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SP's aviation

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60 1964-2024 YEARS OF SP'S

SPECIAL ISSUE
92ND ANNIVERSARY OF INDIAN AIR FORCE

CIVIL
KEY ELEMENTS OF SAF (SUSTAINABLE AVIATION FUEL)

EXCLUSIVE

"IAF AIMS TO BE AN AGILE AND ADAPTABLE AIR FORCE"

AIR CHIEF MARSHAL A.P. SINGH, CHIEF OF THE AIR STAFF, IAF, SPEAKS TO SP'S

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COVER IMAGE

Indian Air Force recently marked completion of 92 years of valour. Leading the anniversary celebrations was the newly appointed Chief of the Air Staff, Air Chief Marshal Amar Preet Singh who took over on September 30, 2024.

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

COVER DESIGN BY: *SP's Team*

ENVIRONMENT

IAF SPECIAL

MILITARY

OEM

REGULAR DEPARTMENTS

NEXT ISSUE: *NBAA Special*

Air Chief Marshal A.P. Singh's appointment as the new Chief signifies a new era for the Indian Air Force, focusing on self-reliance and modernisation. Meanwhile, the nation mourns the loss of Ratan Tata, a visionary leader whose contributions to Indian aviation and philanthropy are immeasurable.

ON OCTOBER 8, 2024, THE INDIAN AIR FORCE CELEBRATED 92 years of distinguished service. Commemorating this milestone, our latest issue includes a message from Chief of Air Staff, Air Chief Marshal A.P. Singh, who underscores the rapid evolution of warfare through disruptive technologies and multi-domain operations. He highlights the essential need for a robust Air Force to maintain credible deterrence.

In an exclusive interview with Jayant Baranwal, Editor-in-Chief, *SP's Aviation*, Air Chief Marshal A.P. Singh discusses a range of subjects critical to the Air Force's strategic growth, with a focus on indigenous advancements and enhanced operational capabilities, particularly the progress in fighter aircraft such as the LCA Tejas and improvements. During his recent press address during the annual Press Day of the IAF, the Air Chief had expressed a vision for a fully indigenised inventory by 2047.

(FILE PHOTO): RATAN TATA WAS A REGULAR AT THE AERO SHOWS IN INDIA. HE CAN BE SEEN HERE WITH JAYANT BARANWAL, CHAIRMAN AND MANAGING DIRECTOR, SP GUIDE PUBLICATIONS AT OUR BOOTH AT AERO INDIA 2011.

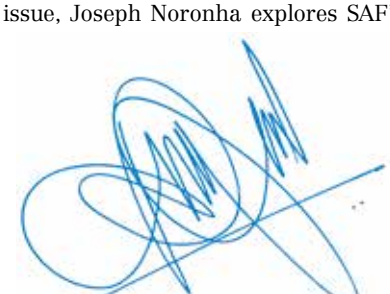
Air Marshal Anil Chopra (Retd) points out in his analysis, that delays in the LCA Mk1A and the slow pace of the MRFA programme present strategic challenges, particularly as the IAF operates below the authorised strength of 42 squadrons. In another report, Manish Kumar Jha also talks about the engine troubles leading to the delays in fighter aircraft (LCA Tejas Mk2 and AMCA) and that India should seek self-reliance in jet engine technology.

This issue also features Air Vice Marshal Sanjay Bhatnagar's (Retd) report on Exercise Tarang Shakti, India's largest multinational air exercise, which showcases the nation's advancing stature in global defence. The exercise, widely covered by international media, highlighted India's growing capabilities and its stature as a reliable partner in global military efforts.

In a major development for modernisation, India and the US signed a ₹34,500 crore deal for 31 Predator drones for the Indian armed forces. Under this agreement, General Atomics will establish a MRO facility in India, marking a significant step toward domestic self-reliance in drone technology. Additionally, this issue includes an exclusive interaction with Frederico Lemos, Chief Commercial Officer of Embraer Defense & Security delving into Embraer's expanding global footprint and partnership with India.

On the sustainability issue, Joseph Noronha explores SAF's challenges, benefits, and the financial realities of achieving net zero, emphasising that while SAF is promising, the road ahead is complex and costly.

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



JAYANT BARANWAL
PUBLISHER & EDITOR-IN-CHIEF

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KEY ELEMENTS OF SAF (SUSTAINABLE AVIATION FUEL)

With SAF being constantly pushed as a panacea, a reality check is essential. The journey to achieve net zero by 2050 will in truth be long, arduous and terribly expensive. Success is by no means assured without urgent measures.

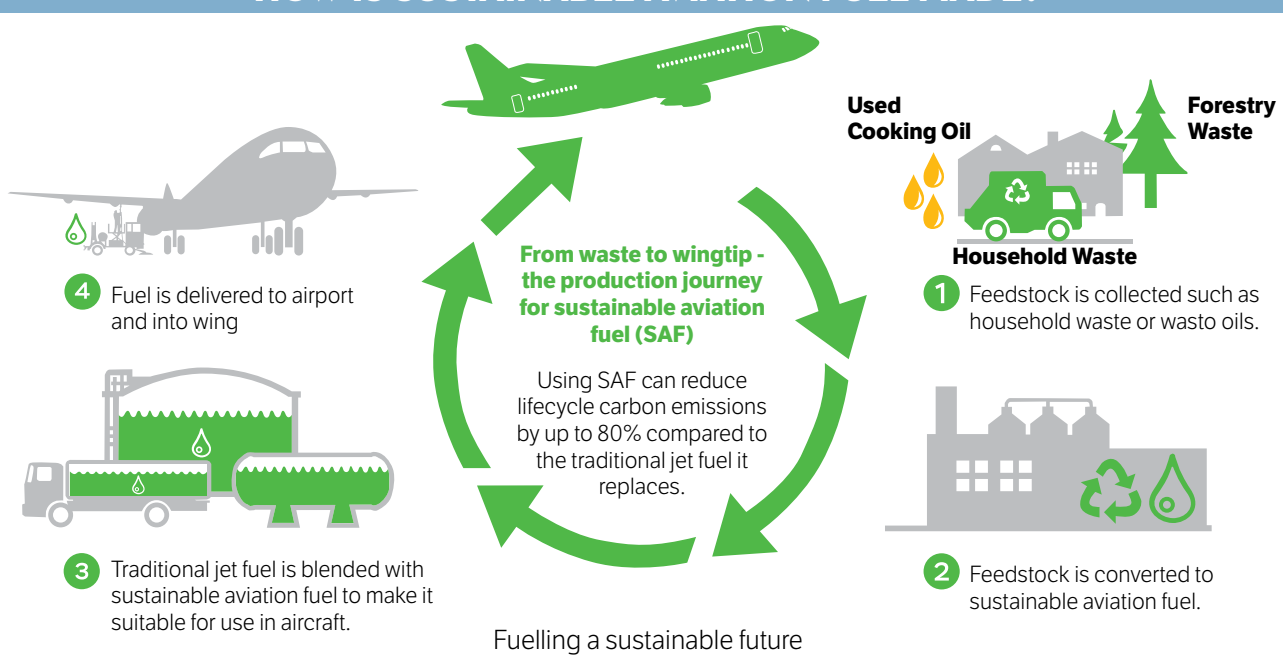
By JOSEPH NORONHA

AIRLINE STRATEGY IS NOW INCREASINGLY INFLUENCED BY environmental sustainability. Both the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) have set impressive climate goals. In October 2022, ICAO member states agreed to a long-term aspirational goal (LTAG) of net zero emissions from aviation by 2050. This followed the aviation industry's commitment to the same net zero objective, adopted by IATA in 2021. Net zero means the amount of greenhouse gases (GHG) removed from the atmosphere is equal to that emitted by that activity.

The quest for sustainability is driven by growing fears of irreversible climate change. In February 2024, for the first time, global warming exceeded 1.5 degrees C through a full year. "Why lose sleep over this?" Climate sceptics demand, adding that ups and downs in the global temperature trend have been recorded throughout history. But an overwhelming majority of scientists believe that 1.5 degrees is a climate change "red line" and overshooting it even for a few years may trigger tipping points that cannot be uncrossed – such as the melting of permafrost that would, in turn, release huge amounts of trapped CO_2 and intensify global warming. If proof were needed, the planet experienced record floods, droughts, heatwaves and wildfires in 2024. Another half degree temperature rise could greatly intensify these effects.

Where does aviation stand? Although flying is very carbon intensive it contributes just 2.5 per cent of global emissions. But thanks to non-CO_2 emissions, soot and contrails, aviation's total

HOW IS SUSTAINABLE AVIATION FUEL MADE?



Source: Air bp

contribution to global warming is more than twice that figure. While engine manufacturers constantly strive to increase fuel efficiency, the gains are dwarfed by soaring demand for aviation services. Convinced of the need to act, the aviation industry has adopted a multi-pronged approach that banks mainly on sustainable aviation fuel (SAF). In fact, in IATA's thinking, as much as 65 per cent of carbon mitigation required to achieve net zero by 2050 will come from SAF.

Yet, many major questions remain unanswered. Is the aviation industry's commitment to sustainability strong and lasting? Can it afford the cost? Will it bear the pain? Even with the best of intentions, can SAF production be steeply ramped up in time to attain the 2050 net zero goal? Unfortunately, action so far – as opposed to mere aspiration – does not offer much hope. So what needs to be done?

SAF is a synthetic replacement for regular jet fuel, made from renewable sources like waste cooking oils, vegetable fats and agricultural waste, as well as captured CO_2. While fossil fuel releases carbon that has been stored in the earth for millions of years, the carbon generated by SAF has only recently been removed, either by plants or by chemical processes. Therefore, SAF does not add to the overall amount of CO_2 in the atmosphere. Apart from this direct CO_2 benefit, SAF reduces the particulates and smoke that emerge from the engine and enhance contrails. Contrails are increasingly seen as deadly by climate scientists.

SAF is a "drop-in" fuel meaning that since its chemical composition is very similar to normal fossil fuel the two can be used interchangeably. Although current regulations only permit up to 50 per cent of SAF in jet fuel blends, efforts are on to clear even 100 per cent SAF. However, the process is slow. Both Airbus and Boeing have pledged to make their aircraft fully compatible with 100 per cent SAF by 2030.

