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COVER IMAGE

Bheem formation with C-17 and Su-30 MKI. IAF's firepower and air superiority stem from aerospace power's capabilities in terms of reach, mobility, responsiveness, offensive lethality, and trans-domain operational flexibility integrated with deep tech and critical technologies.

*(**Cover Photo**: Indian Air Force)*

COVER DESIGN BY: *SP's Team*

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REGULAR DEPARTMENTS

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NEXT ISSUE: *Special Mission Aircraft*

The emergence of asymmetric and hybrid warfare concepts requires the Indian Air Force to dovetail their Space and Information Warfare capabilities into its concept of operations. For the IAF's power projection, Network-centric warfare imbibing NextGen technologies is the most fundamental for Offensive and Air Defence Operations.

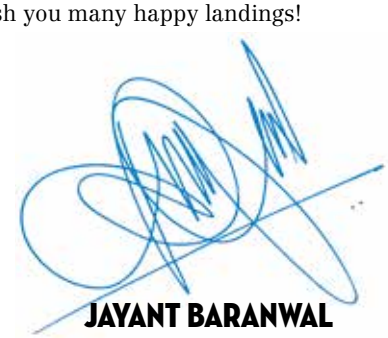
THE INDIAN AIR FORCE (IAF) HAS UNDERGONE A REMARKABLE evolution, emerging as a modern aerospace powerhouse capable of exerting control over both air and space domains to safeguard India's national interests. Drawing from operational experiences and collaborative exercises with allied air forces, the IAF continues to refine its capability concepts, integrating lessons learned into its evolving doctrines. As mentioned by Air Chief Marshal V.R. Chaudhari, Chief of the Air Staff, there is the need to reimagine, reform, redesign and rebuild our traditional war fighting machinery to adapt to emerging paradigms of future wars. In this edition of *SP's Aviation*, Manish Kumar Jha presents a comprehensive overview of the IAF's modernisation roadmap, shedding light on its strategic trajectory, imbibing emerging and critical technologies.

In addition, Air Marshal Anil Chopra (Retd) explores the pivotal role of force multipliers in bolstering air dominance, stressing the imperative of sustained investment and strategic deployment. All major air forces of the world, including Indian Air Force (IAF) invest in force multipliers to enhance operational capability. A country of the size of India with hot borders, needs to seriously invest in building up its force multipliers. His article looks at airborne force multiplier platforms and their status in IAF. Group Captain D.K. Pandey (Retd) delves into India's efforts to strengthen network-centric air operations through advanced airborne early-warning and control (AEW&C) systems. The experience of the IAF with Netra Mk-1 AEW&C was encouraging, significantly increasing the operational productivity and enhancing India's airborne surveillance capabilities. He writes, India is actively working towards developing and deploying modern indigenous AEW&C aircraft, often referred to as "Eyes in the Sky" and the IAF is vigorously pursuing the acquisition of six Mark-1A and six Mark-2 variants of the Netra AEW&C aircraft.

Meanwhile, the Defence Research and Development Organisation (DRDO) has continuously assumed a pivotal role in shaping India's defence technology landscape. With a legacy spanning back to 1958, DRDO stands at a critical juncture, poised for strategic transformation to address existing gaps in defence research and development. Manish Kumar Jha explores DRDO's journey and future imperatives in this edition of the magazine and also provides insights into its broad spectrum of responsibilities.

This edition also offers a nuanced exploration of India's aviation sector, showcasing its transformative journey and burgeoning prospects on the global stage. This issue includes a detailed report on Wings India by Ayushee Chaudhary. The airshow set the stage for India Civil Aviation @2047 through its air displays, exhibition, deals and discussions. A major deal was announced by Akasa Air as it placed a firm order for 150 Boeing 737 MAX aircraft at Wings India 2024. Akasa also ordered more than 300 CFM LEAP-1B engines. Boeing's latest widebody 777X (777-9) took center stage at Wings India 2024 as it made its India debut. Details of these and more are included further in the magazine. Furthermore, in another story by Ayushee Chaudhary, India's pivotal role in spearheading the commercial aviation recovery in South Asia is underscored, with Boeing's forecast predicting over 2,705 new airplane deliveries to the region by 2042.

All this and more in this issue of *SP's Aviation*. Welcome aboard and we wish you many happy landings!



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EXERCISE DESERT KNIGHT: IAF IS MODERNISING AND EXPANDING ITS CAPABILITIES BASED ON THE LEARNING AND EXPERIENCES OF INTEROPERABILITY FROM SUCH EXERCISES

IAF MODERNISATION ROADMAP

IAF's pursuit of Air & Space Supremacy amid a surfeit of challenges

By MANISH KUMAR JHA

THE IAF HAS, OVER THE YEARS, TRANSFORMED INTO A MODERN aerospace power that is capable of controlling and exploiting air and space environments to achieve India's national and security objectives. Over the years, IAF's projection of capability concepts has progressed on operational experiences of real conflict situations as well as exercises within the country and with friendly foreign air forces. Many lessons learnt from these experiences have found a place in the doctrinal space while some of the elements continue to be assimilated incomprehensive discourse based on the fast-progressing air and space areas--for the future.

The IAF's firepower and air superiority stem from aerospace power's capabilities in terms of reach, mobility, responsiveness, offensive lethality, and trans-domain operational flexibility in air to near space. The multi-role capabilities of platforms and weapon systems offer wide-ranging opportunities, capable of rapid role change which provide multiple options to the aerospace power practitioner.

IAF currently has 31 fighter squadrons and will be inducting 83 LCA Mk1A from 2024 onwards. LCA Mk1A is already flying. Development of LCA Mk2 and AMCA—albeit slowly—is moving towards a fifth generation capability with the locally manufactured jet engine –based on technology gains from GE F414 aero-engine and domestic R&D efforts. At the same time, the IAF is also pursuing the older MMRCA initiative which is now christened 114 MRFA (Multi Role Fighter Aircraft) to bridge the gap of depleting squadron strength. In fact, recently, the Chief of the Air Staff (CAS) has spoken about it firmly, giving some wings for MRFA to take off from the hanger, if not the ground.

However, the silver lining is the helicopter fleet which is indeed a greater success story from the house of IAF. One by one, the multi-role fleet of helicopters –all built/integrated indigenously at HAL—is being induced which includes the Light Combat Helicopter (LCH Prachand), Advanced Light Helicopter – Weapon Systems Integrated (ALH WSI), and planned induction of Indian Multi-Role Helicopter (IMRH). Already, a total of 6 LCHs Limited Series Production (LSP) aircraft have been handed over to the IAF. The twin-engine LCH has shown operational capability at 6.5 km altitude with an adequate payload with electro-optical CCD/FLIR Pod, taking the unique position to land and take off at an altitude of 5,000 metres.

The LCH is loaded with Gen-III NVGs, anti-tank guided missile Dhruvastra and air-to-air missile Mistral-2 from MBDA, making India the seventh country in the world to do so.

Among the clusters, the IMRH is another promising air asset in the 10-15 tonne class based on a new powerful 3000 Shaft Horse Power (SHP) engine developed jointly by Safran and Hindustan

PHOTOGRAPHS: INDIAN AIR FORCE

During his recent visit to Military Institute of Technology (MILIT), Pune, **Air Chief Marshal V.R. Chaudhari, Chief of the Air Staff** highlighted the need to reimagine, reform, redesign and rebuild our traditional war fighting machinery to adapt to emerging paradigms of future wars.

Aeronautics Ltd (HAL) called-- Safhal Helicopter Engines Pvt Ltd. This is indeed a progressive area with a proven collaboration for the Shakti engine (the Ardiden1H1), incorporating innovative propulsion technology, which powers the Dhruv, the Armed Dhruv as well as the LCH. Each of these helicopters is powered by two engines, each producing a SHP 1400-2000 per engine – more than 500 Shakti engines have been produced by HAL. How capable it would be: For example, American made AH-64E Apache, is fitted with two General Electric T700-GE-701D turboshaft engines with an SHP of 2000 each, which enables it to carry a lethal package of armaments over high altitudes in Ladakh at ease.

The IMRH will replace older Russian Mi-17I Medium utility helicopters. So far, IMRH has crossed the Preliminary Configuration for the basic IMRH platform based on Operational Requirements (ORs) given by IAF.

IAF'S CONCEPT OF OPERATIONS (CONOPS)

The emergence of asymmetric and hybrid warfare concepts requires IAF to dovetail their Space and Information Warfare capabilities into the CONOPS to ensure an operational continuum. For the IAF's power projection, Network-centric warfare is the most fundamental with Offensive and Air Defence Operations based on an Integrated Air Command and Control System. At the same time, enterprise-level digitisation drives the techno-logistics and administration aspects of the IAF. While networking and automation have enhanced operational efficiency at all levels, the precept of conduct of air operations through 'Joint Planning, Centralised Command, Distributed Control and Decentralised Execution' remain at the core of our doctrinal belief. In this context, the doctrine has been reviewed after studies on op applicability, combat leadership and conduct of air war in all possible scenarios.

THE INTELLIGENT EYES IAF

Currently, India is planning to develop and introduce 12 more "eyes in the sky" advanced indigenous airborne early-warning and control (AEW&C) aircraft to counter the air surveillance advancements of China and Pakistan. The IAF and the Defence Research and Development Organisation (DRDO) are jointly developing six Mark-1A and six Mark-2 versions of the Netra AEW&C aircraft.

The Indian Air Force (IAF) has also kickstarted the indigenous Netra-I Airborne Early Warning and Control aircraft programme. This programme is based on the Brazilian Embraer aircraft where six AEW&C aircraft will be like the first three Embraer-145 jet-based Netra, which have 240-degree radar coverage with advanced software and technologies like new gallium nitride-based TR (transmit/receive) modules for the radars loaded with signal intelligence systems at an estimated cost of around Rs 9,000 crore. Besides, boosting EW&C radars and sen-

INDIA IS PLANNING TO INDUCT 12 MORE ADVANCED INDIGENOUS AIRBORNE EARLY-WARNING AND CONTROL (AEW&C) AIRCRAFT

Behind some of the key strategic and technological capability roadmap, Air Marshal Ashutosh Dixit, Deputy Chief of the Air Staff has led the modernisation plan based on self-reliance ethos. In an exclusive interaction with the author, he outlined the ambitious plan to address the NextGen technologies for aerospace.

sors on second-hand Airbus-321 planes acquired from Air India which is currently underway at a cost of Rs 10,990 crore.

It was evident during the cross-border Balakot air strikes and ensuing aerial engagement with Pakistani aircraft which were supported by Saab 2000 Erieye AEW&C. A simple comparison shows the importance of AEW&C jets; Pakistan operates 11 Swedish Saab 2000 Erieye AEW&C and China-made Karakoram Eagle ZDK-03 AWACS aircraft, while China possesses about 30 AEW&C aircraft, such as Kong Jing-2000 'Mainring', KJ-200 'Moth', and KJ-500 models with next- general and much advanced AWACS in the process of being inducted.

TECHNOLOGY IN AEROSPACE APPLICATION

The air and near space domains are increasingly a continuum for the IAF due to the increasingly high dependency on ISR, navigation, imagery, targeting, meteorology, communication, operational networks, command and control, enhanced AD responsibility etc.

Air Chief Marshal V.R. Chaudhari, Chief of the Air Staff has recently highlighted space-based applications like Positioning, Navigation & Timing (PNT), ISR and Communication. IAF is leveraging the advancement in space with ISRO. Currently, IAF is using GSAT 7A, a satellite expanding on UHF, S, and Ku bands with a coverage area of the Indian Ocean Region (IOR) up to 2,000 km from the Indian coastline to secure communication real-time between naval assets, including ships, submarines, and aircraft. It adds to the interoperability with other military forces—a key component for joint military exercise in emerging conflicts in the region.

These clusters of satellites --GSAT-7 (Rukmini), GSAT-6, and GSAT-7A (Angry Bird) support the communication needs of more than 50 naval ships and aircraft across the Arabian Sea and the Bay of Bengal. The government also recently signed a contract worth ₹3,100 crores ($43.6 million) with New Space India Limited (NSIL) for GSAT-7B, an advanced communication satellite. While the GSAT-7B will be the first dedicated communication satellite for the Indian Army, it will further boost the space reconnaissance capabilities of the IAF and Indian Navy as well.

Next, it is equally about consolidating, Anti-Satellite (ASAT) weapons for the emerging threats for space-based assets of being taken down in any conflict. The IAF is also cognizant of the fact that the IAF needs to have ready-to-launch backup satellites on the ground and launch on-demand rocket capability in possible conflicts.

IAF is expanding on deep tech and emerging areas for integrating critical technologies such as Artificial Intelligence (AI), Machine Learning (ML), Low-Cost Drone Tech, Manned-Unmanned Teaming (MUMT), Quantum Key Distribution (QKD) in Space Tech, Space ISR (Hyperspectral Scanning, anomaly detection), Anti Sat-

WITH THE DEVELOPMENT AND INDUCTION OF LCA MK2 IN THE FUTURE, LCA WILL FORM THE CORE OF IAF'S FIGHTER SQUADRONS

ellite Capability, High Altitude Platform Systems (HAPS), Precision over Long Range, Extended AD Weapon in the top list.

