel tanks; AN/AAS 44C(V) forward looking infrared (FLIR) systems; an operator machine interface assistant; spare containers; software development, delivery and support, including Joint Mission Planning System (JMPS); Identification Friend or Foe (IFF) equipment etc. The estimated total programme cost is \$1.17 billion.



ideaForge Switch Mini in "Fit for Indian Military Use" Certification

ideaForge Technology Limited announced that its Switch Mini UAV has earned the prestigious "Fit for Indian Military Use" certification. The Switch Mini UAV with "its unmatched performance, quality, reliability, and the ability to meet the rigorous demands of the Indian military is the only small UAV to obtain this certification, making it a landmark achievement for the Indian Drone Industry".



ISRO completes RLV demonstrations through LEX trio

The Indian Space Research Organisation (ISRO) has “proudly achieved a third consecutive success in the Reusable Launch Vehicle (RLV) Landing Experiment (LEX) on 23 June 2024. The third and final test in the series of LEX (03) was conducted at 07:10 IST at the Aeronautical Test Range (ATR) in Chitradurga, Karnataka”.

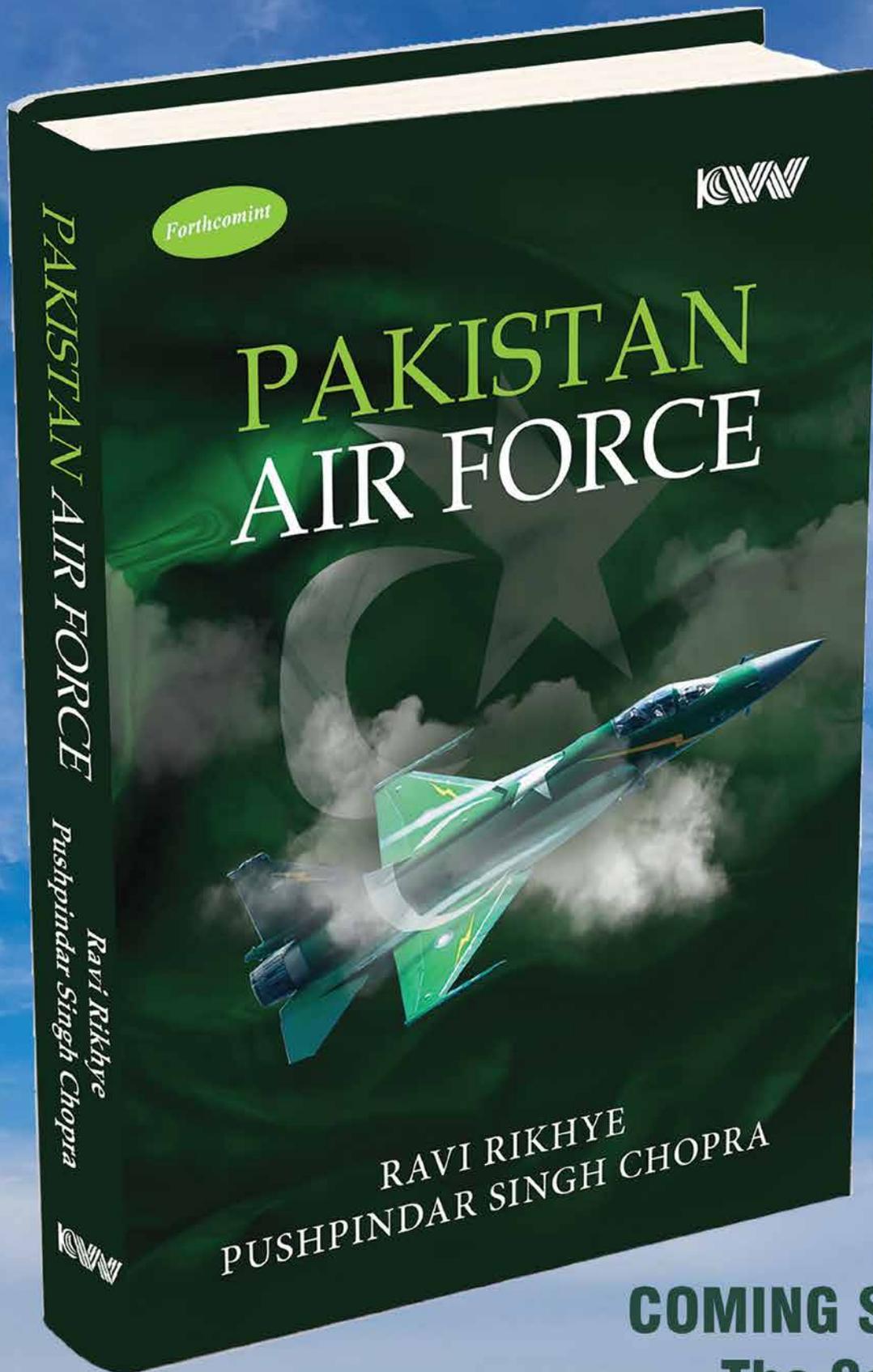
Following the success of the RLV LEX-01 and LEX-02 missions, RLV LEX-03 re-demonstrated the autonomous landing capability of the RLV under more challenging release conditions (cross range of 500 m against 150 m for LEX-02) and more severe wind conditions. The winged vehicle, named ‘Pushpak’, was released from an Indian Air Force Chinook Helicopter at an altitude of 4.5 km. From a release point 4.5 km away from the runway, Pushpak autonomously executed cross-range correction manoeuvres, approached the runway and performed a precise horizontal landing at the runway centreline. Due to this vehicle’s low lift-to-drag ratio aerodynamic configuration, the landing velocity exceeded 320 kmph, compared to 260 kmph for a commercial aircraft and 280 kmph for a typical fighter aircraft. After touchdown, the vehicle velocity was reduced to nearly 100 kmph using its brake parachute, after which the landing gear brakes were employed for deceleration and stop on the runway. During this ground roll phase, Pushpak utilises its rudder and nose wheel steering system to autonomously maintain a stable and precise ground roll along the runway.