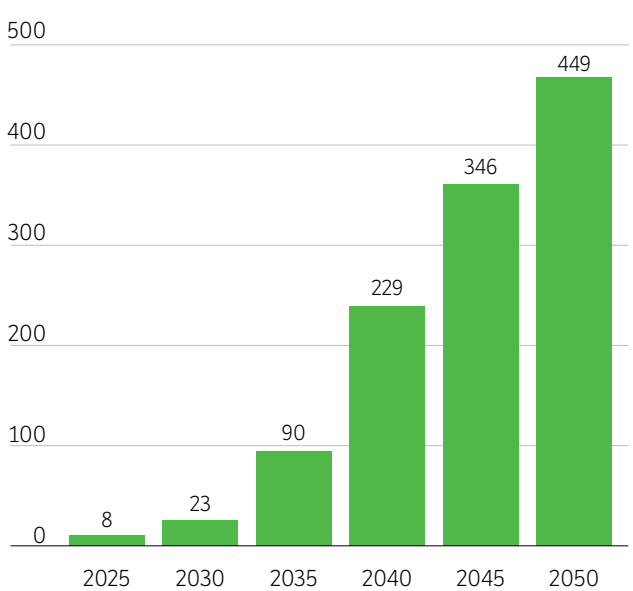
Advocates of SAF claim that it can reduce emissions by up to 80 per cent across the lifecycle of the fuel, with a 100 per cent reduction possible in future. However, some recent studies have concluded that the emissions created in flight are considerable and that the benefits of SAF may be rather less than estimated. There are also concerns about secondary environmental impacts, including SAF feedstocks being grown as cash crops and usurping land used for food production. A 2023 report by the UK-based Royal Society said biofuels do reduce emissions, but that many estimates do not account for "land use changes". Accounting for those changes "significantly" impacts estimated carbon output, and "few hit the renewable energy directive target".

HOW IS SAF PRODUCED?

SAFs can be produced from a variety of feedstocks and through several different technologies. As of July 2023, 11 conversion processes for SAF production had been approved and seven other processes were under evaluation.

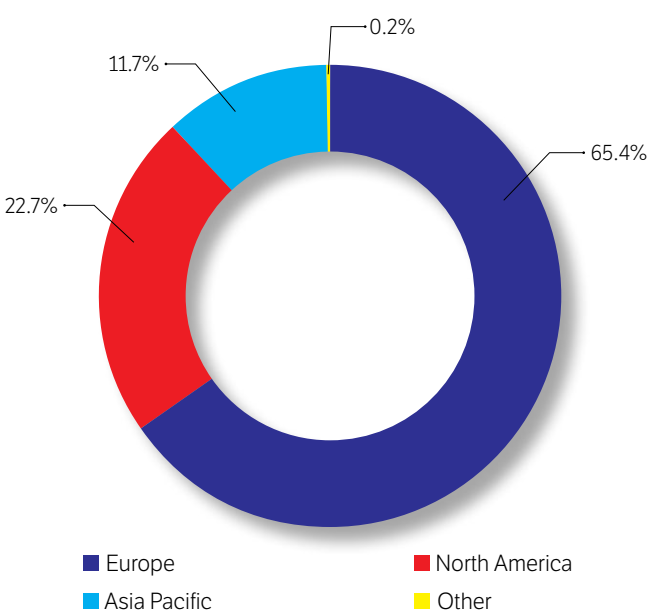
- **First Generation SAFs:** These are the cheapest, simplest to produce and hence most commonly available types. They come mainly from fats, oils and greases (FOGs). However, limited availability of feedstocks prevents significant scaling up of production.
- **Second Generation SAFs:** These are obtained from abundant biomass sources like algae, crop residues, animal waste, forestry residues and sludge as well as from municipal solid waste. But production requires advanced technologies and complex processes that are expensive and energy-intensive.
- **E-Fuels:** Also known as electrofuels, these are prepared from renewable energy and captured CO_2. They are made using a "power to liquid" (PtL) process that produces liquid hydrocarbons synthetically. Although very expensive, they could potentially produce unlimited supplies of

EXPECTED SAF REQUIRED FOR NET ZERO BY 2050 (BILLION LITRES)



Source: IATA

SAF USE BY REGION



Source: CAPA Centre for Aviation

SAF. To be truly sustainable they need large quantities of renewable electricity, as well as a substantial increase in carbon capture and storage capacity.

CHIEF CHALLENGES

According to the Geneva-based Air Transport Action Group (ATAG) over 7,75,000 commercial flights have been operated using SAF since 2011. Worldwide, 69 airports are currently regularly supplied with SAF. And 50 airlines have committed to 2030 SAF goals ranging from 5-30 per cent of their total fuel usage, with most committing to 10 per cent. It all looks rosy. However, formidable challenges lie ahead.

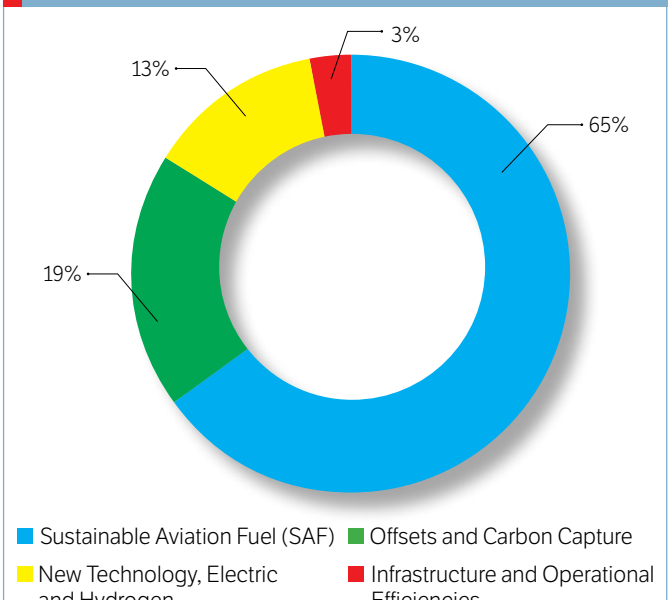
- **Price:** The main issue is producing SAF at scale, across the globe, at an affordable price. This seems a distant dream because SAF currently costs between three and five times as much as regular jet fuel.
- **Production:** According to IATA, around 600 million litres of SAF were produced in 2023. Production is expected to more than triple in 2024, to around 1.9 billion litres. Even this will constitute just 0.53 per cent of the total jet fuel consumed during the year. An ICAO sponsored goal of five per cent CO_2 emissions reduction by 2030 would need around 27 per cent of global renewable fuel production capacity to be devoted to SAF. However, SAF currently accounts for just three per cent of such production. Another daunting figure – in order to reach the 449 billion litres annual SAF production capacity that the 2050 net zero goal is overwhelmingly dependent on, the CAGR needs to be 23.39 per cent.
- **Patchy Usage:** Every drop of SAF is purchased but the users are mostly full-service and network airlines. According to the CAPA - Centre for Aviation, the ubiquitous LCCs are less likely to adopt SAF enthusiastically since fuel typically accounts for a large proportion of their operating costs. Due to limited renewable fuel availability, airlines will also need to purchase much more expensive types like e-fuels. European airlines are mainly driving SAF adoption, accounting for around two thirds of globally reported SAF use. North America, although the world's largest aviation market, is way behind. More worryingly, SAF usage is still low in the fast-growing Asia Pacific region and practically non-existent in the rest of the world.
- **Political Pressures:** A second Donald Trump presidency would quite likely be a nightmare for Earth's climate. It may be recalled that in his first term, Trump pulled the US out of the 2015 Paris climate agreement, rolled back environmental regulations, unleashed large-scale oil and gas drilling and much more. Recent reports quote his advisors as believing he did not go far enough. They are openly planning an "all-out war on climate science and policies". Where would that leave the Biden administration's "SAF Grand Challenge" goal of producing sufficient SAF to meet 100 per cent of US demand by 2050? In July 2024, even the European Commission, otherwise a staunch proponent of strong action to mitigate global warming, succumbed to pressure from legacy airlines and excluded long-haul flights from the scope of its non-CO_2 aviation emissions monitoring scheme that commences in January 2025. This means that 67 per cent of European aviation's contrail climate impact will be ignored for at least another two years.

SEEKING SOLUTIONS

Accelerating production and reducing the cost of SAF is imperative and will best be achieved by a combination of urgent measures. Some of these are:

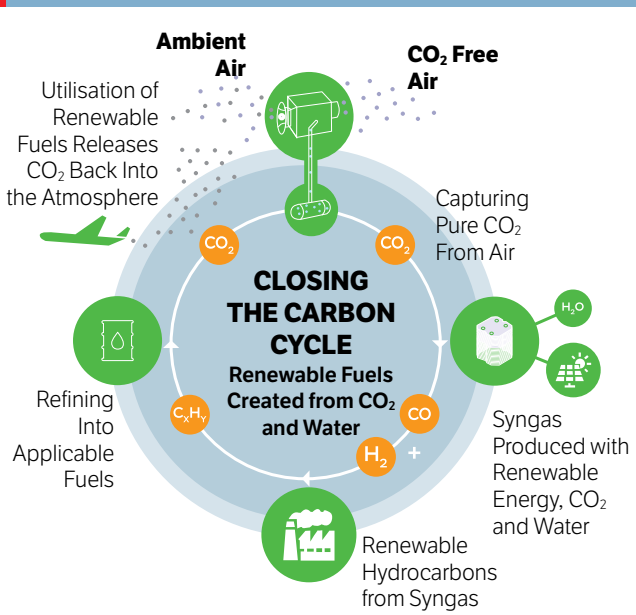
- **Diversifying Feedstocks:** The global supply of hydrogenated fatty acids (HEFA) like used cooking oils and animal

CONTRIBUTION TO ACHIEVING NET ZERO CARBON IN 2050



Source: IATA

POWER TO LIQUID (PTL) SAF PROCESS



Source: Zenid

fats could soon run out. Focussing on other certified pathways and feedstocks will "greatly expand the potential for SAF production," according to IATA.

- **Exploiting Existing Refineries:** Crude oil refineries should be mandated to co-process a small but increasing percentage of approved renewable feedstocks too. This could quickly scale up SAF production.
- **Increasing Aviation's Share:** As mentioned earlier, SAF constitutes just three per cent of renewable fuel. Other sectors that grab the lion's share – like transportation – should be incentivised to go electric, leaving more of the pie for aviation. The switch from diesel to SAF requires only minimal modification of existing renewable fuel facilities.
- **Boosting Investment:** An investment of over $1 trillion may be required to create enough SAF production capacity for 2050. Government support is crucial. The big energy companies should also be compelled to invest some of their huge profits in SAF.
- **SAF Mandates and Subsidies:** The long-term trend is expected to be a reduction in SAF production costs enabled by economies of scale and technological advancements, provided demand is assured. Governments can help with strict mandates and generous incentives to use SAF. The EU, for instance, has introduced regulations that include mandates to use SAF starting at two per cent from 2025 and increasing to six per cent by 2030. The US offers subsidies to bring down the price of sustainable fuels. India has set a target to blend one per cent SAF with jet fuel in 2027 and two per cent in 2028. However, these will apply only to international flights initially.
- **Pursuing Contrail Mitigation:** Recent research suggests that contrails could have a greater climate impact than CO_2 emissions and that reducing the amount of soot emitted can reduce contrail persistence. Contrail management therefore could potentially deliver quick environmental gains for the industry, giving it more time to switch to SAF. The most heartening finding is that SAF results in less persistent contrails.
- **Sustainability at the Heart of Engine Business:** Nearly all major engine manufacturers are working on making their future engines SAF compatible. Leading amongst them is CFM that clearly supports the commercial availability of Sustainable Aviation Fuel (SAF) and is ensuring that their future engines are compatible with 100 per cent SAF integration. For more than four decades, CFM International has invested in technologies to make engines cleaner, quieter, and more efficient. In October 2021, CFM, along with other key aviation leaders, had co-signed the industry declaration to adopt a long-term climate goal of net-zero carbon emissions by 2050. CFM believes that broader adoption of SAF is the best approach to immediately reduce carbon emissions; it has the potential to reduce aviation net carbon emissions up to 80 per cent, independent of other actions. The company began testing SAF in 2006. Since 2016, airlines worldwide have conducted more than 400,000 flights powered by sustainable fuels. In 2021, CFM helped make aviation history with United Airlines and other partners on the industry's first commercial carrier flight full of passengers using 100 per cent sustainable aviation fuel (SAF). The demonstration flight, which carried more than 100 passengers on a CFM LEAP-1B-powered Boeing 737 8 aircraft using 500 gallons of drop-in SAF (fully compatible with existing aircraft fleets) in one engine with the hope to move the industry closer to regulatory approval of 100 per cent SAF. All CFM products are fully compatible with current blended-SAF requirements.