COMMAND, CONTROL, COMMUNICATION, NETWORKS, INTELLIGENCE, AND INTEROPERABILITY (C3NI2)

Unity of command, effective control, seamless communication, leverage of information technology, and shortening the OODA loop through real-time intelligence and interoperability are the imperatives for warfighting and winning wars.

The future of military technology is expected to be shaped by several key factors. How is IAF gearing to address its futuristic capability roadmap?

In the perspective plan, the IAF has meticulously outlined the areas to address in terms of air superiority. The notional factor that the hybrid wars today and in the future rely on air assets as the potent and first strike-and tactical offensive is a widely accepted fact now.

Behind some of the key strategic and technological capability roadmap is Air Marshal Ashutosh Dixit, Deputy Chief Air Staff (DCAS) who has led the modernisation plan based on self-reliance ethos. In an exclusive interaction with the author, Air Marshal Dixit has boldly outlined the ambitious plan to address the NextGen technologies for aerospace.

- **Multi-domain Integration (MDI):** This is about looking at the whole digital ecosystem as one and considering the digital threads the digital threads that bind it all together. All five domains should be integrated into this framework- land, air, sea cyber and space. This will be a critically important structural evolution based on data sharing and edge processing.
- **Directed Energy Weapons:** To develop a weapon that can use energy as an offensive for force applications. This may be achieved by using different forms of energy and is currently under active exploration in the form of LASER and EMP weapons. Additionally, there are efforts underway to conceptualise and develop counters to use such capabilities. This is all about requisite sensors and mitigating measures along the core technology around directed energy.
- **Dual use Space Capability:** Dual-Use space assets for military and civil purposes will be the key focus areas where military innovation will spill over the commercial space—a possibility which is already in vogue today. The Russian-Ukraine war has shown its usage in multiple scenarios so effectively that militaries around the world began to refocus on such space-centric applications.
- **Robotics for IAF:** The market for military robots is expected to reach $24 billion by 2025. IAF is gearing up to explore robotics in combat situations. Certainly, they can assess risks that could potentially lead to human casualties and have capabilities that humans don't.
- **Advancement in Hypersonic Systems:** The ongoing development in the area of hypersonic systems is already prioritised as the most potent futuristic weapon by military and R&D institutions, including DRDO. The speed that surpasses Mach 5 is being developed by advanced militaries. What it can do is simply game-changing in the military offensive and strike capabilities: these systems can hit targets anywhere in the world in a matter of hours—and minutes.
- **Artificial Intelligence (AI) and Quantum Sensors:** The IAF will leverage such technologies which are expected to play a significant role in military operations. AI can help in processing vast amounts of data and making quick decisions, and quantum sensors can provide unprecedented levels of sensitivity and precision in measurements.

CHALLENGES AHEAD

However, as the technology is further progressing, the various components and sub-components need to be developed. Take the case of Hypersonic Glide Vehicle (HGV) technology which is dependent on hypersonic aerodynamics, and materials, required for complex manoeuvring, like in the re-entry phase.

Testing infrastructure: Invariably, the key challenge will be to create the testing infrastructure –both lab testing and field testing. In the case of India, if not available then the government needs to set up like the case of Hypersonic Wind Tunnels.

It is worth mentioning that technology also needs to be certified to ensure quality control. The agencies operate in regulatory areas and are prone to resist the radical shift in bringing a new generation of technologies entirely into its class and applications. If these aspects are not addressed then the systems may be sub-optimal and fail altogether. India has learned its lesson in the case of LCA Tejas and TAPAS Drone in terms of regulatory delays in absorbing the technologies. SP

INTEROPERATBILITY HAS EMERGED AS THE KEY COMPONENT FOR THE FUTURE WARFARE OUT OF THE EXERCISES SUCH AS DESERT KNIGHT

The author is a defence editor and security expert. He writes on National Security, Military Technology, Strategic Affairs & Policies.

FORCE MULTIPLIERS — ACTION UNFOLDING INDIA

Force multipliers play an undeniable role in amplifying air dominance, demanding continued investment and strategic implementation

By AIR MARSHAL ANIL CHOPRA (RETD)

USAF E-2D ADVANCED HAWKEYE AEW&C AIRCRAFT USED TO SUPPORT BOTH DEFENSIVE AND OFFENSIVE AIR OPERATIONS

PHOTOGRAPH: NORTHROP GRUMMAN

IN REAL LIFE, A LEVER OR A WEDGE IS CONSIDERED A FORCE multiplier, because it increases the amount of force you can place on an object. In military, a force multiplier is a factor or a combination of factors that gives personnel or weapons (or other hardware) the ability to accomplish greater feats than without it. The force multipliers are those platforms that may not be directly involved in kinetic combat but greatly support those that actually are. These could mean platforms involved in Intelligence Surveillance and Reconnaissance (ISR), Airborne Early Warning and Control (AEW&C) and Flight Refuelling Aircraft (FRA). Even an Electronic warfare (EW) aircraft can be a force multiplier. These platforms are an important part of the Observe, Orient, Decide, Act (OODA) loop. The information flow in the concept of network-centric warfare (NCW) is also a force multiplier. The moral and perpetual optimism of the forces is a major force multiplier. Therefore, psychological and information warfare have become important. For navies, aircraft carrier is a significant force multiplier. All major air forces of the world, including Indian Air Force (IAF) invest in force multipliers to enhance operational capability. This article will restrict itself to airborne force multiplier platforms and their status in IAF.

AIRBORNE EARLY WARNING AND CONTROL

The AEW&C is an airborne radar platform designed to detect aircraft, ships, vehicles, missiles and other incoming projectiles at long ranges, as well as performing command and control of the battlespace in aerial engagements by informing and directing friendly fighter and attack aircraft. It uses advantage of altitude to see much farther than ground-based radars. Being mobile it can move for outside area contingences. Also changing location makes it safer from attack. AEW&C units are also used to carry out aerial surveillance over ground and maritime targets, and frequently perform battle management command and control (BMC2).

AEW&C aircraft support both defensive and offensive air operations. Some navies also operate AEW&C aircraft for their warships at sea. Typical modern AEW&C have detection ranges of 400 to 600 km, and operate well out of range of most surface-to-air missiles. An AEW&C aircraft flying at 9,000 m (30,000 ft) can cover an area of 312,000 Sq. km.

AEW&C PLATFORMS WITH MAJOR AIR FORCES

United States Navy's Northrop Grumman E-2 Hawkeye AEW&C operates from its supercarriers. The AWACS (Airborne Warning and Control System) is the name of the specific system installed in the E-3 and Japanese Boeing E-767 AEW&C airframes, but is often used as a general synonym for AEW&C.

The Lockheed WV and EC-121 Warning Star, were the early AEW aircraft that inducted in early 1950s and were used in Vietnam War. Later they were replaced by the AEW&C E-3 'Sentry' AWACS. Soviet Tupolev Tu-126 entered service in 1965, and was later replaced by the Beriev A-50 in 1984.

The Royal Australian Air Force, Republic of Korea Air Force and the Turkish Air Force are deploying Boeing 737 AEW&C aircraft. The Swedish Air Force uses the S 100D Argus based on the Saab 340 with an Ericsson Erieye PS-890 radar. Saab also offers the Bombardier Global 6000-based GlobalEye. The Hellenic Air Force, Brazilian Air Force and Mexican Air Force use the Embraer R-99 with Ericsson Erieye PS-890 radar.

Israel has the IAI/Elta EL/M-2075 AESA Phalcon system on a Boeing 707. Later they inducted the IAI EL/W-2085 multiband radar system on Gulfstream G550 which is more capable and less expensive.

CHINA AND PAKISTAN'S AEW&C

China's KJ-2000 (five platforms) is based on the Beriev A-50 aircraft, and has been operating since 2004. China also has smaller platforms like KJ-500 (34) and KJ-200 (11). They are also developing a carrier-based AEW&C.

'EYES IN THE SKY' FOR THE IAF:
(TOP) AEW&C NETRA; (ABOVE) AWACS PHALCON.

Pakistan Air Force (PAF) ordered six Erieye AEW equipped Saab 2000s from Sweden in 2006. The Pakistan Navy ordered three P-3 Orion aircraft equipped with Hawkeye 2000 AEW systems. China and Pakistan also signed a memorandum of understanding (MoU) for the joint development of AEW&C systems.

IAF'S AEW&C PLATFORMS

IAF has been operating three Russian Beriev A-50I with Israeli EL/W-2090 'Phalcon' radar since 2009. IAF's attempts to acquire two additional A-50I were not successful. At one stage DRDO had proposed a more advanced AWACS with a longer range based on the Airbus A330 airframe. However it was decided that India's DRDO will convert used Airbus A321 airliners to AEW&C platforms. Work has already begun on that count.

IAF also has DRDO 'Netra' AEW&C with an advanced Indian AESA radar system fitted on the Brazilian Embraer EMB-145 air frame. Netra gives 240-degree coverage, and also has air-

PHOTOGRAPHS: INDIAN AIR FORCE, IAF_MCC / X

FLIGHT REFUELLING AIRCRAFT: (TOP) BOEING KC-46A; (ABOVE) AERIAL REFUELLING BETWEEN TWO KC-390 MILLENNIUM AIRCRAFT.

to-air refuelling capability. IAF has plans to develop six more Netra. These systems are expected to have an enhanced performance including range and azimuth.

The first known aerial engagement with both opposing sides using Airborne Early Warning and Control aircraft was in the Indian subcontinent, during the February 2019 aerial engagements between India and Pakistan, with India using A-50I Phalcon and DRDO Netra and Pakistan using the Saab 2000.

FLIGHT REFUELLING AIRCRAFT (FRA)

The two main aerial refuelling systems are probe-and-drogue, which is simpler to adapt to existing aircraft, and the flying boom, which offers faster fuel transfer, but requires a dedicated boom operator station.

US Air Force (USAF) had inducted over 700 Boeing KC-135 Stratotankers. Their fixed-wing aircraft use the flying boom system. The Probe-and-drogue is preferred by the British, French, Russians and Chinese among others. Some FRA such as the KC-10 Extender and Airbus A330 MRTT, use both a boom and hose-and-drogue systems. Many KC-135s are also equipped with dual under-wing hose-and-drogue attachments. The Lockheed F-35 users have the option of seeking their aircraft with refuelling configuration of either type. Some fighters such as F/A-18 and the Sukhoi Su-30 act as "buddy tankers" using an external pod loaded on an aircraft hard-point.

The Americans made extensive use of FRA during Operations in Iraq and Afghanistan. Israel used aerial refuelling to strike PLO targets in Tunis, Tunisia, that involved a 2,000 km flight. IAF Rafale were flown direct from France to India with mid-air refuelling enroute. IAF's Su-30 MKI and Rafale regularly do long range missions in Indian Ocean Region using FRA.

MAJOR CURRENT FRA PLATFORMS

The Boeing KC-46 Pegasus is an American FRA and strategic military transport aircraft developed from the 767 jet airliner to replace older Boeing KC-135 Stratotankers. The first aircraft was delivered to the US Air Force in January 2019. 179 Pegasus may enter USAF by 2027. Other operators include Japan, Israel, Italy and Indonesia. India too was a contender once.

The Airbus A330 Multi Role Tanker Transport (MRTT) is a European aerial refuelling and military transport aircraft based on the Airbus A330 airliner. 16 countries have placed orders for approximately 68 aircraft. These include UK, France, Australia, Saudi Arabia, and UAE, among others. India too was once a contender.

Russian Il-78 FRA is a version of the Il-76MD transport aircraft. With the additional fuel tanks removed, the Il-78 can serve as a regular cargo aircraft. Variants of these are operated by Russia, China, India, Pakistan, and Algeria.

The Embraer KC-390 is a medium-weight (26 tonne), multi-mission tactical transport aircraft with many configurations including aerial refuelling. The twin-engine jet-powered aircraft can carry 84 military personnel or be configured for MEDEVAC missions. It is the largest aircraft ever built by Embraer. Among its range of missions is aerial refuelling. The high-wing aircraft made its first flight in February 2015. Aircraft is equipped with a complete electronic warfare (EW) suite including missile warner. Offered for sale in 2019, Brazil has ordered 28 aircraft. Portugal, Austria, Czech Republic, Netherlands, Angola, Hungary, South Korea, and Chile have placed orders. Many more are in discussion. The company has been talking to India for possible 40 medium transport aircraft order.

The Israeli Air Force has a fleet of Boeing 707s equipped with a boom refuelling system similar to the KC-135. Israel has ordered Boeing KC-46 Pegasus boom refuelling.