This mission simulated the approach and landing interface and high-speed landing conditions for a vehicle returning from space, reaffirming ISRO’s expertise



in acquiring the most critical technologies required for the development of a Reusable Launch Vehicle (RLV). Through this mission, the advanced guidance algorithm catering to longitudinal and lateral plane error corrections, which is essential for the future Orbital Re-entry Mission has been validated. The RLV-LEX uses multisensor fusion including sensors like inertial sensor, radar altimeter, flush air data system, pseudolite system and NavIC. Notably, the RLV-LEX-03 mission reused the winged body and flight systems as such without any modification, from the LEX-02 mission, demonstrating the robustness of ISRO’s capability of design to reuse flight systems for multiple missions.

This mission simulates the approach and landing interface and high speed landing conditions for a vehicle returning from space, which will reaffirm ISRO’s expertise in acquiring the most critical technologies required for the development of a Reusable Launch Vehicle (RLV).



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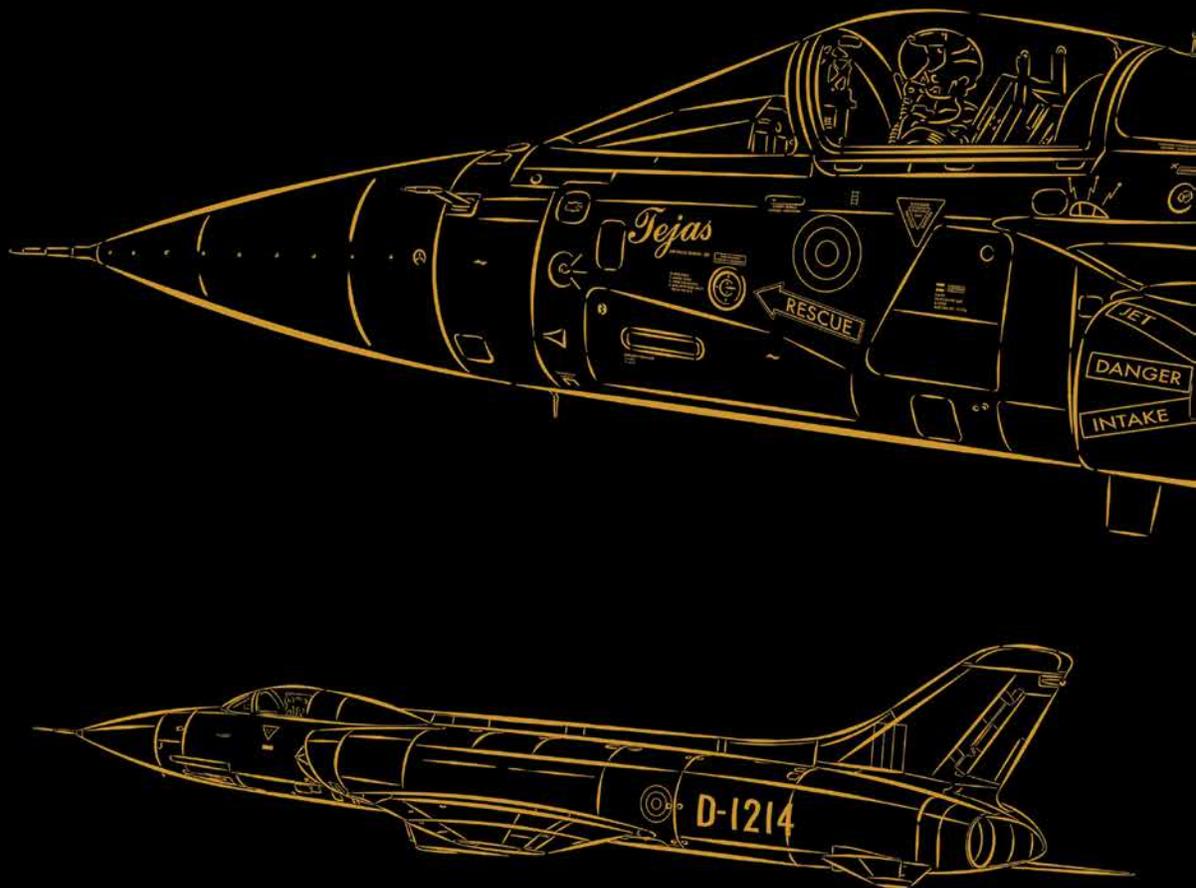
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Premjit Singh

PUBLISHED BY

Vayu Aerospace Pvt. Ltd.

E-52, Sujan Singh Park,

New Delhi 110 003 India

Tel: +91 11 24617234

Fax: +91 11 24628615

e-mail: vayuaerospace@lycos.com

e-mail: vayu@vayuaerospace.in

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The Vayu Team at Defexpo 2020

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