AMONGST ENGINE MANUFACTURERS, CFM IS LEADING THE SAF CHARGE AS ALL CFM PRODUCTS ARE FULLY COMPATIBLE WITH CURRENT BLENDED-SAF REQUIREMENTS

PHOTOGRAPH: CFM

ACTIONS SPEAK LOUDER THAN WORDS!.

Matt Finch, UK head of campaign group Transport & Environment says, "There are good SAFs, and there are bad SAFs, but the brutal truth is that right now there is not much of either. Conversely, right now there are thousands of new planes on order from airlines, and all of them will burn fossil fuels for at least 20 years. Actions speak louder than words, and it's clear that the aviation sector has no plans to wean itself off its addiction to pollution."

Finch's opinion may seem unduly harsh since the aviation industry is indeed sincere in its desire to attain environmental sustainability. Yet, it is undeniable that traffic growth will far outstrip efficiency improvements for the foreseeable future, thus increasing carbon emissions. IATA's strategy therefore rests heavily on SAF. Too heavily perhaps? Just a couple of high-profile accidents even partly attributable to the use of SAF could prove a severe setback.

The cost of SAF will surely fall with higher production levels and economies of scale. However, it is unlikely that it can ever match regular fuel costs. But if not SAF, what? In the near term, there is a woeful lack of alternatives. Battery-powered planes are suitable only for short flights of small aircraft. Hydrogen will probably take decades to overcome technological and infrastructural barriers, problems of scalability, and even environmental concerns.

Yet, with SAF being constantly pushed as a panacea, a reality check is essential. The journey to achieve net zero by 2050 will in truth be long, arduous and terribly expensive. Success is by no means assured without urgent measures. Will the aviation industry shoulder its responsibility to curb emissions, no matter what the cost, even reducing flying if necessary? If not, will planet Earth ever forgive us? SP

AIR CHIEF MARSHAL A.P. SINGH
PVSM AVSM

The Indian Air Force completes 92 years of glorious existence on 08 Oct 2024. It is a day that fills each one of us with immense pride as we remember the accomplishments of the Indian Air Force and celebrate the journey from humble beginnings evolving into one of the finest Air Forces in the world. On this day, we resolve to carry forward the golden legacy of our air veterans and re-dedicate ourselves in service of this great nation.

We are witnessing an era of conflicts and instability in the world. New 'normals' are emerging and existing dogmas are being discarded. The character of warfare is rapidly evolving with disruptive technologies, multi-dimensional & multi-domain operations transforming the warfare landscape. Better global inter-connectivity has contributed to increased complexities requiring new 'risk management' strategies. The breakdown of traditional supply chains due to the pandemic and conflicts is a case in point. We face a multitude of threats and challenges posed by our adversaries and non-state actors. A strong, capable Air Force is an inescapable requirement to ensure credible deterrence. The IAF will remain ever vigilant and we assure you that defence of our nation's sovereignty and integrity will be ensured at any cost.

The IAF has made significant strides in strengthening operational capabilities and adapting to the ever-evolving challenges of modern warfare. Our theme this year - Bhartiya Vayu Sena - Sashakt, Saksham Ewam Atmanirbhar perfectly encapsulates the journey we have embarked upon. We have become more empowered with better technology, achieved new levels of capability in operations, and taken concrete steps toward self-reliance in defence R&D and production. From effectively safeguarding our airspace 24x7, successfully conducting regular operational exercises including an Air Force level exercise Gagan Shakti to undertaking critical humanitarian assistance missions, we have demonstrated a wide range of operational capabilities. The flawless planning and execution of our first multinational air exercise Tarang Shakti is a measure of our fortitude and competence. We are rapidly evolving into a modern air force capable of meeting future challenges with innovation, agility, and resolve.

This would not have been possible without the courage, perseverance and unwavering commitment of our predecessors. I specially want to mention the dedication and support of our families, continued guidance of the veteran community and the backing of the nation. As we march forward, we will continue to strive towards a stronger, more capable, and self-reliant Indian Air Force - a service that will remain a symbol of strength, security, and sovereignty for our nation. Integrated operations to ensure operational efficiency will continue to remain in the forefront of our training and planning.

I convey my heartiest congratulations to SP Guide Publications as it approaches the significant milestone of 60 years of service to the nation. Since, its inception in 1964, SP Guide Publications has consistently demonstrated commitment to high-quality journalism in the aerospace and defense sectors, earning a well-deserved reputation as Asia's largest media house in this domain. I wish SP Guide Publications continued success in its pursuit of excellence. My best wishes for your future endeavours.

Jai Hind!

08, Oct 24

AIR CHIEF MARSHAL
CHIEF OF THE AIR STAFF
INDIAN AIR FORCE

AIR CHIEF MARSHAL A.P. SINGH TAKES CHARGE OF THE INDIAN AIR FORCE AT A CRUCIAL TIME WHEN THE IAF IS FACING CRITICAL SHORTAGES IN ITS NUMBER OF SQUADRONS

"IAF AIMS TO BE AN AGILE AND ADAPTABLE AIR FORCE"

On the occasion of the 92nd IAF Day, **Jayant Baranwal, Editor-in-Chief, *SP's Aviation*** spoke extensively to **Air Chief Marshal A.P. Singh,** Chief of the Air Staff, on a range of subjects concerning the Indian Air Force

PHOTOGRAPHS: IAF_MCC / X

***SP's Aviation* (SP's): As the new Chief of the Air Staff of one of the largest and the most professional Air Forces in the world, what will be your vision:**
(a): Towards the build-up of combat power,
(b): Towards sustainability and boosting process of your human resource,
(c): Towards the overall role for the country and beyond?
Chief of the Air Staff (CAS):
(a): Building up of combat power is directly proportional to self-reliance and increased production in defence manufacturing. The IAF is committed towards the vision of 'VIKSIT BHARAT - 2047' by supporting Atmanirbhar Bharat & Self-Reliance in Defence Manufacturing. The most preferred option for capital acquisition is Buy Indigenously Designed Developed and Manufactured (IDDM) followed by Buy (Indian) category. In the last few years, IAF has signed numerous contracts with Indian DPSUs like HAL and BEL for procurement of major equipment like LCA Mk1A fighter aircraft, Light Combat Helicopter, Aslesha Radar, Low Level Tracking Radar, weapons etc. Contracts with Indian private industries have also been signed for procurement of Counter Drone Systems and other defence equipment. Additionally, production of 40 C295 aircraft by Tata Advanced Systems Ltd (TASL) conforms with the vision of Atmanirbhar Bharat. This is the first project of its kind and will help in developing an aerospace ecosystem in India. Its factory has recently been inaugurated by Prime Minister Modi in Vadodara.
(b): Human resource determines the effectiveness and efficiency of any organisation. Towards this, policies related to Human Resources are formulated, reviewed and refined regularly so that we induct the best talent and provide them the best training through state of art training infrastructure. IAF lays emphasis on 'Right Person for the Right Job at Right Time'. From realistic training, upskilling to carrying out workflow analysis to increase efficiency, we are focussing on HRM to boost our combat effectiveness. Use of modern technology for enhancing skills of human resources by utilising AR/VR in undertaking maintenance activities has been planned. For maintaining IAF's combat edge, upskilling of human resource, who are operating and maintaining complex modern day aerospace systems, is an absolute necessity. Thus, human resource upskilling is a continuous process which includes various in-service courses and courses from other institutes of repute.
(c): The IAF is cognizant of the role it has to play towards national security and defence as well as towards Nation Building as a whole. As mentioned earlier we are fully committed to the vision of 'VIKSIT BHARAT - 2047' and Atmanirbharta while ensuring all steps to enhance our combat potential.

"MRFA would be crucial in bridging the capability gap arising due to phasing out of fighter aircraft and phased operationalisation of indigenous fighter aircraft"
— Air Chief Marshal A.P. Singh, Chief of the Air Staff

SP's: We had recently conducted an exclusive interview with the Chief of German Air Force. He clearly stated and responded to one of our questions as follows:
"We can always develop and manufacture new programmes. However, we cannot wait for 10/15 years for that capability. Hence, we need to acquire the necessary and ready-made equipment to meet such capabilities (instead of allowing any undesirable waiting process and compromise on the build-up of capability) so that we are able to deploy where and when necessary – and today".
(a): As we continue emphasising on Atmanirbharta, how would you like to perceive such an expression coming from the military leadership of one of the leading European countries which otherwise is well-renowned of being capable enough to develop and conclude any of the futuristic programmes.
(b): While we go strong on the Atmanirbharta, can we also ensure that there will be no compromise on National Security?
CAS:
(a): Atmanirbharta will assist in providing innovative solutions during peace and crisis situation. The indigenous manufacturing and supply chain of defence equipment will mean assured availability as per our requirement and hence ensure that the conflicts end on our terms. Dependency on imported equipment/weapons is being reduced in a phased manner.
(b): Indigenisation Push: The IAF is committed towards the vision of 'VIKSIT BHARAT - 2047' by supporting Atmanirbhar Bharat & Self-Reliance in Defence Manufacturing. The most preferred option of capital acquisition is Buy Indigenously Designed Developed and Manufactured (IDDM) category equipment followed by Buy (Indian) category. In the last few years, IAF has signed numerous contracts with Indian DPSUs like HAL and BEL for procurement of major equipment like LCA Mk1A fighter aircraft, Light Combat Helicopter, Aslesha Radar, Low Level Tracking Radar and Light Specialist Vehicle-Mobile Communication Terminal etc. Contracts with Indian private industries have also been signed for procurement of Counter Drone Systems and other defence equipment.