PHOTOGRAPHS: BOEING, EMBRAER

A COUNTRY LIKE INDIA, WITH HIGHLY CONTESTED BORDERS, A HIGH NUMBER OF FLIGHT REFUELLING AIRCRAFT ARE REQUIRED

INDIAN FRA

India acquired six Russian Il-78MKI with Cobham Mk.32B air refuelling pods, which allow to refuel both Russian-built and Western aircraft. Attempts to acquire additional FRA kept getting derailed for various technical reasons. The IL-78, Airbus Multi Role Tanker Transport (MRTT) and American KC-46 were the contenders. Finally, in September 2021, it was decided to convert six pre-used Airbus A321s acquired from Air India instead. Hindustan Aeronautics Limited (HAL) entered into a memorandum of Understanding (MoU) with Israel Aerospace Industries (IAI) to convert civil aircraft to multi-mission tanker transport aircraft. Of late the KC-390 too has also become a contender. Multi role variants have the advantage of switching roles. These are preferred by countries who cannot afford large numbers. For a continental sized country like India with major threat on both borders, the numbers required could be as high as 15 to begin with. Meanwhile the IAF is considering wet/dry lease of a few FRA to meet its emergent requirements.

DEDICATED ELECTRONIC WARFARE AIRCRAFT

Many countries including India have had dedicated electronic warfare aircraft to act as cooperative or escort jamming platforms. These had powerful jammers to mask or shield other penetrating aircraft. The Antonov An-12BK-PPS, Antonov An-26REP, Sukhoi Su-24MP, Tupolev Tu-16RM-2, Yakovlev Yak-28PP and Mil Mi-8PP of the Soviet Union. Ilyushin Il-22PP of Russia. Boeing EA-18G Growler, Northrop Grumman EA-6B Prowler, Douglas EA-3 Skywarrior, Douglas EB-66 Destroyer, Douglas EF-10B Skyknight, Lockheed EC-130H, and General Dynamics/Grumman EF-111A Raven of United States. Tornado ECR (Germany/Italy). Embraer R-99 of Brazil), Denel TP1 Oryx EW of South Africa. Shaanxi Y-8EW, Shaanxi Y-9-GX11, Xi'an HD-6, Shenyang J-15D, Shenyang J-16D, and Chengdu J-10D of China. IAI 202B Arava of Israel). Kawasaki EC-1 and RC-2 of Japan. IAF's 35 squadron was equipped with dedicated EW Canberra and MiG-21 aircraft. Later Escort jammers were inducted with Mirage 2000 aircraft. There are reports that IAF will receive approval for three A319 based SIGINT and COMJAM aircraft to be developed in India. Pakistan continues to operate three modified Dassault Falcon 20 in electronic warfare role.

With advances in technology, and need for protecting all aircraft in both offensive and defensive operations, self-protection jammers and more advanced EW suites came up on all aircraft. The Thales/MBDA SPECTRA is a fully internal electronic warfare system on the Rafale aircraft that incorporates radar warning, laser warning and Missile Approach Warning for threat detection plus a phased array radar jammer and a decoy dispenser for threat countering.

WAY AHEAD INDIA

India is a continental sized country with threat in the north and west and also from the Oceans. Indian AEW&C and FRA have thus to cover very large area. The current 3+3 AEW&C and six FRA are too inadequate. Most of the analysts have been suggesting 10 large and 10 small AEW&C and 15 FRA. Finally, the work has commenced in this direction in all earnest.

India's Mahindra Group and Brazil's Embraer have signed a Memorandum of Understanding (MoU) to fulfil the acquisition of the C-390 Millennium multi-mission aircraft by the IAF in its upcoming Medium Transport Aircraft (MTA) procurement project. C-390 will be the contender.

Electronic Warfare will continue to play greater role in times to come. There has been a debate on whether the IAF requires dedicated EW aircraft. Once the fighter squadron numbers come up, and the FRA and AEW&C requirements are met then it may be considered.

Force Multipliers are important assets of any air force. Despite IAF being the fourth largest air force of the world, it is still quite behind in numbers of force multipliers vis-à-vis the top three nations USA, Russia, and China. As India heads for the third slot of largest economies, more investments should flow for Capital acquisitions. Significant of these must go to force multipliers. SP

PHOTOGRAPH: EMBRAER

NETRA AEW&C HAS DEMONSTRATED ITS EFFECTIVENESS IN ENHANCING INDIA'S AIRBORNE SURVEILLANCE CAPABILITIES, AND ITS SUCCESSFUL IMPLEMENTATION SHOWCASES THE COUNTRY'S ADVANCEMENTS IN DEFENCE TECHNOLOGY

NETRA — EYES IN THE SKY

Indian AEW&C Platforms to Bolster Network-Centric Air Operations

By GROUP CAPTAIN D.K. PANDEY (RETD)

INDIA IS ACTIVELY WORKING TOWARDS DEVELOPING AND deploying modern indigenous airborne early-warning and control (AEW&C) aircraft, often referred to as "Eyes in the Sky". This would significantly improve its surveillance and detection capabilities.

The AEW&C is a highly sought-after force multiplier that is highly valued by military forces around the globe. Modern AEW&C/AWACS systems comprise various sensors, communications, and computing systems, contributing to their comprehensive Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) capabilities. The platform, in dense airspace, will minimise the situational awareness fog. Hence, it enhances the direction and interception capabilities of the friendly fighters during air combat with enemy jets.

The Radar, the primary sensor of any airborne system, is mainly valued for its degree of capability to detect moving targets at long distances in all weather conditions and present a clutter-free picture. DRDO has successfully developed a fully indigenous primary radar system for the AEW&C system. This remarkable achievement showcases the country's expertise in designing and manufacturing the complete system, including its electronics and antenna array. The critical electronics, such as the Transmit Receive module, etc, have been meticulously crafted, developed by DRDO and produced by an industry partner.

EVOLUTION OF INDIAN AEW&C

Established in 1985, the Airborne Surveillance, Warning and Control (ASWAC) Centre was tasked with exploring the potential of creating an Airborne Warning and Control System (AWACS) in the country. In 1991, it evolved into the CABS, focusing on designing and developing AWACS systems. CABS then accepted the task of transforming an Avro Aircraft into a compact Air-

PHOTOGRAPHS: SP GUIDE PUBNS

borne Surveillance Platform (ASP). The effort to develop this system was a resounding success, with the successful development and demonstration of critical systems such as primary radar and data links. Unfortunately, the experiment ended with a tragic accident, leaving CABS in despair.

The AEW&C Programme, approved by the Government in 2004, experienced a rollercoaster of emotions, with moments of excitement and despair and a series of ups and downs that could rival the plot of a thrilling book. The design teams at CABS (Centre for Airborne Systems) and DRDO (Defence Research and Development Organisation); work centres at LRDE (Electronics and Radar Development Establishment), DLRL (Defence Electronics Research Laboratory), DEAL (Defence Electronics Applications Laboratory), and DARE (Defence Avionics Research Establishment) were effectively assisted by the IAF (Indian Air Force) Project Team at CABS, CEMILAC (Centre for Military Airworthiness and Certification), DGAQA (Directorate General of Aeronautical Quality Assurance), DRDO HQ, IAF HQ, and Squadrons, as well as ASTE (Aircraft and Systems Testing Establishment), among others. They collaborated closely to elevate the country's status to that of a league of countries by developing the capabilities for Airborne Surveillance systems.

Collaborative efforts led to the initiation of the development of an indigenous Airborne Early Warning and Control System (AEW&C). The project involved the creation of three AEW&C systems, which included an Active Electronically Scanned Antenna Primary Radar (PR), an Identification Friend or Foe (IFF) system, and an ELINT and SIGINT system. These systems were to be installed on the Embraer-145 executive jet platform. The system was designed to have complete net-centric capability with the use of multiple LOS and Satellite Communication Data links. It also includes an onboard mission computer that allows the operator to perform information fusion and mission control and interact with reconfigurable operator consoles. This enables the operator to utilise the capabilities of the Netra effectively.

The inaugural Airborne Early Warning and Control System developed indigenously was formally handed over to the IAF on February 14, 2017, in the presence of a worldwide gathering at the Aero India Exhibition. The ceremony was memorable for CABS, DRDO and IAF, the developers, producers and users. The AEW&C made its inaugural flight at the Republic Day Fly Past on January 26, 2017. The designated call sign for the Airborne AEW&C system was Netra. The announcer proclaimed the name of the flight as Indian AEW&C Netra as it gracefully soared past the main podium. This name has become closely associated with the system ever since.

India is actively pursuing the acquisition of advanced variants of AEW&C aircraft, such as Netra Mark-1A and Mark-2, which promise improved detection range, resolution, and tracking capabilities, in response to the urgent operational needs of the Indian Air Force amidst regional conflicts.

CONDUCT OF OPERATIONS

The onboard 'Intercept Control and Battle Management' (IC&BM) system is a valuable tool for Air Battle Managers (Fighter Controllers) to achieve and maintain air superiority in a contested air space. It assists the fighter controller in evaluating airborne targets, implementing tactical measures, eliminating these targets, guiding fighters on offensive strike missions, and safely returning aircraft to an airbase. The IC&BM module also explores the resilience and susceptibility of interceptors when faced with various threats. The Intercept Control generates a range of interception options for the operator to consider when deploying fighter aircraft to counter a specified threat.

The IC&BM consists of five main functionalities: Advanced Threat Evaluation (ATE), Battle Management, Weapon Assignment, Intercept Control (IC), Guidance and Recovery.

The Operator Work Station (OWS) is the interface between the operators and the Mission Systems on board the AEW&C system. The CABS OWS system was created internally to offer operators a real-time view of the comprehensive tactical air situation on a robust and user-friendly Human Machine Interface (HMI). This allows operators to enhance their situational awareness of the monitored region.

The Ground Exploitation Station (GES) serves as a vital interface between the AEW&C and the IACCS, facilitating seamless communication and coordination. The real-time Recognisable Air Situation Picture (RASP) generated onboard AEW&C is transmitted to the GES, which is connected to the IACCS through an interface unit to distribute tactical information to the decision-makers on the ground. In a similar vein, the directive from the IACCS to the AEW&C is channelled through GES.

Once the sensor data is on the IACCS network, it ensures that the information is readily accessible from any location in India. GES, with its modular design, is incredibly convenient for transportation and deployment. Several GES can be simultaneously operational, allowing for real-time monitoring of sensor data from various locations.

Network-Centric operations (NCO) are lifelines of highly dynamic and lethal battlefields. NCO enabled enhanced and real-time situational awareness of the war theatre to enable prompt decision-making. The fact that the IAF has thoroughly incorporated its Netra (AEW&C) and Phalcon (AWACS) into its integrated air command and control system is a significant factor. The ongoing expansion of this fully automated air defence network, which includes data linkages, aims to incorporate a diverse range of military and civilian radars in order to fill surveillance gaps in Indian airspace.

STEPPING AHEAD

The operational urgency to acquire additional AEW&C aircraft is acute for the IAF for the aerial conflict. The persistent conflict with China in the eastern region of Ladakh has emphasised the necessity even more. The experience with Netra Mk-1 was encouraging, as all supports were made available promptly. The operational productivity increased significantly. The IAF collaborates with the DRDO and other agencies to address maintenance needs promptly. The Netra Mark-1 has demonstrated its effectiveness in enhancing India's airborne surveillance capabilities, and its successful implementation showcases the country's advancements in defence technology. The IAF is vigorously

THE IAF IS VIGOROUSLY PURSUING THE ACQUISITION OF SIX MARK-1A AND SIX MARK-2 VARIANTS OF THE NETRA AEW&C AIRCRAFT

pursuing the acquisition of six Mark-1A and six Mark-2 variants of the Netra AEW&C aircraft.

Netra Mark-I. An Embraer-145 executive jet platform, with an endurance of four hours, powers Netra Mark-I. It has EL/M-2050 AESA Radar AESA-based Primary Radar, Identification Friend or Foe (IFF), also known as SSR (Secondary Surveillance Radar) and Electronic Support Measures (ESM) sensors. Numerous line-of-sight (LOS) and satellite communication data lines, as well as the onboard and mission computers, provide the system with complete net-centric capabilities. For voice communication, it works with the C-Band Data Link (CBDL), the Ku-Band SATCOM data link (KBDL), and the V/UHF communication connection. Although specific cost figures are not publicly divulged, the Netra Mark-1 is generally considered cost-effective compared to procuring similar systems from foreign vendors.

Netra MK-1A. The platform used for Mk-1A is ERJ-145LR. It has EL/W-2085 AESA Radar AESA-based Primary Radar AESA Radar. The additional sensors onboard are electronic intelligence (ELINT) and signal intelligence (SIGINT). Its endurance is five hours. It is likely to be available for IAF in the year 2025.

Netra MK-2. Provides significantly improved detection range, resolution, and tracking capabilities compared to the mechanically scanned radar used in Mark-1 and Mark-1A. Mark-2 is to be equipped with DRDO's Uttam, advanced AESA radar, having enhanced detection capabilities of more than 500 km. It has an operational ceiling of 40,000 ft and an endurance of 8 hours. It is likely to be developed and delivered in 2026-27. It will provide integrated data from ELINT and the Missile Approach Warning Systems (MAWS) to enhance threat detection and situational awareness for decision-making. It will be equipped with imaging systems, Electro-Optical / Infra-Red (EO/IR), that use both visible and infrared sensors to provide total situational awareness during both day and night, as well as in low light conditions. It is to be mounted on second-hand Airbus-321 planes bought from Air India. It will be able to conduct operations for eight hours. It is likely to have its first flight trials in the year 2025.

WAY AHEAD

The indigenous AEW&C system needs to be designed and developed in accordance with the operational environment to enable uninterrupted, efficient, and effective operations. The developers and operation team must be in sync for better system designs, necessitating consistent R&D. The timebound brainstorming among stakeholders for innovative operations architect is essential. Cohesive efforts will only make the system user-friendly and productive.The R&D processes and exploration of other dimensions of operations require the attention of all regulators. The factors that need attention are appended below:

Invest in resources towards research and development of critical technologies, including advanced sensors, airframes, and software, in order to reduce dependence on foreign suppliers and bolster ongoing initiatives for indigenous development. The domestic defence industry may benefit from more private sector participation, academia-industry synergy, and regulatory simplification to improve efficiency and innovation. Strategic collaborations involve sharing technology and creating resource-integrated projects with friendly states. It is recommended to adopt a phased approach, in which one begins by developing fundamental skills using easily accessible instruments and progressively progresses to producing everything indigenously. Establish domestic testing and certification facilities and restructure.

CONCLUSION

AEW&C Netra has demonstrated its capabilities in real-world operations in Balakot, and two Netra Systems have come together as a key component of the Airborne Surveillance Systems of the IAF. In view of the dynamism of regional geopolitics and threat perception, the development and production of AEW&C on a war footing to meet urgent IAF needs merits consideration. SP

The author has conducted as well as audited AWACS operations

THE AUTHOR IN CONVERSATION WITH DR SAMIR V. KAMAT, SECRETARY, DEPARTMENT OF DEFENCE R&D AND CHAIRMAN, DRDO

DEFENDING DRDO — RESTRUCTURE THE RESPONSIBILITIES

A strategic transformation of DRDO is needed to chart a course for excellence in defence technology and a more agile and responsive future

By MANISH KUMAR JHA

A HIGH-POWERED COMMITTEE, HEADED BY FORMER PRINCIPAL Scientific Advisor to the Government K. Vijay Raghavan Committee recommends major changes in DRDO, which is based on a renewed thrust to address the critical gaps in R&D in defence in India. Then the burden is solely put on the DRDO as the only credible institution, shouldering the entire spectrum of military technology for the Indian Armed Forces. It is also the result of a simple outcome that the most crucial aspect of building capabilities depends on many elusive technologies that are hard to acquire through existing mechanisms. What adds to the problem is the lack of R&D in the private sector in its entirety. While the reason is plenty, the core of the argument rests on the defence R&D being a heavy investment-centric exercise.

The committee's recommendation is tabled before the highest echelons of the government and some of the reports talk about the structural changes and core competencies of the DRDO. These are speculative as usual. However, what is pertinent is the fundamentals which revolve around the anomalies which exist. It is also true that DRDO as an institution, a lone warrior, is responsible for the Research, Design & Development of military systems & platforms, the scale is so staggering, it baffles!

PHOTOGRAPH: MANISH KUMAR JHA

DRDO: MANY TASKS, MYRIAD ROLES

DRDO was established in 1958 to build up science-based capability towards making improvements in existing weapon systems including imported equipment. Later on, during the seventies, it got involved in the development of armaments and ammunition. Thrust was given to major programmes, like the development of guided missiles, electronic warfare systems, aircraft, communication systems, etc, in the 1980s. These programmes gave a new impetus to multiple design and technology centres, which resulted in the productionisation of weapon systems during the 1990s.

As these arms manufacturing countries offered only the "Buy" category of systems to India, it became mandatory for DRDO to develop each system, sub-systems, and components abinitio including infrastructure and testing facilities of their own volition indigenously.

DRDO has a mission mode structure, headed by the Secretary, Department of Defence Research & Development and Chairman, DRDO. The Secretary is assisted by the Director Generals (DGs). The Organisation has Corporate Head Quarters at New Delhi and laboratories/establishments, regional centres, field stations, etc spread all over the country from Jodhpur to Tejpur and Leh to Kochi.

These are engaged in R&D activities in the field of aeronautics, armaments, missiles, combat vehicles, advanced computing & networking, electronics, optoelectronics, military engineering systems, life sciences, advanced materials & composites, underwater sensors/weapons, warship technology, low-intensity conflict technologies, NBC Technology, cyber security etc. These laboratories and establishments have been grouped into the following 7 clusters.

These are Naval Systems & Materials (7 labs); Missiles & Strategic Systems (6 labs); Aeronautical Systems (4 labs); Armaments & Combat Engineering system (4 labs); Microelectronic Devices & Comp. Systems (5 labs); Life Sciences (8 labs); and Electronic & Communications Systems (6 labs).

With such a staggering infrastructure what ails then?

THE BUDGETARY CONSTRAINT

Time and again, the R&D comes into focus and the accountability is measured in terms of the number of systems and platforms inducted—the applied side of the whole R&D. The question is raised over the expenditure while the irony is all about the insufficient budget in R&D itself.

Over the years, it has gone up and touched ₹23,263.89 crore for the Financial Year 2023-24 with a corresponding increase in several projects/programmes. Out of the total allocated budget of ₹23,263.89 crore, approximately 34.90 per cent is utilised for the development of strategic systems and 65.10 per cent for the tactical and other systems, including salaries, transportation, training, miscellaneous, etc. The total (Net) budget for Defence R&D is 5.38 per cent of Defence Budget (₹4,32,604.72 crore). 65 per cent of funds are earmarked for R&D activities, and the fund requirement for the strategic scheme is ₹6,140 crore, which is about 52 per cent of funds earmarked for R&D.

A high-powered committee, headed by former Principal Scientific Advisor to the Government K. Vijay Raghavan Committee recommends major changes in DRDO, which is based on a renewed thrust to address the critical gaps in R&D in defence in India

HITECH SUCCESSES OF DRDO: (TOP) SUCCESSFUL LAUNCH OF AGNI-5; (ABOVE) ACTIVE ELECTRONICALLY SCANNED ARRAY (AESA) RADAR.

Some of the best projects of DRDO have been based on the Mission Mode (MM) Projects like Medium Range Surface to Air Missile (MRSAM) system for Indian Air Force, LCA Mk-II, LRSAM, Quantum Communication for Metropolitan Cities (QMAN), Airborne Early Warning & Control System Mk – II (AEW&C Mk-II) for IAF and Advanced Light Weight Torpedo (ALWT).

The Directed research is managed by Directorate of Futuristic Technology Management (DFTM) and DRDO has established eight Advanced Technology Centres (ATCs) at the premier institutes for carrying out research in the niche technology areas related to defence & security. The ATCs conduct the basic & applied research to offer solutions for technological or engineering challenges to raise the technology readiness level.

Additionally, DRDO has a strong partnership with 50 Public Sector Undertakings (PSUs), 30 Ordnance Factories (OFs) and more than 1,800 private sector industries. This has enabled

PHOTOGRAPHS: DRDO

INDIGENOUS TECHNOLOGIES FROM DRDO: (CLOCKWISE FROM TOP-LEFT) FIRING OF ASTRA BEYOND VISUAL RANGE AIR-TO-AIR MISSILE; ANTI-TANK GUIDED MISSILE HELINA; TAPAS MALE DRONE; SUCCESSFUL FLIGHT TRIAL OF AUTONOMOUS FLYING WING TECHNOLOGY DEMONSTRATOR.

the Organisation to minimise the effect of the sanctions and technology denials, which were imposed by the technologically advanced countries from time to time and also to enhance self-reliance in Defence Products.

RESTRUCTURING DRDO

As speculated, besides the committee's binding report which is not in the public domain, the role of the private players in defence is now a fact which government has been talking about in terms of policy as well as in procurement.

The suggestion that DRDO must focus on the core research and development is already agreed upon. What is being deliberated on whether DRDO should also be actively engaged in developing prototypes or technology demonstrators?

As we take a look a look at some of the Technology Demonstration (TD) projects, it provides some direction as, for technology demonstration, maturity is the key to self-reliance in defence. These are some of the areas where the future role of DRDO can be assessed in Active Electronically Scanned Array (AESA) Radar, New Generation Anti-Radiation Missile (NGARM), Supersonic Missile Assisted Release of Torpedo (SMART), Beam Combined Fiber Laser Source (BCFL) and Digital Fuel Flow Controller.

Global R&D giants like the Defence Advanced Research Projects Agency (DARPA) (US), EADS (Europe), DD R&D (Israel) and of course, SRSC (China) have their standards and certainly are counted among the best. Certainly, there will be evaluation and comparison. However, India must adopt the model which is the best mix. For example, according to a senior DRDO scientist, without a technology demonstrator, some very high-stakes futuristic projects may be in jeopardy. While working together with private industries, there must be a collaboration. Later, the DRDO can pass the baton for the production and upgradation to private players or public sector undertakings. If we look at some of the major spending in the advanced countries, the R&D budget is marked in the range of a few billion of US Dollars for specific projects -- advanced and futuristic.

Another key recommendation is the most crucial which is all about the test facilities for various systems. DRDO must optimise its vast network of R&D infra where the private players get to use such facilities.

However, over the years, the idea that institution of such a national importance be placed under the Prime Minister's portfolio has received greater acceptance. It is the usual comparison with the success story of the ISRO as various programmes are seen as a great success, it is also about the greater accountability which matters.

Additionally, some structural changes are on the horizon like the rationalising the post of Secretary (Research and Development) in the MoD as the DRDO Chairman currently holds dual responsibility which also takes a good deal of administrative works amid the piles of files. SP

PHOTOGRAPHS: DRDO, DRDO_INDIA / X, PIB

THE DAC ACCORDED AON FOR PROCUREMENT OF FLIGHT REFUELLER AIRCRAFT FOR ENHANCING THE OPERATIONAL CAPABILITIES AND REACH OF THE IAF

PHOTOGRAPH: INDIAN AIR FORCE

GOVERNMENT APPROVES BIG-TICKET MILITARY ACQUISITION WORTH ₹84,560 CRORE ($10.57 BN)

The Defence Acquisition Council (DAC) granted approval for Acceptance of Necessity (AoN) for various capital acquisition proposals amounting to ₹84,560 crore ($10.57 billion). The DAC also notified amendments in Defence Acquisition Procedure (DAP) 2020, reducing the overall procurement cycle for Start-Ups & MSMEs.

By MANISH KUMAR JHA

THE DEFENCE ACQUISITION COUNCIL (DAC), UNDER THE chairmanship of the Defence Minister, accorded approval for Acceptance of Necessity (AoNs) for various capital acquisition proposals worth ₹84,560 crore. The DAC's approval on February 16 focuses on the procurement of various equipment from Indian vendors, leading to a simplified procedural process and payment systems for startups and Micro, Small & Medium Enterprises (MSMEs) in the defence sector.

The AoNs include key systems and sub-systems which include next-generation anti-tank mines, Air Defence Tactical Control Radar, Heavy Weight Torpedoes, Medium Range Maritime Reconnaissance and Multi-Mission Maritime Aircraft.

Addressing the criticality of the impending Flight Refueler Aircraft (FRA), the DAC also accorded AoN for the new FRAs, boosting the IAF's capabilities for greater operational reach for the fighter jets.

Additionally, the DAC also cleared the proposal for procurement of the Software Defined Radiosfor the Indian Armed Forces under the Buy (Indian-IDDM) category (DAP 2020).

This will fulfil the ICG requirement for high-speed communication with secure networking capability for seamless information exchange between the ICG and the Indian Navy units.

POLICY AMENDMENTS FOR DAP 2020

The MoD has brought out a significant change which aims to promote the procurement of Advanced technologies from start-ups and MSMEs. The amendments imply that such initiative and development under the Innovations for Defence Excellence (iDEX) and Technology Development Fund schemes will be prioritised and accorded much-needed change in the procurement cycle.

Under the Defence Acquisition Procedure (DAP) 2020, the government has simplified the process of benchmarking and cost computation, payment schedule, and procurement quantity for startups. According to a senior official from the MoD, "The amendments will boost and support a business environment for the start-ups and MSMEs under iDEX and TDF schemes."

Earlier, the DAC also approved the new simplified procedure for procurement from iDEX startups and MSMEs by reducing the procurement cycle from the AON to contract signing to around 22 weeks as per the new procedure. Further, the DAC also approved the simplified procedure for Make-II category projects on similar lines to the iDEX procedure.

Besides considerably bringing down the time taken from prototype development to Contract signing in Make-II projects, the new amendment will enable startups to showcase their technological demonstration in the early stage.

FLIGHT REFUELLER AIRCRAFT FOR THE IAF

The DAC accorded AoN for procurement of Flight Refueller Aircraft for enhancing the operational capabilities and reach of the Indian Air Force. The IAF has been looking to replace its ageing fleet of six IL-78 Midas aircraft. The issue remained pertinent due to the IL-78s' maintenance issues which require urgent replacement of refuelling pods after serving nearly two decades since its induction in 2003.

For this strategic acquisition, the IAF has been looking at various proposals from leading global OEMs which include Airbus, Boeing, and Lockheed Martin with each company offering different types of aircraft. Earlier, Boeing offered to convert its 767-passenger aircraft into Medium Multirole Transport Aircraft.