Additionally, production of 40 C295 aircraft by Tata Advanced Systems Ltd (TASL) conforms with the vision of Atmanirbhar Bharat. This is the first project of its kind and will help in developing aerospace ecosystem in India. All these plans in no way compromise on National Security which will always be paramount. Constant liaison is being maintained with DPSUs to ensure that the promised production rate is achieved.

IAF'S WISH LIST

SP's: Can you kindly share the wish-list of our Air Force for next 5 years?

CAS: IAF aims to be an agile and adaptable air force that provides decisive aerospace power in furtherance of our national interests. Towards this we have a definite road map to enhance our combat potential.

Towards achievement of the same, some of the contracts planned/ likely to be signed in the next five years are as follows:

S. No.	Scheme
1.	AL-31FP (LH & RH) Aero Engine of Su-30 MKI
2.	Low Level Transportable Radar
3.	Avionics Upgrade Dornier 228
4.	Additional C295 aircraft
5.	Lease-Basic Trainer aircraft (BTA)
6.	MLH Upgrade
7.	Multi Role Fighter Aircraft (MRFA)
8.	Light Combat Helicopter (LCH) - Series Production (SP)
9.	Light Utility Helicopter (LUH)
10.	Additional Su-30 MKI aircraft with associated equipment and Su-30 upgrade project
11.	Wet Lease of Flight Refuelling Aircraft (FRA)
12.	Helicopter for VVIP
13.	Medium Transport AC (MTA)
14.	RPA (MALE)
15.	VSHORADS
16.	ISTAR
17.	High Altitude Long Endurance Remotely Piloted Aircraft (HALE RPA)
18.	Bullet Proof Security Vehicle (BPSV)
19.	Akash-NG Missile
20.	Astra Mk-II
21.	Next Generation Anti-Radiation Missile (NGARM)
22.	Combined Enterprise Regional Information Exchange System (CENTRIXS) Fly Away Kit (CF AK)
23.	Light Machine Gun (LMG)
24.	Procurement of 97 LCA Mk1A aircraft from HAL
25.	Additional Fighter Refueller Aircraft (FRA)
26.	Chaff & Flares for Aircraft
27.	Long Range Dual Band Infrared Search and Track Systems (IRST)
28.	Multi Band Navigation Receiver (MBNR)
29.	Long Range Glide Bomb (LRGB)
30.	Fuzes for Aerial Bomb
31.	Directed Energy Weapons
32.	AWACS/AEW&C

SP's: Please allow us to request for status update on MRFA (Multi-Role Fighter Aircraft) requirement of our Air Force. Will 'Make in India' be a mandatory requirement for this programme?

CAS: MRFA would be crucial in bridging the capability gap arising due to phasing out of fighter aircraft and phased operationalisation of indigenous fighter aircraft. The case is being progressed as per provisions of DAP 2020 and due impetus will be given to Atmanirbharta.

SP's: Kindly indicate on the progress of Space Command. And please also give your perspective how (and why) this frontier will be crucial, in coming times?

CAS: Air and Space form a continuum, and this fact presents both opportunities and threats to air operations. Space applications are increasingly being used in military operations. Hence, it is essential to understand the nuances of space domain and the concept of operation. Our adversaries are pursuing niche space domain warfighting technologies which are considered as threats. Therefore, IAF has updated its doctrine, and recognised the importance of space domain in military operations. Measures are being taken to exploit the maximum potential of space domain into IAF operations. Considerable strides have been taken by us for inculcating 'space culture' in IAF. IAF has taken space domain training seriously, towards which space training syllabi at all levels has been formulated and implemented. The IAF has initiated necessary steps to coordinate with the established Defence Space Agency (DSA) for training of all defence personnel. This is the first step and we will move forward from here. SP

> "Use of modern technology for enhancing skills of human resources by utilising AR/ VR in undertaking maintenance activities has been planned. For maintaining IAF's combat edge, upskilling of human resource; who are operating and maintaining complex modern day aerospace systems, is an absolute necessity."

MEDIA BRIEFING BY CHIEF OF THE AIR STAFF, AIR CHIEF MARSHAL AMAR PREET SINGH

A BOLDER APPROACH

TOWARDS BUILDING CAPABILITY INDIGENOUSLY — AIR CHIEF MARSHAL A.P. SINGH

The annual press day by Chief of the Air Staff Air Chief Marshal A.P. Singh was a testament to the Indian Air Force's strategic vision for modernisation and self-reliance

By MANISH KUMAR JHA

PHOTOGRAPHS: INDIAN AIR FORCE

ON THE OCCASION OF THE INDIAN AIR FORCE'S ANNUAL PRESS day, the new Chief of the Air Staff, Air Chief Marshal A.P. Singh addressed the media, highlighting pivotal advancements in the IAF's capabilities, particularly regarding the Tejas fighter aircraft and improvements in anti-defence systems.

In his address, the Air Chief announced that the IAF is looking at having the entire inventory produced in India by 2047. "It is important to have indigenous weapons systems to deal with any future security challenges," he said. "You cannot afford to have them being bought and rely on that supply chain. We must have these things being produced in India. We can't be stocking up everything forever. These things will have life. If we keep stocking up, we'll have wastage." Air Chief Marshal A.P. Singh said.

ADVANCEMENTS IN FIGHTER AIRCRAFT (LCA TEJAS & AMCA)

One of the major focal points of Singh's address was the ongoing development of the Tejas fighter jet. The IAF has made significant strides in integrating advanced technologies into the Tejas, enhancing its operational efficiency and combat readiness. Singh noted that these advancements not only improve the aircraft's performance but also ensure that it meets contemporary warfare requirements.

However, IAF Chief Air Chief Marshal A.P. Singh also flagged the delayed delivery of the LCA Tejas combat jets. "Unless you have private industry coming in and chipping in, I don't think we can continue relying only on one agency. Hindustan Aeronautics Limited (HAL) will also have its limitations when it comes to what it can do in a (certain) timeframe," Chief suggested during the interaction.

He clearly warned that India lags in technology and production capacity. He has earlier also explained in terms of achieving the necessary strength (number of squadron) that 'Atmanirbharta' cannot come at the cost of Nation's defence. Chief explained that besides HAL, there is a need to bring private industry to aerospace manufacturing. This is crucial in achieving scale and speed towards production and delivery. "It is a known fact that Tejas has been delayed. There is no doubt. There is also a promise that the production rate will be increased to 24 aircraft per year," he said.

Chief also highlighted the recent revamp of HAL's fighter jet assembly line which is geared toward manufacturing 24 aircraft annually. He was cautiously optimistic about the inadvertent seven-month delay as per the roadmap. The IAF signed a contract for 40 LCA Mk1 in 2016. I was posted in ASTE when the first induction took place. Today in 2024, we have so far received 38," the Air Chief Marshal said.

The Cabinet Committee has already sanctioned the 83 Tejas Mk1A with further planned orders for 97. Further, upon the advancement of Tejas Mk1A, IAF is aiming for seven squadrons each of the Tejas MK 2 aircraft and the 5th generation Advanced Medium Combat Aircraft (AMCA).

In his overall assessment, the Air Force Chief also highlighted the timeline for AMCA and Tejas –design and structural (R&D). Especially on the LCA advanced version, he said: "This year, December 27 is supposed to be the end of R&D for LCA Mk II."

The Chief of Air Staff revealed plans for an increased operational deployment of Tejas, with ongoing efforts to expand its capabilities across various combat scenarios. The emphasis on indigenous production aligns with the government's 'Atmanirbhar Bharat' initiative, reinforcing the IAF's commitment to bolstering local aerospace manufacturing and innovation.

INDIAN AIR FORCE DAY CELEBRATIONS THIS YEAR WERE HELD AT CHENNAI STARTING WITH AN AMAZING FLYING DISPLAY

A CASE FOR MEDIUM-ROLE FIGHTER AIRCRAFT (MRFA)

The Air Force Chief emphasised that while indigenous efforts are on, the quest for 114 MRFA should also happen parallel to boost the overall capability. Chief said the IAF has issued a Request for Information for the acquisition of 114 fighter jets under MRFA. The acquisition process further requires the RFP and an Acceptance of Necessity (AoN) from the government to move ahead.

ENHANCEMENTS IN ANTI-DEFENCE SYSTEMS

The IAF's focus on enhancing anti-defence systems was a key topic. Singh outlined ongoing upgrades and new technology

PHOTOGRAPHS: CAPTAIN RAJAN K. GUPTA

THE FLYING DISPLAY AT CHENNAI INCLUDED SOME OF THE LATEST AND CRITICAL PLATFORMS AVAILABLE

PHOTOGRAPHS: CAPTAIN RAJAN K. GUPTA

acquisitions aimed at effectively countering emerging threats, ensuring air superiority. In an era where air superiority is paramount, Singh addressed the IAF's strategic focus on enhancing its anti-defence systems. He announced a series of upgrades to existing capabilities and the acquisition of cutting-edge technologies aimed at countering emerging threats effectively. This proactive approach is designed to fortify the IAF's ability to penetrate hostile airspace and protect its assets from sophisticated adversarial systems.

In its highly advanced air defence arsenal, Russia has delivered three S-400 missile system units to India, and the Chief also talked about the rest of the units under the timeline. Singh emphasised the necessity of staying ahead of potential threats, indicating that the IAF is continuously evaluating and upgrading its strategies in response to an evolving security landscape. This commitment not only enhances operational readiness but also underscores the importance of adaptive tactics in modern warfare.

COMMITMENT TO INDIGENOUS DEVELOPMENT

A significant theme of the press day was the IAF's unwavering commitment to indigenous development. Singh reiterated the importance of reducing dependency on foreign technology, stating that self-reliance is crucial for national security. The IAF is actively supporting initiatives aimed at fostering local innovation and capability building in aerospace technology.

By promoting domestic production, the IAF is not only enhancing its operational capabilities but also contributing to the broader goal of economic growth through the aerospace sector. Singh's remarks emphasised collaboration with the Indian defence industry, which plays a vital role in the country's strategic landscape.

IAF'S MANPOWER AND OPERATIONAL SUPERIORITY AGAINST CHINA

On asked if IAF is capable of taking China, Air Chief Marshal said: "We have done our analysis. We don't have a design to go offensive unnecessarily. Only when we are pushed will we be doing something."

He emphasised impeccable training and multinational military exercises with highly advanced militaries worldwide. "India interacts with more air forces as compared to China and hence the training is better. As far as the human angle is concerned, we are way ahead of them," he said.

"So, we have our plans in place. One place we can positively say we are training much better than them. We have exposure much better than them. Because we do come to know through our sources how they train, how many different air forces they interact with and how many do we interact with. So, I am very confident that as far as the human angle is concerned, as far as our people behind the machines are concerned, we are way ahead of them."

However, Chief also made a point that as far as technology is concerned, "we may not be so good as of now". "We have lagged. We were better than them in technology too some time back. But we have lagged in that and we need to catch up with it. As far as production rates are concerned, we are way behind. We need to catch up with that. And that will happen over a while. It cannot happen overnight," he further emphasised.