AIR DEFENCE AND TACTICAL RADARS FOR THE ARMED FORCES

Addressing the current challenges in building the capabilities to detect slow, small, and low-flying aerial targets, the DAC has approved AoN for procurement of Air Defence Tactical Control Radar. The decision comes at a crucial time when the need for such Air Defence Systems for the surveillance, detection & tracking of different aerial targets remains a key area for the IAF.

The DAC has also accorded AoN under the Buy {Indian-Indigenously Designed Developed and Manufactured (IDDM)} category for procuring a new generation of Anti-tank mines with seismic sensors and providing remote deactivation with additional safety features. The DAC also approved the AoN for the Tactical Battle Area for engaging targets that are Beyond Visual Line of Sight by the Mechanised Forces.

Additionally, the government also approved the procurement of Canister Launched Anti-Armour Loiter Munition System underthe Buy (Indian-IDDM) category.

MULTI-MISSION MARITIME AIRCRAFT FOR NAVY

Addressing another significant area in the surveillance and interdiction capabilities of the Indian Navy and the Indian Coast Guard (ICG), the AoNs were accorded to procure Medium Range Maritime Reconnaissance and Multi-Mission Maritime Aircraft.

While the government did not clarify the models of the proposed aircraft, the current discussion hints at a maritime surveillance version of the C295 aircraft made by Airbus.The procurements for Medium Range Maritime Reconnaissance and Multi-Mission Maritime Aircraft will take place under the Buy and Make category.

MARITIME SURVEILLANCE VERSION OF THE C295 AIRCRAFT MADE BY AIRBUS

India has already inked a deal with French OEM Airbus Defence and Space to procure 56 C295 transport worth ₹21,935 ($2.74 billion) crore to replace its ageing Avro-748 fleets. The deal entails the first 16 aircraft in 'fly-away' condition and the rest of the 40 aircraft to be manufactured and assembled jointly by Airbus and Tata Advanced Systems (TASL) in India.

After the initial approval, the proposed acquisition will have to pass through the complex bidding processes or manufacturer negotiations leading to the final approval by the cabinet committee.

The DAC has also accorded the AoN under Buy (Indian) category for procurement of Active Towed Array Sonar having capabilities to operate at low frequencies and various depths for long-range detections of adversary submarines. The AoN has also been accorded for procurement of Heavy Weight Torpedoes for enhancing the attacking capabilities of Kalvari Class submarines.

Additionally, the AoN for sustainment support through Follow On Support (FOS) and Repair Replenishment support through Follow On Supply Support (FOSS) for 24 MH-60R aircraft under Foreign Military Sale route with the US Government has also been accorded. SP

Note: Exchange rate taken as $1= ₹80.

PHOTOGRAPH: AIRBUS

WINGS INDIA 2024 HIGHLIGHTED INDIA'S PROWESS IN THE AVIATION SECTOR AND ITS EMERGENCE AS THE WORLD'S THIRD LARGEST CIVIL AVIATION MARKET

SCRIPTING THE INDIAN AVIATION STORY

Connecting India to the world in Amrit Kaal and setting the stage for India Civil Aviation @2047

By AYUSHEE CHAUDHARY

IN A FOUR-DAY EVENT HELD AT HYDERABAD'S BEGUMPET Airport, the biennial Wings India 2024, encompassing Commercial, General, and Business Aviation, unfolded its wings under the inauguration of Jyotiraditya M. Scindia, the Minister of Civil Aviation (MoCA), Government of India (GoI). The event, organised by MoCA, in collaboration with the Airports Authority of India (AAI) and Federation of Indian Chambers of Commerce & Industry (FICCI), carried the theme "Connecting India to the World in Amrit Kaal: Setting the Stage for India Civil Aviation @2047. "Uniting business leaders and policymakers, the primary objective of the event was to highlight India's prowess in the aviation sector and its emergence as the world's third-largest civil aviation market.

The grand inauguration marked the commencement of a series of activities, including a global ministerial conference, a CEOs' forum, B2B/B2G meetings, an awards ceremony, cultural evening, and a business networking dinner. Capturing the diverse aspects of India's civil aviation sector, from policy discussions and technological innovations to ambitious growth plans and global partnerships. The event stood as a testament to India's commitment to becoming a global aviation hub.

In his inaugural address, the Minister emphasised the philosophy of "Vasudhaiva Kutumbkum," underlining civil aviation's role in connecting the world as one family. Highlighting India's aviation growth, he stated that the country, despite substantial progress, remains a highly under-penetrated market, with ambitious plans to reach 635 million domestic passengers by FY 2030.

At the Wings India Awards 2024, various awards were given. For instance, joint honors were bestowed upon the Kempegowda International Airport in Bengaluru and the Indira Gandhi International Airport in Delhi as the 'Best Airport of the Year.' The award ceremony brought together luminaries from the aviation sector. Spanning various categories, the awards recognised excellence in traffic handling, innovation, sustainability, and more. Bengaluru's Kempegowda International Airport was additionally honored with the '25 MPPA Traffic Award'

PHOTOGRAPH: FICCI

(LEFT) AIR INDIA'S FIRST AIRBUS A350-900 AIRCRAFT ON DISPLAY;
(RIGHT) A SCINTILLATING FLYING DISPLAY AT THE SHOW.

for handling over 25 million passengers annually. Air India received the 'Best Airline for International Connectivity' while Vman was honored with the 'Best Leasing Company' award among other awards at Wings India 2024.

AIRSHOW EXTRAVAGANZA

Wings India 2024 truly embodied its theme, "Connecting India to the World in Amrit Kaal: Setting the Stage for Indian Civil Aviation @2047." The airshow held at Begumpet Airport in Hyderabad showcased a mesmerising array of aerial displays, with jets and helicopters painting captivating spirals across the sky, captivating the large audience in attendance.

The spotlight of the event shone brightly on the Global Stars and Sarang. The British aerobatic champions, the Global Stars dazzled spectators with their breath-taking maneuvers. Additionally, the Indian Air Force's Sarang Helicopter team added to the spectacle with their awe-inspiring performances.

Adding to the spectacle, a Drone Show was organised after the main event, providing not only a visual feast but also narrating the story of aviation's evolution, captivating audiences with its innovative displays.

STATE-OF-THE-ART SPECTACLE

Minister Scindia also unveiled India's first 'Airbus A350' aircraft on the first day of Wings India 2024. The arrival of this state-of-the-art aircraft not only bolstered Air India's fleet but also symbolised India's growing stature as a global player in the aviation industry. The coming of the A350 coincides with a period of rapid growth and transformation for Air India. The airline is undergoing a comprehensive transformation aimed at renewing its fleet, expanding its global route network.

Alongside Airbus A350-900, another centre of attraction at Wings India 2024 was Boeing's newest widebody aircraft, the Boeing 777X that made its debut in India. Around 20+ aircraft were on static display at the four-day aviation conclave and exhibition. On the sidelines of Wings India 2024, Maillard said Airbus will double its sourcing from India to $1.5 billion by the end of the decade from the existing $750 million. Hindustan Aeronautics Limited (HAL) also showcased its indigenous civil platforms, Hindustan-228 aircraft and ALH Dhruv upgraded civil helicopter.

> "Even if, as per projections, the number of domestic passengers reaches 635 million by FY 2030, India will still be one of the least penetrated of the 20 largest markets," Scindia said

CHARTING THE COURSE

Wings India 2024 served not only as a showcase for the latest developments in the aviation industry especially that of India but also as a catalyst for shaping its trajectory in the coming years through the many deals, discussions, and interactions that took place through the show. Here's a look back at some of the major ones.

Major announcements made at Wings India 2024:

- Release of the joint knowledge paper on civil aviation by FICCI and KPMG
- Launch of UDAN 5.3
- Launch of the Airbus-Air India Train-

PHOTOGRAPHS: AIRINDIA / X, FICCI

(CLOCKWISE FROM TOP-LEFT) AKASA AIR PLACES ORDER FOR 150 BOEING 737 MAX JETS; UDAN 5.3 SCHEME RELEASE BY THE CIVIL AVIATION MINISTER; ADVANCED AIR MOBILITY SOLUTIONS ON DISPLAY; MEHAIR PLACES ORDER FOR 20 ZEROAVIA ZA600 HYDROGEN-ELECTRIC ENGINES.

ing Centre, with the purchase of more airplanes and the setting of a flight training center in Gurugram with 10 flight simulators and 10,000 pilots being trained in the coming years

- GMR and IndiGo also signed a consortium to collaborate with multiple patterns in developing sustainable training in the aerospace industry
- Deal announcement of Akasa Air with a triple order of 200 aircrafts in a period of 17 months
- Domestic passenger traffic will reach 300 million by 2030, says Jyotiraditya Scindia
- Airbus delivers on 'Skill India', forms a JV with Air India to launch a pilot training centre, and partners with GMR to train maintenance crew.
- GMR Aero Technic, the MRO division of GMR Air Cargo and Aerospace Engineering Ltd (GACAEL) launched GMR Aviation School in collaboration with Airbus.
- TASL and Mahindra Aerospace secure additional manufacturing deals from Airbus
- Airbus to double procurement from India to $1.5 billion from current $750 million, according to Remi Maillard, President & MD, Airbus India.

DEALS AND DISCUSSIONS

Akasa Air, boasting to be India's fastest-growing airline, placed a firm order for 150 fuel-efficient Boeing 737 MAX aircraft at WINGS India 2024. The order includes 737 MAX 10 and 737 MAX 8-200 jets, ensuring a steady delivery stream until 2032 and supporting the airline's expansion plans. With this announcement, Akasa Air became the first Indian airline to exceed 200 aircraft orders within 17 months of operation, demonstrating strong financial standing and Boeing's confidence. The airline initially ordered 72 Boeing 737 MAX aircraft in 2021 and added 4 Boeing 737 MAX 8 aircraft in June 2023, bringing the total order to 226 aircraft. Akasa Air currently operates 22 aircraft and expects to receive 204 aircraft deliveries over eight years.

Akasa Air also inked a strategic partnership with the upcoming Noida International Airport in Uttar Pradesh, making it the second airline to align with the ambitious project. The announcement follows IndiGo's pioneering collaboration with the greenfield airport, marking a crucial step toward enhancing air connectivity in the Delhi-NCR region and western Uttar Pradesh. The partnership agreement between Akasa Air and Noida International Airport was formalised during the 'Wings 2024' industry event in Hyderabad. According to a statement released by the airport, Akasa Air will station aircraft at the facility to facilitate both domestic and international flights.

A Bengaluru-based engineering company unveiled India's first-ever aircraft passenger seat at Wings India 2024, marking a significant step in aircraft design and innovation.

Maritime Energy Heli Air Services Pvt Ltd (MEHAIR) announced a conditional

Uniting business leaders and policymakers, the primary objective of the event was to highlight India's prowess in the aviation sector and its emergence as the world's third-largest civil aviation market

PHOTOGRAPHS: WINGSINDIA2024 / X, SP GUIDE PUBNS, MEHAIR

AKASA AIR ORDERS MORE THAN 300 LEAP-1B ENGINES

IN CONJUNCTION WITH THE STATE visit of the French President Emmanuel Macron to India, Akasa Air and CFM International announced an agreement to purchase CFM LEAP-1B engines to power 150 Boeing 737 MAX airplanes, the sale of which was announced earlier. The agreement also includes spare engines and a services contract.

The Mumbai-based operator launched its operations in August 2022 and had previously ordered a total of 76 LEAP-1B- powered 737-8 aircraft, of which 22 are currently in service.

"This significant, long-term agreement is testament to the confidence that CFM International has in Akasa Air. Continuing to partner with CFM as our engine maintenance provider not only reaffirms our focus on operational reliability but equally underscores Akasa Air's relentless pursuit of world class safety" said Vinay Dube, Founder and CEO of Akasa Air.

"With CFM as our long-term engine maintenance provider, we remain confident in our path to becoming one of the top 30 leading airlines in the world, by the turn of this decade", he added.

This new order grows CFM's footprint in India, with more than 400 CFM-powered aircraft in service and 2,500 LEAP engines in the backlog. Both CFM's parent companies GE Aerospace and Safran Aircraft Engines have also significantly invested in India to build state-of-the-art facilities dedicated to LEAP production and maintenance, while signing strategic partnerships with Indian aerospace companies as part of the "Make in India" policy.

CFM LEAP-1B ENGINE

"Our customers, including Akasa, are seeing 15 to 20 per cent better fuel efficiency with their LEAP-powered fleets and it has the highest reliability and daily utilisation rates in this thrust class," said Gaël Méheust, President & CEO of CFM International. "Today's order will continue to bring these benefits to Akasa and support their continued growth, as well as play an important role in India's economic development."

The LEAP engine family has the fastest accumulation of flight hours in commercial aviation history, amassing more than 45 million engine flight hours and 18.7 million flight cycles. Since entering service in 2016, the LEAP engine has helped operators save more than 30 million tons of CO_2 compared to the same flights with previous generation engines. SP

order for 20 ZeroAvia ZA600 hydrogen-electric engines at Wings India 2024. This strategic move aligns with India's vision for clean flights and involves retrofitting Cessna Aircraft Company Caravan to embrace clean energy. ZeroAvia, working on global certification, collaborates with MEHAIR for fuel supply.