To ensure that personnel are equipped to handle advanced systems, Singh highlighted ongoing training programmes that prioritise skill development and operational preparedness. He stated that the IAF is committed to maintaining high levels of readiness, with joint exercises and collaborations with other branches of the armed forces being key components of this strategy.

These training initiatives are crucial for ensuring that the IAF remains agile and effective in addressing contemporary threats, further solidifying its position as a formidable force in the region. SP

Manish Kumar Jha is a Consulting & Contributing Defence Editor for SP's Aviation, SP's Land Forces and SP's Naval Forces and a security expert. He writes on national security, military technology, strategic affairs & policies.

FIRST FLIGHT OF LCA MK1A

LCA MK1A DELAYED, MRFA ON SLOW MODE — IMPLICATIONS FOR IAF

The IAF is currently operating at around 30 squadrons, well below the authorised strength of 42 squadrons, and defence analysts recommend 50 squadrons to handle a two-front conflict

By AIR MARSHAL ANIL CHOPRA (RETD)

PHOTOGRAPH: CAPTAIN RAJAN K. GUPTA

LCA 'TEJAS' MK1A DELIVERIES TO THE INDIAN AIR FORCE (IAF) were to begin in March 2024. The strategic community got a jolt when they were told that there were delays because of issues related to supplies of the GE F404-IN20 engines from US-based GE Aerospace. That the aircraft will now be handed over in August. Later the date of delivery was changed to November.

IAF that is already at an all-time low of nearly 30 squadrons was facing the prospect of going below that already low figure. The security establishment and defence hierarchy was reportedly seized of the situation, and acting to retrieve the situation and prevent further delays. During his visit to the US, Defence Minister Rajnath Singh had reportedly flagged the issue.

Not just engines, Tejas Mk1A delivery could be hit over key Danish part, the engine charge amplifiers, now on export blacklist. Denmark authorities have reportedly put export restric-

tions on this item, which is likely to be due to the ongoing Russia-Ukraine conflict. India is in talks with Denmark. It was a small product which was being imported. Because of this export blacklisting, HAL had contracted a Bengaluru firm to indigenise it. The firm, we are told, has almost completed it, and then HAL will carry out tests. It can then be mass produced.

AERIAL THREAT PERCEPTION

China is pulling ahead. They are directly competing with USA. In March this year, in a testimony on Capitol Hill, the head of US Indo-Pacific Command (USINDOPACOM) Navy Admiral John C. Aquilino said that China would "soon have the world's largest air force". In its 2023 report on Chinese military power, the Pentagon noted that the PLA Air Force (PLAAF) and PLAN combined have over 3,150 operational aircraft other than trainers and uncrewed aircraft systems (UAS).

PLAAF has a modern airpower with advanced fighter aircraft. Of its 1,800 combat aircraft (fighter, attack, and bombers), nearly 1,200 are 4th and 5th generation aeroplanes in more than 25 frontline combat brigades. The main active combat aircraft currently include 580 J-10 (multirole) variants, 245 J-11 (air superiority), 280 J-16 (multirole strike), 300 J-20 (5th generation air superiority), 32 Su-27 (air superiority), 97 Su-30 MKK (multirole), and 24 Su-35. China is accelerating its production of the J-16, J-10, and its sea variants as well.

They have nearly 180 H-6 aircraft (Soviet Tupolev Tu-16), of which around 60 are the H-6K cruise missile carrying bombers. They have around 320 transport aircraft including 50 Y-20 (66 tonne). 28 AEW&C and 21 FRA. There are nearly 25 EW aircraft. PLA Ground Forces have nearly 300 attack helicopters.

Pakistan Air Force (PAF) remains significant with 19 fighter squadrons and growing numbers of J-10CE and JF-17 supplementing the F-16 fleet. Pakistan has more AEW&C than much larger and more threatened India. India faces a collusive threat from PLAAF and PAF, who regularly improve interoperability through 'Shaheen' series of exercises. Most defence analysts feel that to take on a two-front war, India must have at least 50 squadrons. Against the authorised strength of 42 squadrons, IAF currently has only around 30 squadrons.

STATE OF IAF FIGHTER FLEET

The Su-30 MKI fleet and the two squadrons of Rafale are the leading-edge operational fighter assets. The Mirage 2000 and MiG-29 fleets have been upgraded to near 4.5 generations standards. Jaguars are ageing but remain significant strike aircraft assets. There are two squadrons of LCA Mk1 with the IAF having already inducted 35 of the 40 LCA Mk1 and five two-seat variants. Last MiG-21 squadron will retire very soon. All this adds up to around 650 operational fighters, with around 450 of 4th and 5th generation.

The plan to acquire 114 additional fighters under MRFA (Multi Role Fighter Aircraft) is still at post RFI (Request for Information) stage. RFI was received in mid-2018. The Request for Proposal (RFP) has still to go out. Even if it were to be sent out today, it could take nearly 5-6 years for aircraft to induct.

LCA MK1A NUMBERS AND PLANNED TIMELINES

The Tejas Mk1A has more than 40 improvements over the Mk1. It features a new avionic suite centred around EL/M-2052 AESA Radar and later will have the Uttam AESA Radar developed in-house. DARE Unified Electronic Warfare Suite (UEWS), an externally mounted self-protection jammer (SPJ) for enhanced survivability. On-board Oxygen Generation System (OBOGS). And an expanded weapon suite consisting of Astra BVRAAM and ASRAAM. The Tejas Mk1A will have a reduced turnaround time.

The initial contract for 83 Tejas Mk1A aircraft, worth ₹48,000 crore, was signed in 2021 as part of India's broader strategy to enhance its indigenous defence capabilities. The first aircraft was to be delivered by March 2024. On May 20, 2022, the Tejas Mark 1A prototype completed its first flight. On March 28, 2024, the first production series Mark 1A aircraft (LA 5033) conducted its inaugural flight. The aircraft will undergo more testing before being officially transferred to the IAF.

> LCA 'Tejas' Mk1A deliveries to the Indian Air Force (IAF) were delayed due to supply issues with GE F404-IN20 engines from GE Aerospace, with the first aircraft now expected in November 2024

The first Tejas Mark 1A will now be delivered in November 2024 as a result of the delay in obtaining new engines (F404-IN20) and necessary certifications. In FY2024-25, HAL was scheduled to deliver 16 fighter jets. In future, 16 jets will be produced by the Bengaluru plant, and eight by the Nashik production line. Total 83 jets are expected to be delivered by 2028-29. It is hoped that notwithstanding the initial delays, supply chains will be suitably secured, and the deliveries will catch up.

LCA MK2 AND AMCA NUMBERS AND TIMELINES

The Tejas Mk2, also called the MWF (Medium Weight Fighter) will be larger in dimensions and weight, and will incorporate a more powerful General Electric F414-INS6 engine, canards and other design changes. The Tejas Mk2, which is expected to be rolled out in 2025, will have an increased payload carrying capacity and internal fuel, more external hard-points, improved combat range, a completely redesigned cockpit, and an integrated infrared search and track (IRST) system, in addition to the AESA radar. The first flight of Tejas Mk2 is expected to be in 2025. Presuming it happens on schedule, the aircraft should induct into IAF by early 2030s.

The Advanced Medium Combat Aircraft (AMCA) will be a twin-engine, fifth-generation stealth, multirole combat aircraft. The Mark-1 variant of the aircraft will be a fifth generation fighter while the Mark-2 variant will have sixth-generation technologies. A Special Purpose Vehicle (SPV) consisting of Aeronautical Development Agency (ADA), Hindustan Aeronautics Limited (HAL) and a private company is being formed for the development and production of AMCA. In March 2024, the project received approval from India's Cabinet Committee on Security for the prototype development. The General Electric F414 engine will power the first two squadrons of AMCA.

IAF PLANS TO PROCURE AT LEAST 125 AMCA AND WILL START RECEIVING THE AIRCRAFT FROM 2038

Total five prototypes are to be built. The first flight is expected in late 2028. Mass production of the aircraft is planned to start by 2035. The IAF plan to procure at least 125 AMCA in Mark-1 and Mark-2 configurations. If all goes as per plan, the AMCA squadrons will start forming around 2038.

LCA MK1A DELIVERIES

Engines are a critical part. The aircraft is built around the engine. The engine cannot be just changed like that. HAL and General Electric had signed a contract for 99 F404 engines, which are crucial for the Tejas Mk1A jets. GE Aerospace had initially planned to deliver 16 engines annually starting in FY23, as of August 2024, none had been supplied. As expected, HAL has begun using the existing F404 engines in stock to begin testing more Mk1As. Additionally, the certification of new systems for the LCA Mk1A is still reportedly pending, further complicating the aircraft's delivery schedule. Some stock market financial analysts have predicted reduced LCA Mk1A delivery estimates from 14 to 10 jets in FY25. HAL has plans to make good the initial delays by raising production numbers.

TO SUMMARISE

The LCA Tejas is poised to become a cornerstone of the IAF, helping to bolster its fighter squadron strength, which currently stands at 30 squadrons against the sanctioned strength of 42. Notwithstanding the challenges in delivering the Tejas Mk1A aircraft on time, HAL remains confident in its ability to meet the contractual obligations. Operationalisation of the Nashik facility should hasten the process.

American engine maker GE has promised two engines per month and assured that the overall delivery schedule would not be pushed. The firm had explained to the defence ministry that there were global supply chain issues and that it usually takes time for new vendors to be duly certified since parts have to undergo various tests. Meanwhile, HAL is working to ensure that the indigenisation is completed.

97 LCA Tejas Mk1A for ₹67,000 crore was cleared by DAC in November 2023. IAF is set to place many more aircraft orders in times ahead. The success of the LCA Tejas and AMCA programmes is crucial not only to enhance the IAF's operational capabilities but also contribute to India's goal of self-reliance in defence production.

> If the LCA and AMCA programmes stay on schedule and the 114 MRFA aircraft are acquired, the IAF could reach its sanctioned 42 squadrons by 2038

Pakistan is already talking to China for acquisition of the 5th generation J-31 fighter. Pakistani technicians are also working in Turkey on the TAI TF Kaan 5th generation fighter programme. China is targeting to have 1,000 J-20s by 2035, to match USA in the region. Clearly, it is a wake-up call for India. If the LCA and AMCA programme were not to slip and if the 114 MRFA were to be acquired, the IAF will get its 42 squadrons only around 2038. SP

PHOTOGRAPH: SP GUIDE PUBNS

INDIA'S QUEST FOR INDIGENOUS JET ENGINE REMAINS AT THE THRESHOLD

While the Ministry of Defence (MoD) has denied the reports to impose penalties on GE over the delays of the F404 jet engine, India's quest for the indigenous jet engine remains at the threshold in search of its IPs and tech

By MANISH KUMAR JHA

GE'S F404 ENGINE

PHOTOGRAPH: GE AVIATION

THE MINISTRY OF DEFENCE (MOD) HAS REBUFFED REPORTS that India has invoked penalties against the US jet engine manufacturer General Electric (GE) which signed a $716 million deal with HAL in 2021 for 99 F404 engine for Light Combat Aircraft (LCA) Tejas Mk1A.