GMR Aero Technic (GAT), MRO division of GMR Air Cargo and Aerospace Engineering Ltd (GACAEL) announced partnerships with Lufthansa Technik AG (LHT) and Spirit Aero System at the Wings India 2024 in Hyderabad. A MoU was signed between GAT and LHT mutually agreeing to bring the innovative technology utilised by LHT's Cyclean jointly at Indian airports for the operators in the region.

Minister Scindia engaged in comprehensive discussions with global CEOs during a roundtable session. Joined by General (Dr) V.K. Singh (Retd), Minister of State, Ministry of Civil Aviation & Minister of State, Ministry of Road, Transport and Highways, Government of India, the 'Global CEOs Forum' offered insights into sustainability, efficiency, technology, and more. A panel focused on Sustainable Aviation, explored the transformative power of Sustainable Aviation Fuel (SAF) in navigating towards greener skies.

'Women in Aviation' was a powerful session where stories of progress, potential, and empowerment took center stage. The speakers shared their journey and insights on how women are carving their path, seeking specific training, and influencing organisational dynamics despite facing challenges.

A roundtable on Skill Development, Startups & FTO delved into efforts by the Government of India to foster talent in the aviation sector. Speakers highlighted initiatives starting from school days, emphasising the fusion of productivity and knowledge transfer. The discussion underlined the glamorisation of the aviation sector as a key driver in attracting and cultivating talent for future innovation and growth.

A panel discussion on Travel and Tourism unveiled India's ambitious aim for a $3 trillion tourism market by 2047, contributing 6 per cent to GDP. The discussion highlighted the role of digitalisation in easing travel for foreign tourists and the expansion of Ayodhya to feature 8-9 properties, emphasising the pivotal role of green destinations. Another panel discussion chaired by Piyush Srivastava explored the immense potential of the Maintenance, Repair, and Overhaul (MRO) sector in India and globally. The discussion showcased the sector's readiness to face challenges, regulatory excellence, efficient management of airport rentals, and collaborative policies shaping a robust future.

A roundtable on "Driving Investments & Financing for Multimodal Connectivity" in Airports of the Future highlighted airports as successful Public-Private Enterprises (PPEs) and the aviation sector as highly impactful. While airports evolve into dynamic centers of economic activity, challenges persist in their expansion to contend with increased accessibility and ridership.

In a high-energy roundtable, global delegates hailed India as the hottest and fastest-growing aviation market. The discussion focused on the colossal ecosystem of the industry, highlighting the vital mix of fleet, network, product, and connectivity. Against the backdrop of India's aviation surge, the sector propels forward, ensuring an exciting future.

A riveting roundtable unfolded as industry leaders and experts took the stage, and delved into economic transformation, regional advancement, and the surge in demand for business aviation and small aircraft. Insights unveiled innovative business models, discussed regional impacts, and highlighted the skyrocketing demand for aviation solutions. SP

PHOTOGRAPH: CFM

BOEING 777X AT WINGS INDIA 2024 HELD IN HYDERABAD.
BOEING CLAIMS 777X IS MUCH MORE EFFICIENT AND FUTURISTIC COMPARED TO A350 BY AIRBUS.

BOEING 777X (777-9) MAKES ITS INDIA DEBUT

Boeing's latest widebody 777-9 takes center stage at Wings India 2024, poised to redefine travel experience

By **AYUSHEE CHAUDHARY**

PHOTOGRAPHS: SP GUIDE PUBNS

IN A MOMENT OF GREAT ANTICIPATION AND EXCITEMENT, Boeing made its mark on Indian soil with the grand debut of its latest marvel, the widebody 777-9 aircraft. Standing proudly at the static display area of Wings India 2024 in Hyderabad, this colossal machine, touted as the world's largest and most fuel-efficient twin-engine jet, captured the attention of aviation enthusiasts and industry experts alike.

Derived from the immensely successful 777 and incorporating advanced technologies from the 787 Dreamliner family, the 777-9 is a testament to Boeing's commitment to pushing the boundaries of aviation. Unveiling the newest member of Boeing's market-leading widebody family, the 777-9 promises not only to be the world's largest but also the most efficient twin-engine jet to grace the skies.

Ryan Weir, Boeing Vice President, Commercial Sales and Marketing for India, expressed enthusiasm, stating, "We welcome the opportunity to introduce the state-of-the-art 777-9 to India and look forward to its induction in our customers' fleets



(TOP LEFT) DETAILED CHARACTERSTICS OF THE AIRCRAFT PRESENTED BY MADELEINE EDBOM, REGIONAL DIRECTOR - PRODUCT MARKETING AT BOEING - (TOP RIGHT) STATE-OF-THE-ART AVIONICS ON BOARD; (BOTTOM LEFT) SIZE OF WINDOWS COMPARED WITH THAT ON AIRBUS A350; (BOTTOM RIGHT) COMFORTABLE AND FLEXIBLE SEATING ARRANGEMENTS.

over the coming years. The 777-9 will become the flagship of many airlines around the world."

Air India, in a strategic move to bolster its fleet and cater to the surging demand for international air travel in South Asia, has placed a substantial order for 10 of these aircraft. Boeing's order book for the 777X family, encompassing the 777-8 and 777-9 passenger models along with the 777-8 Freighter, has soared beyond 450, underscoring the global demand for this cutting-edge aircraft.

The airplane has had 3,000 hours of flight test and 1,000 cycles. Boeing has not started certification flight testing yet but they have had good results from their flight test programme. They have done almost all of their Boeing flight test programme and are confident of the airplane's performance.

INSIDE THE 777-9

At the show, an immersive display of the 777-9 flight test airplane offered a sneak peek into the passenger experience of the future. The static display of the flight test airplane was complimented with a mock-up cabin in the exhibition area. Here are some highlights from the captivating tour inside the aircraft:

- **Capacity and Innovation:** The 777-9 boasts a remarkable capacity ranging from 426 seats (configured for premium economy) to 515 (mostly for economy). It claims the title of the largest production commercial airplane, with the largest wing ever built by Boeing.
- **Unique Folding Wing Tip:** With a groundbreaking folding wing tip and the power of the GE engine, the aircraft can automatically fold its wings during taxiing, ensuring compatibility with all airports currently served by the legacy 777. This innovation asserts to enable 10 folds of airport landing ability.
- **Cabin Comfort:** Passengers onboard the 777-9 can enjoy reduced cabin altitude to about 6,000 ft, and increased humidity, creating a more comfortable environment. The cabin, 4 inches wider than the current legacy 777, facilitates a spacious and airy travel experience. Extra emphasis has been laid on the lights inside the cabin to smoothen the passenger experience further and enhance the ambience so that the passenger arrives at his/her destination less fatigued. The lights have been aligned with natural colors of the sky, painting the ceiling from sunset shades to starry night skies. The two sides of aisle can even have different shades at the same time and the airlines can choose to customise the lighting.
- **Technological Advancements:** The flight deck is equipped with large displays, similar in size to those on the 787, with advanced touch screen capabilities. Boeing has further enhanced and advanced the cockpit, providing a mix of familiarity and innovation for pilots.
- **Windows of the Future:** The 777-9 boasts electronically dimmable windows that are 30 per cent larger than those on the A350, offering passengers breathtaking views and a customisable experience.

BOEING 777X – A COST EFFECTIVE FAMILY

777X: lower cost | lower fares | more passengers

THE WRITER AYUSHEE CHAUDHARY WITH BOTH PILOTS OF THE BOEING 777-9 TEST AIRCRAFT

A LEAP IN EFFICIENCY AND SUSTAINABILITY

Boeing's 777X family aims to set new standards in efficiency, sustainability, and passenger comfort. With 20 per cent greater fuel efficiency than the 777-300ER and a commitment to Sustainable Aviation Fuel (SAF) compatibility by 2030, the 777-9 presents a vision of a greener and more sustainable future for air travel.

The aircraft's innovative features, including an all-composite wing spanning 72 meters, emphasise Boeing's dedication to efficiency. The folding wing tip and the larger GE9X engine contribute to unprecedented levels of aerodynamic excellence.

Boeing's 777-9, projected to enter service in 2025, represents not just a new aircraft but a leap into the future of aviation. With its emphasis on ambiance, experience, and advanced technology, the 777-9 is poised to become a flagship for airlines worldwide, promising passengers a journey that goes beyond transportation–a true flight experience of the future.

On being asked about the key futuristic elements in this aircraft by Jayant Baranwal, Editor-in-Chief of *SP's Aviation*, the team highlighted its 20 per cent more fuel efficiency than the 777-300ER, so on a per seat basis, it is 10 per cent more efficient than the A350-100. The test team is confident that 777-9 will replace all of the bigger airplanes out there.

At Wings India 2024, Boeing not only showcased its groundbreaking aircraft but also reiterated its commitment to fostering an Atmanirbhar aerospace ecosystem in India. The exhibit featured a dazzling array of cutting-edge technologies, services, sustenance solutions, and training capabilities. Boeing's dedication to India's civil aviation growth and its alignment with the Atmanirbhar Bharat vision were prominently highlighted.

Salil Gupte, President, Boeing India, affirmed this commitment, stating, "Our dedication to bolstering India's civil aviation growth remains unwavering, providing efficient aircraft, top-notch services, and innovative solutions in line with the Atmanirbhar Bharat vision. We are excited to reinforce our commitment to India's aerospace industry as we showcase our leading products and services at Wings India 2024." SP

THE EXPANDING MIDDLE CLASS IS PLAYING A PIVOTAL ROLE IN DRIVING AIR TRAVEL AND THUS THE AVIATION BOOM IS INDIA

INDIA TO LEAD COMMERCIAL AVIATION RECOVERY IN SOUTH ASIA

According to Boeing's 2023 Commercial Market Outlook, India and South Asia are expected to have over 2,705 new airplane deliveries until 2042

By **AYUSHEE CHAUDHARY**

PHOTOGRAPHS: BOEING

787 FAMILY OFFERS THE RIGHT AIRPLANE FOR THE RIGHT MARKET

787-8

Chennai - Tokyo

250 seats

Market Opener
Lowest Risk

787-9

Delhi - Seattle

315 seats

Market Fragmentation
Most Versatile

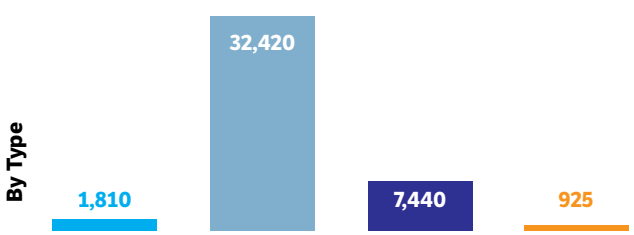
787-10

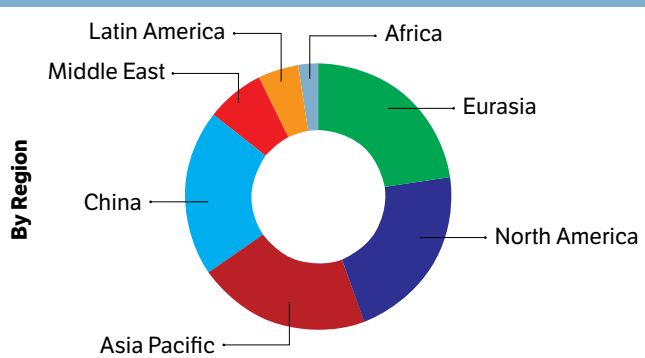
Mumbai - London

375 seats

Dense Markets
Lowest Unit Cost

AIRLINES WILL NEED 42,595 NEW AIRPLANES OVER 20 YEARS





Source: Boeing CMO

IN A PIVOTAL MOMENT FOR THE AVIATION INDUSTRY, BOEING'S latest forecast positions South Asia, led by India, as the fastest-growing commercial aviation market globally. Propelled by India's robust economy and a burgeoning middle class, the region is poised to experience an impressive annual traffic growth of over 8 per cent in the next two decades.

Boeing's Commercial Market Outlook (CMO) reveals that South Asian carriers are gearing up to quadruple their fleets, necessitating the addition of more than 2,700 new airplanes over the next 20 years. This substantial expansion is a strategic response to the escalating demands of both passengers and cargo.

At the heart of this aviation boom is India, where the expanding middle class is playing a pivotal role in driving regional air travel. Boeing anticipates that carriers in the South Asian region will require an extensive fleet expansion to meet this surge in passenger and cargo demand.

"Indian low-cost carriers continue to stimulate demand and connect emerging regions with low fares, holding nearly a 90 per cent share of all domestic seats in the region. This reflects the rapid pace of the region's recovery and economic activity, as traffic and capacity now exceed pre-pandemic levels," said Darren Hulst, Boeing Vice President of Commercial Marketing.

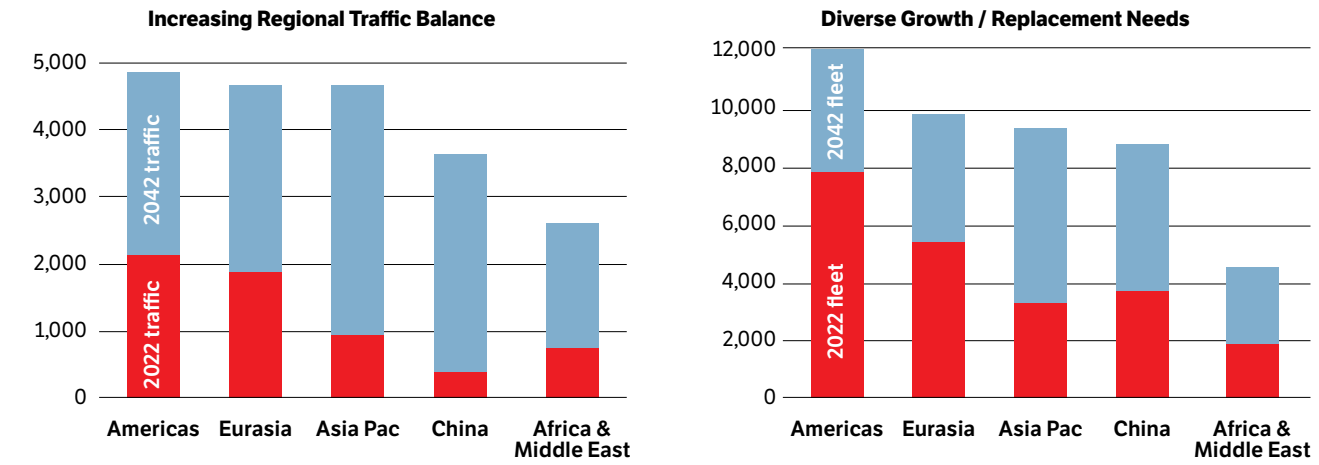
While focusing on South Asia, Boeing's forecast also shed light on the broader global aviation landscape. The industry is on a trajectory to return to pre-pandemic traffic levels, with a forecasted demand for over 42,000 new airplanes in the next two decades. This resurgence is underpinned by a recovery in domestic and regional markets, closely followed by a rebound in international travel.

"Similarly, long-haul traffic and capacity to and from India and South Asia lead the way globally, relative to 2019, as non-stop services to North America, Europe, East Asia and Oceania continue to be added. Strong economic growth and confidence in the commercial aviation market have led to record orders for new, more efficient airplanes in India," Hulst added.

Growth of India's middle class, tourism, and manufacturing will drive 4X 2022's GDP growth over 2050, a $15 trillion GDP output by 2050, gaining the third highest GDP world ranking by 2031.

The CMO also brought to light that while the capacity is back, the dynamics still vary and the supply recovery has been lagging resilient demand. However, airlines continue to evolve to meet market dynamics, with a large number of carriers sim-

AIR TRAVEL DEMAND DRIVES PASSENGER FLEET NEEDS



Source: Boeing CMO, Note: Eurasia includes Europe, Russia and Central Asia

COMMERCIAL AIRPLANE DELIVERIES TO INDIA AND SOUTH ASIA (2023-2042)

Regional Jet	<5
Single Aisle	2,320
Widebody	380
Freighter	5
Total	**2,705**

plifying existing fleets, increasing premium cabin offerings and providing more point-to-point capacity. Likewise, changing supply chain models and the growth of e-commerce continues to drive robust demand for dedicated freighters.

Boeing's projection for the South Asia market until 2042 includes:

- 72 per cent of 2,705 new deliveries supporting fleet growth.
- 28 per cent replacing older jets with more fuel-efficient models.
- Single-aisle airplanes constituting over 85 per cent of new deliveries.

The surge in South Asia's aviation sector is expected to create a demand for 37,000 pilots and 38,000 maintenance technicians by 2042, with India being a primary driver of this workforce expansion.

As global air travel outpaces economic activity, mature markets like North America and Europe are anticipated to witness slower growth, while emerging markets, particularly in Asia, will experience above-average growth. This forecast underscored a geographically balanced global aviation market in the long term. On average, 2-3 per cent of the commercial jet fleet is replaced every year. Growth and replacement needs vary widely between regions. In markets with large installed fleets, new airplane demand is focused more on replacement. Two-thirds of projected new airplane deliveries to North American carriers will replace existing fleets. In contrast, markets earlier in their aviation development and with smaller installed fleets have lower replacement needs but higher growth demand. Asia-Pacific markets are forecast to deploy over 60 per cent of new airplane deliveries for growth.

Boeing's analysis revealed that, on average, 2-3 per cent of the commercial jet fleet is replaced annually. The dynamics vary between regions, with mature markets emphasising replacement, while Asia-Pacific markets are forecasted to deploy over 60 per cent of new airplane deliveries for growth. The outlook in 2024 is resuming growth with 2.3 per cent GDP growth economically, airline net profit expected to be $27.5B, the cargo market projected to see 4.5 per cent year-o-year (y/y) growth FTKs full year and passenger market to see 105 per cent of 2019 RPKs full year.

As the aviation industry reshapes itself for the future, South Asia, with India at its helm, stands as a beacon of growth, innovation, and transformative change. The skies are not just the limit but a realm of boundless opportunities for the region's soaring aviation sector.

Air travel is forecasted to continue growing faster than global economic activity driven by tourism demand and increased service levels, particularly in developing markets. Global passenger air travel has become increasingly diverse and balanced over the last several decades, a trend that is expected to continue over the next 20 years. These varying trajectories are driving a more geo-

BOEING FORESEES A REMARKABLE 7 PER CENT LONG-TERM GROWTH IN INDIA'S PASSENGER TRAFFIC, SURPASSING THE GLOBAL AVERAGE

STEADY LONG-TERM FORECAST DRIVEN BY FUNDAMENTALS

			
World Economy (GDP)	**Passenger Traffic (RPKs)**	**Cargo Traffic (RTKs)**	**Fleet (jets)**
US$92T 2022	**6 trillion** 2022	**260 billion** 2022	**24,500** 2022
US$155T by 2042	**20 trillion** by 2042	**630 billion** by 2042	**48,600** by 2042

Source: Boeing CMO

graphically balanced global aviation market in the long-term.

Amid the optimism, the CMO also highlighted some of the challenges facing aviation in India:

- Volatile fuel prices
- Currency pressure
- Low yields
- Infrastructure
- Market share imbalance
- Hyper-competition

As the aviation industry reshapes itself for the future, South Asia, with India at its helm, stands as a beacon of growth, innovation, and transformative change. The skies are not just the limit but a realm of boundless opportunities for the region's soaring aviation sector.

FREIGHT AVIATION IN INDIA: UNLEASHING A SKYWARD SURGE

In a visionary outlook, Boeing is gearing up for a colossal leap in India's cargo aviation sector, foreseeing a fivefold growth in market opportunities. The aerospace giant anticipates that India's cargo fleet will burgeon to an impressive 80 airplanes over the next two decades, underpinned by various strategic factors.

"Financially stable airlines are leading India with profitable books and accessibility to capital. Yield stability would help airlines in managing the profitability. Additionally, cargo as a strategic investment needs to be factored in the planning process. 5X market growth opportunity is projected for dedicated single aisle freighters for India over the next 15-20 years," said Ashwin Naidu, Managing Director-Commercial Marketing (Indian Subcontinent), Boeing.

INDIA'S CARGO FLEET WILL GROW TO AN IMPRESSIVE 80 AIRPLANES OVER THE NEXT TWO DECADES

At the core of this ambitious projection lies India's domestic strength, a powerhouse of untapped potential with a mere 15 freighter aircraft currently in operation. Bolstered by a robust 7 per cent GDP growth, the flourishing e-commerce landscape, and an expanding middle class, the demand for freight services is poised to soar, necessitating the addition of 45 or more airplanes to meet burgeoning requirements.

Boeing envisions a significant uptick in regional cargo expansion, driven by economic collaborations with ASEAN and the Middle East. The ongoing redesign of manufacturing and supply chains, with India at the epicenter, is expected to result in the acquisition of 20 or more cargo airplanes.

India's 'Make in India' initiative, coupled with burgeoning pharmaceutical and automotive trade links, is reshaping the global trade and manufacturing landscape. As supply chains realign globally, and technology manufacturing gains momentum, the demand for widebody airplanes is projected to escalate, with an estimated addition of 15 or more aircraft.

Boeing foresees a remarkable 7 per cent long-term growth in India's passenger traffic, surpassing the global average. This robust growth trajectory not only signifies an increased demand for passenger aircraft but also underscores a dedicated freighter opportunity that holds strong potential for substantial expansion.

In response to India's burgeoning aviation needs, Boeing believes that its diverse family of aircraft is tailor-made for the Indian market. Whether addressing the domestic cargo surge, regional expansions, or the global trade and manufacturing nexus, Boeing envisions its family of products as the ideal fit to support India's multifaceted growth across all market segments.

As the skies above India witness an unprecedented surge in demand for cargo services, Boeing stands as a stalwart partner, ready to propel the nation's aviation landscape into new dimensions of growth and connectivity. The future of freight aviation in India is not just promising but poised to redefine the very contours of the nation's economic and logistical prowess. SP

MARY ELLIS (1917–2018)

At one RAF base where Mary Ellis landed a Wellington bomber, the ground crew flatly refused to believe that she was the pilot. They even searched inside the bomber convinced that its male pilot was lurking somewhere.

MARY ELLIS WAS A BRITISH FERRY PILOT DURING THE SECOND World War. At that time women were not considered capable of engaging in combat, or even of flying skilfully for that matter. However the War Office, in its desperation to find enough pilots to ferry planes to and from the frontline bases, was ultimately compelled to accept women.

Mary Wilkins Ellis was born on February 2, 1917, in Leafield, Oxfordshire. Since her home was located close to a couple of Royal Air Force (RAF) airfields she was familiar with aviation from an early age. When she was eight, the Sir Alan Cobham Flying Circus visited the area. Mary's father did not need much persuasion to sign her up for a joy ride in an Avro 504 biplane. And she promptly lost her heart to flying. She took her first flying lessons as a teenager at a flying club in Witney and successfully gained her private pilot's licence. Thereafter she flew whenever possible for pleasure.

When World War II broke out all civilian flying was stopped. However, to her good fortune, Mary heard a radio advertisement about women pilots being urgently needed in the Air Transport Auxiliary (ATA). She applied to join in October 1941 and was sent to Hatfield, where she demonstrated her flying abilities in a Tiger Moth. She trained further on Moth, Hart and Hind biplanes at the RAF's Central Flying School in Wiltshire, before joining a pool of female flyers based in Hamble, Hampshire. During her stint in the ATA she flew over 1,000 planes of 76 different types, including 400 Spitfires and 47 Wellington bombers, clocking around 1,100 flying hours. The frequent cockpit changes – sometimes from a Spitfire to a Tiger Moth to a Wellington all in the same day – would have challenged even a seasoned test pilot. And all this was with little or no type training.

The exploits of the ATA during the war was a saga in itself. The ATA was a civilian organisation hurriedly set up in February 1940, to transport urgently needed military aircraft and supplies from the factories to the operational bases, and sometimes from one base to another depending on where the requirement was most pressing. Initially it had only male pilots. But as the ferry needs multiplied it was decided to employ qualified females as well. The first eight women pilots joined the ATA in 1940 and were immediately dubbed "Atagirls". The Atagirls could only ferry aircraft other than fighter and bomber aircraft. However, as the supply of aircraft and casualties both mounted, even this restriction had to be lifted.

As can be imagined, the decision to allow women to fly Britain's frontline fighter and bomber aircraft, albeit only on ferry missions, was met with widespread consternation and even resistance. "Women anxious to serve their country should take on work more befitting their sex instead of encroaching on a man's occupation," an editorial published in Aeroplane magazine declared. As Mary Ellis later put it, "Girls flying airplanes was almost a sin at that time." At one RAF base where Mary landed a Wellington bomber, the ground crew flatly refused to believe that she was the pilot. They even searched inside the bomber convinced that its male pilot was lurking somewhere. "Everybody was flabbergasted that a little girl like me could fly these big aeroplanes all by oneself," Mary later recalled.

However, by the time the ATA was wound up in November 1945, following the end of the war, 166 women from many different countries, comprising more than 12 per cent of the total pilots in the ATA had served. Around 15 women lost their lives in the course of their duties. Initially female pilots were paid a fifth less than men. But after 1943 they became among the first women in the UK to achieve equal pay with their male counterparts. In all the ATA ferried 3,09,011 aircraft.

Mary had several brushes with death including once when her aircraft was shot at, possibly by friendly fire. On another occasion her Spitfire narrowly missed colliding with another as both landed from opposite ends of the same runway in thick fog. ATA pilots could not use radio equipment, as the limited frequencies were kept clear for the RAF. Mary also survived a crash landing when the undercarriage of her Spitfire jammed.