In a message to journalists on the evening of October 29, the Ministry of Defence (MoD) said, "It has been noted that some media organisations have carried a story that India plans to impose penalties on GE for the delay in delivery of Tejas engines. The story is factually incorrect as no such proposal was considered. The contract is between HAL and GE."

The false reportage was based on the delays from GE and the speculations that the government might impose a penalty. However, it is a pertinent fact that there is an inherent clause – Liquidity Damage –which is embedded in such high stake deals through government-to-government (G-to-G) routes and many cases of military procurement. According to the contract, the first tranche of the jet engines was supposed to start by 2023. In fact, the talks on engine supply did take place during the recent visit of Prime Minister Narendra Modi and Defence Minister Rajnath Singh to the US. As reported, GE has committed to start delivering the engines (F404) for LCA Tejas Mk1A by March/April 2025.

THE ENGINE BLUES FOR TEJAS

The contract was signed in August 2021 between GE and HAL. According to the contract, the US engine maker was to start delivery of 99 engines for the 83 LCA Mk1A last year. The delay has certainly caused the IAF to red-flag the issues at the highest level, leading to multiple talks with the firms and officials from the MoD, India.

The first in the Tejas Mk1A series (LA 5033), which was supposed to demonstrate its worthiness and readiness for the further assembly process took its first sortie in March. However, it did fly with a 'used engine' which was tested for the LCA Tejas in the earlier stage.

Moreover, looking at the state of affairs and clumsy delays, IAF Chief Air Chief Marshal A.P. Singh also flagged the issues on the annual day session with the media.

"It is a known fact that the Tejas aircraft has been delayed. If the promise of producing 24 aircraft per year is kept, that delay can be addressed. We need to look at private players coming in. HAL also has its limitations and looking at the numbers involved, we need the private industry to chip in to meet the production challenges," he said.

Again, HAL also has been ramping up its production line, readying for additional capacity at a newly established line in

(CLOCKWISE FROM TOP LEFT) GE F414 ENGINE FOR TEJAS MK2; M88 ENGINE ON RAFALE BY SAFRAN AIRCRAFT ENGINES; ADOUR ENGINE BY HAL POWERING THE JAGUAR AND SHAKTI OR THE ARDIDEN 1H1 ENGINE JOINTLY DEVELOPED AND PRODUCED BY SAFRAN WITH HAL.

Nasik. In its existing capacity in Bengaluru, the HAL can produce 16 aircraft with the added capacity of 4-5 at the Nasik base.

WHAT CAUSED THE DELAY?

Firstly, reports suggest the supply chain constraint of the components in the wake of ongoing conflict where the US needs to continuously supply military equipment to its partners in the European Union. Reports also suggest the disruption took place due to the bankruptcy of a South Korean defence firm which is supposedly a key supplier of parts and components for the engine.

It is pertinent to note that the jet engine involves the most complex integration of critical parts which requires the highest order of precision and certification.

In fact, recently, at an open session, Larry Culp, Chief Executive Officer, GE, highlighted the supply chain issues, and pointed out "15 different suppliers across its supply chain are involved in the disruptions."

SELF-RELIANCE ON JET ENGINE

India has been striving to have its indigenous engine. It is not that India has not been able to develop jet engines. Kaveri did manage to power aircraft which flew multiple hours in its test run.

However, that fell sort of expectation in terms of overall thrust and weapon load which is what a fighter jet is supposed to do in a combat role. Despite this, Kaveri is now geared up for unmanned aerial vehicles (UAVs) of various payloads and weaponry.

How is the establishment gripping with the possibilities especially that IAF is looking at 500 aircraft in coming decades? Two key projects are already in the pipeline—AMCA and Tejas 2.

The three giants of global engine manufacturers: Rolls-Royce, GE and Safran— each has a working mechanism with the Indian aerospace entity HAL for a variety of aircraft and helicopters.

Cooperation with GE emerged as one of the key possibilities for a tech transfer which will allow India to leapfrog in jet technology and reduce the lengthy time frame for such a complex task which is so far mastered by only a very few – the UK, the US, France and Russia and China with Russian tech.

GE announced it was ready to supply India with its newer F414 engines for the forthcoming Tejas Mk2. The agreement includes the potential joint production of the F414 engines in India.

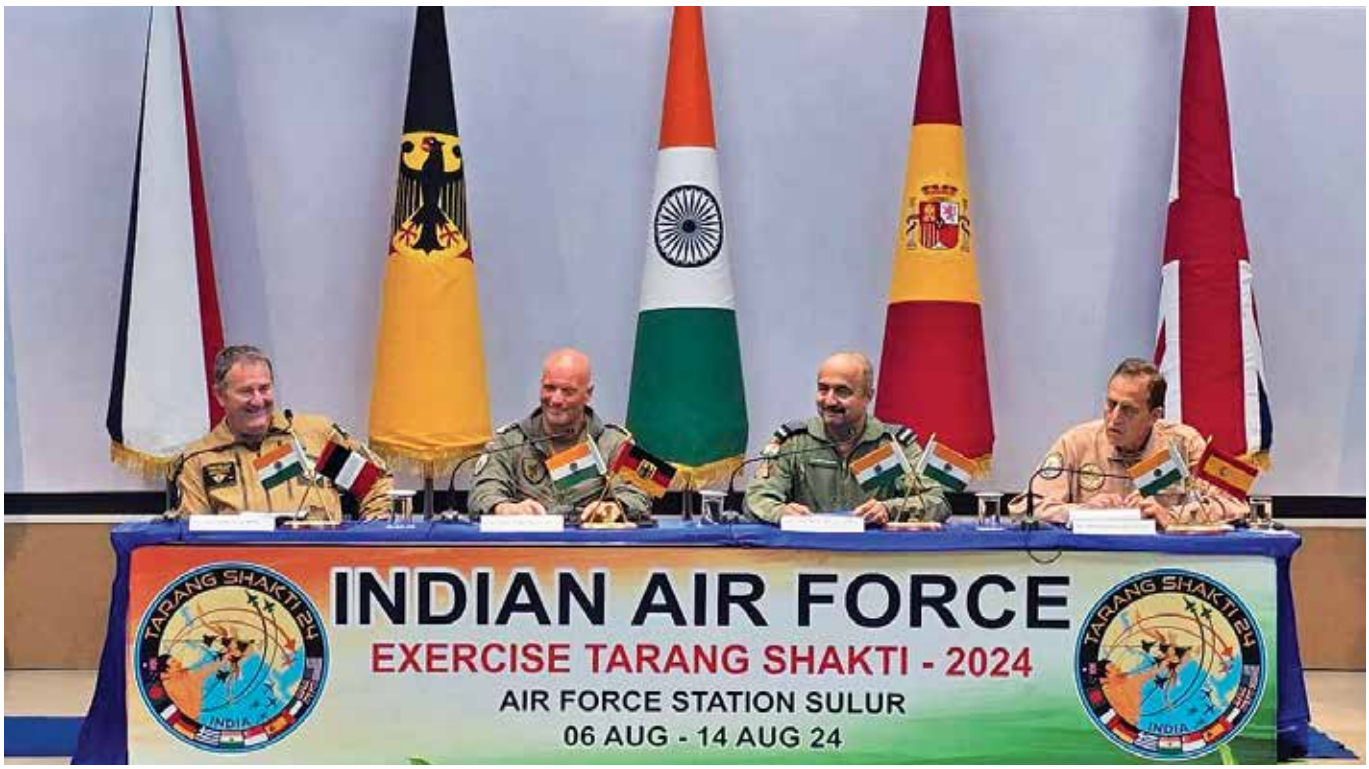
However, the question still hangs around the very question of "IPs"—the Intellectual Property—the rights to owning the full tech for the jet engine which involves the "core" of the engine.

Key players like Rolls-Royce insist on co-development with India which is about having to build it from scratch and acquire the full capability for futuristic projects.

On the other hand, French OEM Safran is already in cooperation with HAL for the Shakti/Ardiden 1H1 engine, certified in 2009, which is one of the key components in the partnership between the two countries for indigenous Light Combat Helicopter (LCH) and Light Utility Helicopter (LUH).

In addition to that Safran Helicopter Engines and HAL have already formalised a workshare agreement for the collaborative development of an Aravalli turboshaft engine for the Indian Armed Forces' 13-tonne Medium Lift class, Multi-Role Helicopter (IMRH) and 12.5-tonne Deck-Based Multi-Role Helicopter (DBMRH). SP

PHOTOGRAPHS: GE AVIATION, SAFRAN GROUP, ROLLS-ROYCE



SPEAKING AT THE PRESS CONFERENCE, THEN IAF CHIEF, AIR CHIEF MARSHAL V.R. CHAUDHARI, CONVEYED HIS APPRECIATION TO ALL PARTICIPATING FRIENDLY FOREIGN COUNTRIES. THE CHIEFS OF THE GERMAN, FRENCH AND SPANISH AIR FORCES, APPRECIATED THE CAPABILITY OF IAF TO HOST SUCH A COMPLEX EXERCISE, AND COMMENTED ON ACHIEVING ENHANCED ABILITY TO WORK TOGETHER.

SHOWCASING POWER OF COLLABORATION

Exercise Tarang Shakti, India's largest multinational air exercise aimed at enhancing interoperability and strengthening operational capabilities, also demonstrated India's growing stature in global military and defence production

By AIR VICE MARSHAL SANJAY BHATNAGAR (RETD)

AMONGST THE VARIOUS BILATERAL AND MULTILATERAL combat exercises that the Indian Air Force (IAF) participates with its Friendly Foreign Countries, the recently concluded Exercise Tarang Shakti was one of the most talked-off in geopolitical circles and also very well covered by the international media.

This indicates India's recognition as a serious professional player in the global military arena and a force to reckon with. Exercise Tarang Shakti, India's largest multinational air exercise was aimed at enhancing interoperability, build better cooperation amongst participating forces, gain operational experience and enhance coordination among Friendly Foreign Countries (FFCs). Primarily, it strengthened partner forces' capability to work cohesively across multiple domains.

Air Forces of ten friendly nations including Australia, Bangladesh, France, Germany, Greece, Spain, United Arab Emirates, United Kingdom, United States, and Singapore flew in with 67 combat aircraft. There were also 38 observers from 18 countries. This landmark air warfare combat exercise was conducted in two phases at two different locations.

THE FIRST PHASE: AF BASE SULUR

The first phase of Exercise Tarang Shakti was conducted at

PHOTOGRAPH: IAF_MCC / X

AT EXERCISE TARANG SHAKTI, THE THEN IAF CHIEF AIR CHIEF MARSHAL V.R. CHAUDHARI FLEW IN A FIGHTER AIRCRAFT FORMATION WITH GENERAL STEPHANE MILLE, CHIEF OF STAFF OF THE FRENCH AIR & SPACE FORCE, LT GENERAL INGO GERHARTZ, CHIEF OF THE GERMAN AIR FORCE AND AIR GENERAL FRANCISCO BRACO CARBO, CHIEF OF STAFF, SPANISH AIR AND SPACE FORCE.