After the war, Mary Ellis was accepted as a pilot by the RAF and continued to ferry aircraft. She was one of the first women to fly the Gloster Meteor, Britain's first jet fighter. In 1950, she became the manager of Sandown Airport, and Europe's first female air commandant. She also founded the Isle of Wight Aero Club. She died at her home in Sandown, Isle of Wight, on July 24, 2018, at the ripe old age of 101. SP

— JOSEPH NORONHA

MILITARY

WINNERS OF INNOVATION LEADERSHIP DEVELOPMENT PROGRAMME 2023-24

Boeing announced seven teams comprising university students and early-stage start-up entrepreneurs as winners of the third edition of Boeing University Innovation Leadership Development (BUILD) programme 2023-24. Each of these seven teams received INR 10 lakh as a financial grant, and their ideas covered solutions for community development, the defence and space industry, and sustainability. These winners will be further supported by Boeing and their respective incubator partners for over a few months to help develop their ideas into market-ready and viable business solutions.

"BUILD has evolved into an aspirational and dynamic start-up platform, nurturing young entrepreneurial minds of the country with the right skills and support to scale up operations, develop cutting-edge technologies, and help implement ideas that impact not only the nation but the world at large. I want to congratulate our incubator partners for leading this programmeto success over these years and would like to congratulate winners and the applicants for their active participation this year," said Salil Gupte, President, Boeing India.

PRATT & WHITNEY EXPANDS INDIA OPERATIONS

Pratt & Whitney, an RTX business, announced the establishment of its new India Digital Capability Center (IDCC) in Bengaluru. The new center will accelerate innovation and drive digital and business transformation for Pratt & Whitney worldwide. The facility will be co-located with Pratt & Whitney's engineering and supply chain operations centers of excellence. The location will also facilitate close collaboration with other RTX businesses in India including Collins Aerospace and RTX Enterprise Services. The center will be focused on delivering multiple digital technology capabilities across various priority areas of Pratt & Whitney's digital transformation.

"With $40 million already invested in engineering and supply chain operations centers in the past two years, Pratt & Whitney continues to grow its presence and contribution to India's aerospace ecosystem with this additional multi-million-dollar investment in the IDCC," said Ashmita Sethi, President & Country Head, Pratt & Whitney, India (UTCIPL).

APPOINTMENT

NIKHIL JOSHI

NIKHIL JOSHI TO LEAD BOEING DEFENCE INDIA

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

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

"We are delighted to welcome Nikhil to our team. His wealth of experience and strong leadership will drive our growth strategy in India and strengthen our commitment to continue serving our defence customers in the country," said Scott Carpendale, Vice President, Asia Pacific, Boeing Global Services – Government Services (BGS-GS).

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

"Efficient solutions, timely support, and flawless execution are critical elements of BDI's commitment to our customers and the Indian aerospace and defence industry. We welcome Nikhil to Boeing India and look forward to collaborating to support our customers with their future requirements," said Salil Gupte, President, Boeing India and South Asia. SP

PRATT & WHITNEY'S NEXT-GENERATION ADAPTIVE PROPULSION OFFERING

Pratt & Whitney, an RTX business, has completed a critical assessment of its Next-Generation Adaptive Propulsion (NGAP) offering with the US Air Force, moving the program closer to completing its detailed design review. The team is now working towards ground testing of its NGAP prototype, referred to as XA103, which is expected to occur in the late 2020s. The engine will enhance performance that is key to enabling future air dominance capabilities, which are needed to ensure the US Air Force achieves air superiority and deters pacing challenges.NGAP technologies will provide advanced survivability, fuel efficiency, and robust power and thermal management. These are necessary to enable the required range, weapon and sensor capability, and persistence future air dominance platforms will require to meet evolving operational needs.

EMBRAER AND MAHINDRA ANNOUNCE COLLABORATION

Embraer Defense & Security and Mahindra announced that they have signed a Memorandum of Understanding (MoU) with the objective of jointly fulfilling the acquisition of the C-390 Millennium multi-mission aircraft by the Indian Air Force in its upcoming Medium Transport Aircraft (MTA) procurement project. Embraer and Mahindra will engage with the Indian Air Force to identify the next steps of the MTA programme, as well as contact the local aerospace industry in India to start developing the industrialisation plan for the project. The collaboration around the C-390 Millennium will bring the latest technology in terms of aerospace & military transport aircraft to India. Both Embraer and Mahindra will explore the potential to turn India into a future hub of the C-390 aircraft for the region.

The C-390 Millennium multi-mission tactical transport aircraft offers unmatched mobility, combining high productivity and operating flexibility with low operating costs, which is an unbeatable combination. To date, the C-390 Millennium has been selected by Brazil, Portugal, Hungary, the Netherlands, Austria, the Czech Republic and most recently, South Korea.

CHARTING A SUSTAINABLE COURSE

India's aviation sector is experiencing rapid growth accompanied by an inevitable surge in carbon emissions. To counter this environmental challenge, collaborative initiatives between airlines and the MoCA need to taken shape for the integration and adoption of SAF.

By ROHIT GOEL

IN THE AFTERMATH OF A RESILIENT RECOVERY FROM THE impacts of the pandemic, the aviation industry is strategically realigning its trajectory with a dual focus on economic resurgence and heightened environmental consciousness. At the forefront of this transformative shift is Sustainable Aviation Fuel (SAF), a pivotal player in the endeavour to decarbonise air travel.

CHALLENGES AND OPPORTUNITIES IN SAF ADOPTION

The primary hurdle facing the widespread adoption of SAF is its current cost relative to conventional jet fuel. The aviation sector, grappling with narrow profit margins, seeks governmental support and market-based mechanisms, including carbon pricing, to bridge the cost gap.

Sourcing sustainable feedstocks such as waste oils and agricultural residues is pivotal to avoid land-use change and address food security concerns. A conscientious approach to feedstock acquisition is vital for ensuring the sustainability of SAF production.

Critical steps include boosting domestic SAF production capacity, expanding blending facilities at airports, and investing in infrastructure to meet the growing demand for SAF. Research and development efforts in next-generation SAF technologies are essential for reducing emissions and making SAF economically viable.

Strategic investments in research, development, and commercialisation of indigenous SAF production technologies are crucial. Effective incentives and support mechanisms must be implemented by the government to create a conducive environment for private sector involvement and foster economies of scale.

INDIA'S PATH TO SELF-RELIANCE IN SAF

While the global aviation industry sets ambitious targets, India must intensify its efforts towards a sustainable future. Beyond environmental benefits, SAF adoption can stimulate economic growth, creating jobs and green businesses in the biofuels sector. Public awareness and advocacy, coupled with supportive policies, can drive demand for SAF and accelerate the transition towards a cleaner and more responsible future in aviation.

India currently lacks sufficient domestic SAF production capacity. Strategic investments in research, development, and commercialisation of indigenous SAF production technologies are crucial for establishing a robust and self-reliant supply chain. Upgrading airport infrastructure is a prerequisite for successful integration.

In the Indian context, transitioning to SAF requires collaboration among airlines, the government, and other stakeholders. While commendable progress has been made, it is imperative to acknowledge that current efforts may not be sufficient. More robust policies, enhanced infrastructure, and accelerated interventions are required to expedite India's journey towards sustainable aviation practices.

The challenges of cost disparities and financial implications necessitate a comprehensive review of existing policies and the swift implementation of innovative solutions. Governmental support, coupled with market-based mechanisms like carbon pricing, can bridge the financial gap, making SAF adoption financially viable for the aviation sector.

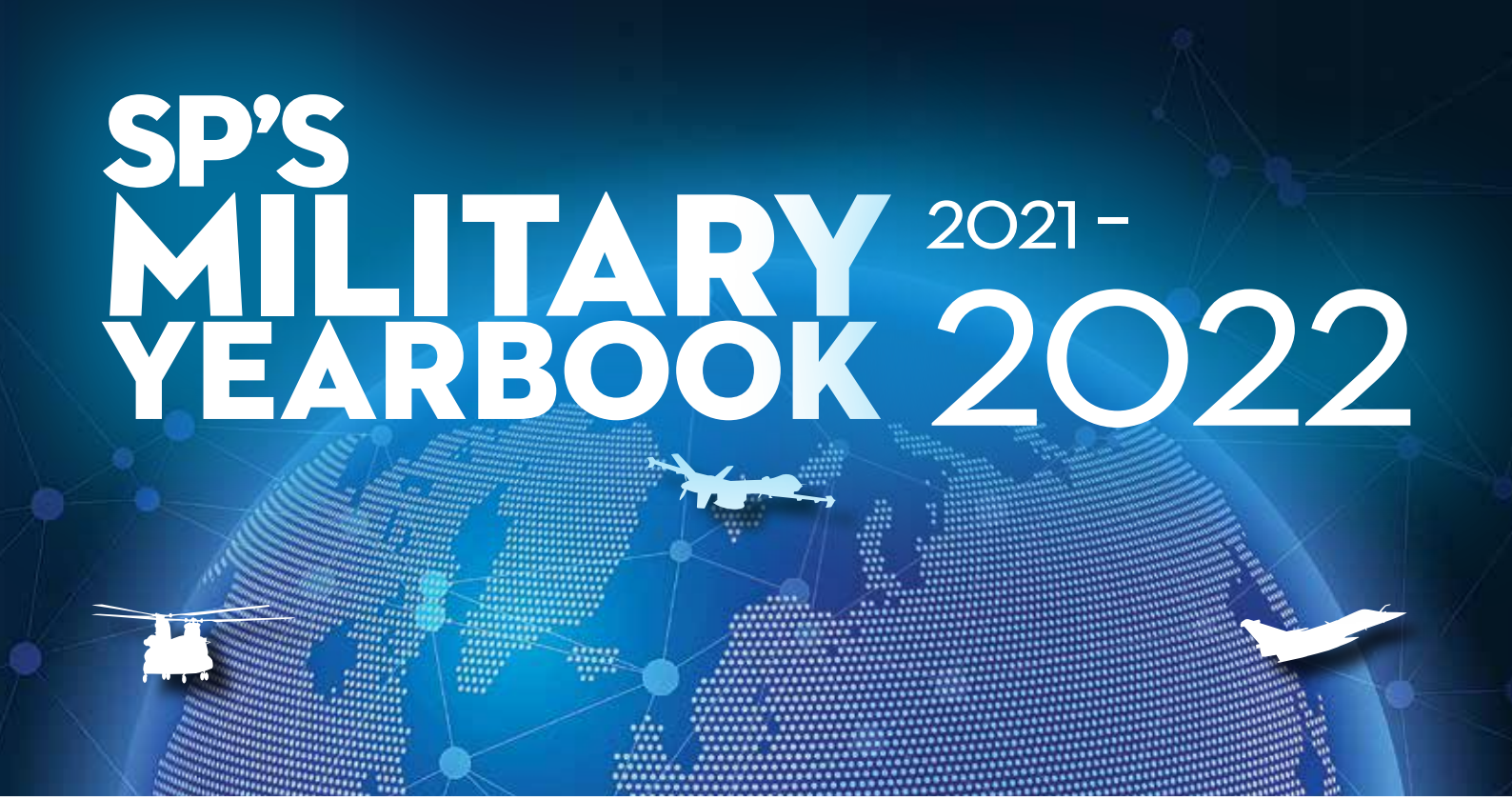
Sourcing sustainable feedstocks presents an opportunity to align SAF production with environmental and food security goals. A conscientious approach to feedstock acquisition, avoiding land-use change, and prioritising waste oils and agricultural residues are crucial steps. Additionally, boosting domestic production capacity, expanding blending facilities, and investing in infrastructure are vital components for fostering a seamless transition within the aviation sector.

Recognising India's current lack of sufficient domestic SAF production capacity, strategic investments in research, development, and commercialisation are imperative. This necessitates a dual-pronged approach of creating a conducive environment for private sector involvement and fostering economies of scale. Upgrading airport infrastructure to handle SAF efficiently is pivotal for successful integration.

The strides taken by Indian carriers in embracing SAF are commendable, but it is evident that more needs to be done. Current efforts, though positive, must be augmented by bold policy decisions, increased investments, and a steadfast commitment to sustainable practices. Each flight powered by SAF is a significant step, but a collective, accelerated effort is essential to meet the challenges posed by climate change and propel India towards a more sustainable future. Only through concerted action can India truly embrace SAF, not just as a measure of resilience but as a beacon for a greener and more sustainable tomorrow in aviation. SP

ILLUSTRATION: SP's TEAM

SP'S MILITARY YEARBOOK 2021 – 2022



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C-390 MILLENNIUM

UNBEATABLE COMBINATION

MISSION-READY WITH THE PORTUGUESE AIR FORCE

We're delighted to announce the Portuguese Air Force now joins the Brazilian Air Force as a C-390 Millennium operator. The first Portuguese aircraft of the newly formed 506 Squadron is now in service at Beja Air Base, with four more aircraft to be added in the near future. A growing number of countries are choosing the C-390 Millennium (including Hungary, Netherlands, Austria and Czech Republic) attracted by its unbeatable combination of technology, speed, performance and multi-mission capabilities. Hungary will take delivery of their first C-390 Millennium in 2024 – another milestone for an incredible aircraft that has already achieved 10,000 flight hours with the Brazilian Air Force.

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