AF Station Sulur, Tamil Nadu from August 6 to 14, 2024. Sulur witnessed diverse array of advanced fighter aircraft from FFCs operating more than 34 aircraft provided by air forces of four nations, viz. French Air and Space Force, Luftwaffe Air Force, Spanish Air Force, and the Royal Air Force of UK. Overall a total of more than 205 sorties were flown. Exercise involved more than 700 personnel.

The French contingent comprised of Rafale fighter jets, A400M transports, A300 MRTT mid air refuellers and 160 personnel. Five German Eurofighters and an A400M transport aircraft took part. The Spanish Air force participated with its Eurofighters.

Several indigenous platforms, the LCA, Light Combat Helicopter (LCH), Light Utility Helicopter (LUH), trainer HTT-40, and the aerobatic helicopter team, Sarang, took to the skies over Sulur in an air display.

THE SECOND PHASE: AF BASE JODHPUR

Participating forces collaborating during this phase included USAF units, as well as units from the Royal Australian Air Force (RAAF), Sri Lanka Air Force (SLAF), Hellenic Air Force, Republic of Singapore Air Force (RSAF) and United Arab Emirates Air Force.

The exercise was mega in true sense. Jodhpur offers a very congenial and safe flying environment. The base witnessed the USAF participating assets viz. the A-10 Thunderbolt-II and the F-16C Fighting Falcon. The RAAF that deployed for the first time to India, flew the F-18 combat aircraft in the exercise. Jodhpur skies also witnessed German, Spanish and UK's Typhoon aircraft. Crucial combat enabling roles participation came from the Air Refueling Squadron's KC-135 Stratotanker and the C-130H Hercules. RAAF also included EA-18G Growler the Electronic warfare aircraft. Luftwaffe Air Force also had A400M participating in the exercise. UAE Air Force took part with its AWACS aircraft. SLAF participated with its C-130 aircraft. A total of 800 sorties were flown during this phase. Besides these active participants, representatives of 18 countries also participated through their observers.

The night skies above Jodhpur reverberated with the thunderous sound of powerful 100 aircraft taking to the skies by night. The night time sorties showcased the skills of the participating forces, demonstrating their remarkable interoperability, thereby demonstrating their readiness of the forces to operate effectively in any appointment by day and night.

IAF PARTICIPATION

In each of these phases, the IAF pitted about 40 plus aircraft comprising of Su-30 MKI, Rafale, Mirage 2000, LCA Tejas Mk1, Jaguar and MiG-29 fighter aircraft. Other aircraft included LCH Prachand, ALH Mk-IV Rudra, C-130, IL-78 FRA, AEW&C. Besides the crew of these platforms, the exercises also provided an unique opportunity to the weapons system operators (WSOs), fighter controllers air traffic controllers. In the Sulur phase, the MiG-29K aircraft of the Indian Navy also participated.

INTEGRATED OPERATIONAL FLYING

Both the phases covered broad array of operational combat scenarios. Flying exercises comprised of unique and challenging scenarios incorporating large force engagements (LFEs), simulating beyond visual range missile engagements of vary-

PHOTOGRAPH: IAF_MCC / X

EXERCISE TARANG SHAKTI, INDIA'S LARGEST MULTINATIONAL AIR EXERCISE, HAD AIR FORCES OF TEN FRIENDLY NATIONS FLYING IN WITH 67 COMBAT AIRCRAFT. THIS LANDMARK AIR WARFARE COMBAT EXERCISE WAS CONDUCTED IN TWO PHASES AT TWO DIFFERENT LOCATIONS.

ing lethal envelopes, offensive counter air and air defence exercises were practiced. The scenarios also involved controlling the fighter aircraft by AWACS and AEW&C platform and respective fighter controllers guiding them for a kill. It also offered operational practice to elements of surface to air missiles.

On the sidelines of exercise Tarang Shakti, a series of FFC operational engagements were also undertaken. During the exercise, the 25th Expeditionary Fighter Squadron Commander and Detachment Commander of USAF in India, took to the skies in Su-30 MKI aircraft with the Commanding Officer of the Su-30 MKI squadron of the IAF. He appreciated that, "this training we do here is very rewarding and the partnership we're building with other squadrons from multiple nations is very valuable." Another interesting joint event was IAF Su-30 MKI being refueled in the air by Western A330 MRTT MMU tanker aircraft of the Luftwaffe Air Force.

AIR DOMAIN AWARENESS SYMPOSIUM

The multinational level exercise was not just restricted to operational flying aspects, interaction included an academic exchange and a professional development multinational symposium on 'Air Domain Awareness' by the IAF on September 11, 2024 at Jodhpur. The theme was 'Collaborative approach to facilitate air domain awareness towards enhancing regional security.'

This unique symposium had 50 delegates, representing 27 nations, wherein international delegates shared their concepts of air domain awareness and discussed strategies to tackle challenges from both national and regional perspectives. The symposium fostered an open exchange of ideas among subject matter experts on emerging challenges related to air situational awareness and airspace management. Discussions focused on policy matters and technological solutions for effective information sharing.

SHOWCASING INDIAN DEFENCE PRODUCTION CAPABILITIES

With an objective to showcase India's booming indigenous defence production ecosystem, Defence Minister inaugurated India Defence Aviation Exposition (IDAX-24) from September 12 to 14, 2024. 50 plus participants from DRDO and its labs, Indian DPSUs, private firms and start-ups participated. It provided good exposure to all the participants and local populace. IDAX-24 showcased indigenous skills and indomitable spirit of Indian aviation industries to a wide spectrum of decision makers and end users from global Air Forces. IAF also fielded its LCA Tejas, LCH Prachand and ALH Mk-IV Rudra, the platforms that are competing globally to equip various modern air forces.

FLYING AND GROUND DISPLAYS

The Exercise Tarang Shakti also showcased on the sidelines a display by Agniveer Vayu Women Air Warrior Drill team (AWDT) and demonstration from LCA Tejas, LCH Prachand, Sarang Helicopter Display Team of the IAF flying the HAL manufactured Advanced Light Helicopter (Dhruv) and the Surya Kiran Aerobatic Team (SKAT) IAF, flying the Hawk aircraft. The displays were well appreciated by visiting participants and local populace.

LCA TEJAS PROVES ITS METTLE

Employment of LCA Tejas in almost all exercises, the LCA Tejas became a mascot for showcasing India's manufacturing prow-

PHOTOGRAPHS: IAF_MCC / X, TEAM_LUFTWAFFE / X

ALL THE THREE VICE CHIEFS OF THE INDIAN ARMED FORCES TOOK TO THE SKIES AT AIR FORCE STATION JODHPUR IN THE INDIGENOUS LCA TEJAS FIGHTER JETS DURING EXERCISE TARANG SHAKTI. THE INTEGRATED FLYING WAS LED BY THEN VICE CHIEF OF IAF, AIR MARSHAL A.P. SINGH, WHO PILOTED THE SINGLE-SEATER LCA TEJAS, WHILE THE INDIAN ARMY AND INDIAN NAVY VICE CHIEFS FLEW IN THE TWIN-SEATER VARIANT.

ess. It was seen in action alongside Typhoon, Rafale, F-18, the F-16, fighter aircraft of foreign air forces. Two of the most eyeball catching event were a display of multinational synergy during Phase-1 at Sulur by undertaking a joint fighter aircraft mission by the four Air Chiefs of participating air forces, these included German and French Chief flying the indigenous LCA Tejas Mk1 trainer aircraft while the IAF Chief and Spanish Chief flew sorties in Su-30 MKI.

Another event was the Vice Chiefs of Indian Army, Navy and Air Force creating history by flying together in the indigenously manufactured LCA Tejas. Joint participation in the exercise demonstrated the growing focus on cross domain cooperation with the land, sea and air force working to face operational challenges together.

KEY TAKEAWAYS

Air forces play a critical role in the defence strategies of all nations, enabling them to maintain sovereignty and exert global influence. There is a fair amount of learning by each participant, starting from long distance deployments, coordinating for a mammoth event such as this and scheduling the individual air exercises.

IAF regularly participates with foreign air forces. However, over the past few years there has been a significant increased participation by the IAF in various bilateral and multilateral exercises. It is interesting to note that in last 20 years the IAF has participated in more than 90 air exercises with 32 of them being hosted by the IAF itself. Holding an air exercise in a professional manner conveys a message about the organising capability and enhances the professional stature of any air force.

Overall, Exercise Tarang Shakti provided to the IAF an excellent opportunity to operate alongside some of the best Air Forces of the world. This will help participating nations build strong aviation associations, facilitates interoperability among participants with diverse resources. Also, collation of debrief points and analyses of various issues that emerge leads to lessons learnt and refinement in tactics and employment philosophy that ultimately proves beneficial in enhancing operational capability of the IAF. There is also learning in how to operate an aircraft with or without a datalink, how to create a common communication protocol. Exercises such as these also provide an excellent exposure to the young crew to learn aviation aspects while participating in international environment.

Exercise Tarang Shakti provided a memorable learning experience to all the participating forces. In the words of IAF then Vice Chief of the Air Staff (VCAS), Air Marshal A.P. Singh, "Tarang Shakti was an opportunity to combine cultures and perspectives while building security and interoperability with our participating and observing partners. The spirit of collaboration and embracing diversity is key to not only better executing flying maneuvers, but also to broaden people's minds." Defence Minister Rajnath Singh termed the multinational Exercise Tarang Shakti as an effort to strengthen cooperation, coordination and mutual trust with partner countries. Stating that the Exercise Tarang Shakti underscores the growing stature of Indian Armed forces, he added that the 'resolve of making India Atmanirbhar in Defence is demonstrated by Exercise Tarang Shakti." He said that the country has transformed from being only an importer of arms and equipment to a nation which today exports arms and equipment to about 90 countries.

Then Air Chief Marshal V.R. Chaudhari announced that IAF will consider exercise Tarang Shakti to be planned as a biennial feature. SP

PHOTOGRAPH: IAF_MCC / X

EXCLUSIVE

"WE FORESEE POTENTIAL SUPPLIERS ACROSS DEFENCE, COMMERCIAL AVIATION AND EXECUTIVE JETS BUSINESSES GIVEN THE ADVANCE AEROSPACE ENGINEERING CAPABILITIES IN INDIA."

FREDERICO LEMOS
CHIEF COMMERCIAL OFFICER, EMBRAER DEFENSE & SECURITY

In an exclusive interaction, **Frederico Lemos,** Chief Commercial Officer, Embraer Defense & Security speaks with **Jayant Baranwal, Editor-in-Chief,** on a range of subjects concerning their increased global footprint, especially on expanding their partnership with India

Jayant Baranwal (Baranwal): On C-390
(a): Can you share the progress update?

Frederico Lemos (Lemos): The C-390 multi-mission aircraft programme has been growing from strength to strength and our recent activities reflect it.

At the start of September, the first C-390 Millennium multi-mission aircraft was delivered to the Hungarian Air Force. The aircraft is the first in the world equipped with a roll-on/roll-off Intensive Care Unit, enhancing the capability to perform humanitarian missions and Medical Evacuation Missions. The Hungarian C-390 is fully compatible with NATO requirements, not only in terms of its hardware but also in its avionics and communications configuration.

At the Farnborough Airshow in July, The Netherlands and Austria collectively signed the contract for the acquisition of nine Embraer C-390 Millennium aircraft - five aircraft for the Royal Netherlands Air Force and four aircraft for the Austrian Air Force.

This joint order will enable both countries to increase their ability to rapidly deploy or evacuate equipment and personnel worldwide, even under difficult operational conditions. The enhanced tactical airlift capacity provided by the C-390 increases operational flexibility and responsiveness, provides logistical support in various missions and operations, and enables a wide range of humanitarian and medical tasks.

To recap, the C-390 Millennium has been selected by seven countries: Brazil, Portugal (NATO configuration), Hungary (NATO), Austria, Netherlands (NATO), Czech Republic (NATO), and notably in Asia, South Korea.

Since entering operation with the Brazilian Air Force in 2019 and the Portuguese Air Force in 2023, and now the Hungarian Air Force, the C-390 continuously proves capacity, reliability, and performance. The current fleet of aircraft in operation has accumulated more than 14,000 flight hours, with mission capable rate of 93 per cent and mission completion rates above 99 per cent, demonstrating exceptional productivity in the category.

(b): Which of countries in Asia are the promising and potential customers of C-390?

PHOTOGRAPHS: EMBRAER

A TESTAMENT TO ITS MULTI-ROLE CAPABILITIES, THE KC-390 MILLENNIUM CONDUCTS AERIAL REFUELING, EXTENDING THE REACH OF FIGHTER JETS

Lemos: We are very honoured by South Korea's selection of the C-390 Millennium and that has further triggered interest in the C-390 across the region because of the platform's agility and versatility. Our market research has shown that across the globe, there are around 260 tactical airlifters that are over 45 years old and due for retirement, with 34 per cent stemming from the APAC region. We are having active discussions with countries across Asia, especially India, on how the C-390 can enhance their capabilities.

A modern platform like the C-390 can enable air forces to achieve more in their Humanitarian Assistance and Disaster Relief (HADR) missions. The C-390 can carry more payload (26 tons) compared to other medium-sized military transport aircraft and flies faster (470 knots) and farther, being capable of performing a wide range of missions such as transporting and dropping cargo and troops, medical evacuation, search and rescue, firefighting, and humanitarian missions, operating on temporary or unpaved runways such as packed earth, soil, and gravel.

In addition, beyond the benefits of the aircraft platform, our intention is to build a robust ecosystem that will enable us to contribute to the capabilities of the local defence and aerospace industries.

India is a key market for us and the Netra AEW&C, based on the ERJ145 platform, that we built in cooperation with DRDO, has contributed to the country's national security. We aspire to grow further in the country.

> "Our intention is to build a robust ecosystem that will enable us to contribute to the capabilities of the local defence and aerospace industries."

(c): Give us examples of missions and exercises that the C-390 has been involved in

Lemos: The C-390 has taken part in a variety of missions and exercises that applies its capabilities and performance across various conditions. It is undertaken alongside other aircraft which proves the C-390 interoperability capabilities.

- In March 2024, the FAB's C-390 Millennium participated in the Storm Flag Operational Exercise, in Louisiana, United States. The objective was to strengthen the partnership and interoperability between Brazilian and United States Air Forces, in addition to contributing to the improvement of Tactics, Techniques and Procedures related to the use of transport aviation in conflict environments.
- In October 2022, a KC-390 Millennium (C-390 equipped with Air-to-Air Refuelling equipment) took part in the Multinational Combined Air Exercise SALITRE IV, performing in-flight refuelling missions. The exercise was held in the Atacama Desert region, Chile, and involved other air forces from South America, the United States and Canada, increasing their interoperability through common planning in a NATO format.

Further examples of the C-390 in action:

EMBRAER'S C-390 MILLENNIUM DEMONSTRATES ITS CAPABILITY AND PRECISION DURING A FIREFIGHTING EXERCISE

- In June 2024, the C-390 was deployed to combat fires in the region of Pantanal, Brazil. The multi-mission aircraft was equipped with the Modular Airborne Fire Fighting System (MAFFS II), which provides the C-390 Millennium capability to deploying up to 3,000 gallons of water (approximately 11,300 litres), both with and without fire retardant. The aircraft dropped over 1 million litres of water during this flawless operation.
- Rations and supplies to flood-hit Rio Grande do Sul in 2024.
- Humanitarian evacuation in Poland (2022) when war in Ukraine broke out.
- Humanitarian aid to Haiti following an earthquake where firefighter equipment and medicines were transported to the country.
- Transport of ambulance and oxygen equipment across Brazil during COVID crisis.
- In 2022, the Brazilian Air Force undertook cargo airdrops with the C-390 Millennium in Antarctica, reinforcing the aircraft's performance across varying climates and conditions. The aircraft took off from the city of Punta Arenas, south of Chile, carrying supplies to the Brazilian research station and back non-stop.

Baranwal: On Collaborations

(a): Are you fine with transfer of technology to countries like India which may have a larger number requirements of such a programme?

(b): Does Brazilian Government back the programme?

(c): What, if C-390 selected by India, the route of cooperation will be? Will the process involve Brazilian Government dealing with Government of India?

(d): Is Brazil open to share the first-hand technology / first-hand technology programmes with its potential customer countries around the world?

Lemos: Industrial partnership is a cornerstone in our C-390 programme. Building on the strong country relations between India and Brazil, as demonstrated by recent high-level visits to India from Brazil's Foreign Minister and the Commander of the Brazilian Air Force, we look forward to harnessing the synergies that exist between the robust defence and aerospace industries of both India and Brazil.

> "We see India as a key partner in the region and may include an assembly line for the C-390 in India, if selected for the MTA programme."

A high-level delegation from Embraer visited India, in its latest series of visits, to evaluate the expansion of its supply chain into the country. We foresee potential suppliers across defence, commercial aviation and executive jets businesses for areas such as aerostructures, machining, sheet metal, composites, forgings, wire harness, and hardware and software development, given the advance aerospace engineering capabilities in India.

We see India as a key partner in the region and together with

THE C-390 MILLENNIUM UNDER ASSEMBLY IN EMBRAER'S FACTORY

Mahindra, with whom we announced an MoU in February, we look forward to implementing an extensive local supply chain programme. This initiative may include an assembly line for the C-390 in India, if selected for the MTA programme. Tied with a local long-term support programme offer, Embraer and Mahindra aim to contribute to the "Make in India" and Atmanibhar Bharat objectives.

Baranwal: On MRO solutions

(a): Please give us little details on the MRO-centric solutions on the part of Embraer Defense & Security; (MRO - Maintenance, Repair and Operations)

(b): What's the turnaround timing for any customer in the world?

Lemos: Embraer MRO network consists of owned service centres as well as authorised service centres. We are constantly assessing how we can tap on the MRO capabilities of our customer's home market, with the aim of ensuring that the reliability and operability of our defence aircraft remains high.

Baranwal: On India's Netra – AEW&C

(a): Former Indian Air Force Chief, Air Chief Marshal Chaudhari, in one of exclusive interviews with us, told us there is a requirement of additional six Embraer jets for this programme. How do you perceive this progress?

(b): India's Defence Research & Development Organisation (DRDO) has been the key organisation collaborating in the context of this particular collaboration. What has been the experience of Embraer with such a partnership?

(c): Can you share an update on this front?

Lemos: The Indian AEW&C Netra was jointly developed and produced by DRDO and Embraer. Three aircraft in this configuration have been operational for several years with positive feedback.

Beyond that, the partnership has allowed for knowledge sharing and mutual learning, benefiting both organisations. We have appreciated DRDO's technical acumen and their commitment to developing advanced defence technologies.

> "The Indian AEW&C Netra was jointly developed and produced by DRDO and Embraer. Three aircraft in this configuration have been operational for several years with positive feedback."

We share India's pride in this project and view it as an example of an excellent partnership between DRDO and Embraer but also a reflection of strong ties and cooperation between India and Brazil. We are keen to repeat this success story and see opportunities for further collaboration that will grow relations between both countries and foster greater South-South cooperation.

(d): Which are countries, as of today, are operating Embraer jets for such a specialised role?

Lemos: We are very proud to have India, Brazil, Mexico and Greece as operators of the Embraer AEW&C platform. SP

THE MQ-9B IS CAPABLE OF AUTOMATIC TAKE-OFFS AND LANDINGS, AND IS ARMED WITH STRIKE MISSILES FOR HITTING TARGETS WITH HIGH PRECISION

INDIA AND US SIGN GA'S MQ-9B PREDATOR DRONES; AGREEMENT ON ESTABLISHING MRO FACILITY IN INDIA

General Atomics Predator Drones represents a pivotal asset for India's defence capabilities, particularly in enhancing ISR and strike capabilities

By MANISH KUMAR JHA

PHOTOGRAPH: GA-ASI

IN A SIGNIFICANT DEVELOPMENT FOR THE MILITARY modernisation plan, India and the United States formally inked a deal worth ₹34,500 crore to acquire 31 Predator drones for the Indian armed forces. As per the terms of the negotiations, General Atomics which manufactures the Predator drones will also facilitate in setting up a Maintenance, Repair, and Overhaul (MRO) facility in India. The MRO will be primarily for the Predator's upkeep, maintenance and parts. GA has already collaborated with the Indian defence entity, Bharat Forge for the components and a maintenance hub for drones in India.

The General Atomics MQ-9B represents a significant advancement in unmanned aerial vehicle (UAV) technology. Designed for Intelligence, Surveillance, Reconnaissance (ISR), and strike missions, the MQ-9B is characterised by its stealth

INDIA SIGNED A CONTRACT WITH THE US GOVERNMENT FOR THE PROCUREMENT OF 31 MQ-9B SKY/SEA GUARDIAN HIGH ALTITUDE LONG ENDURANCE (HALE) REMOTE PILOT AIRCRAFT SYSTEM (RPAS)

capabilities, long endurance, and versatility. As India explores the acquisition of such advanced UAVs, the establishment of an efficient Maintenance, Repair, and Overhaul (MRO) infrastructure is crucial to ensuring operational readiness and longevity.

The Defence Acquisition Council (DAC), on June 15, 2023, accorded the Acceptance of Necessity (AoN) for the acquisition of 31 MQ-9B (16 Sky Guardian and 15 Sea Guardian) High Altitude Long Endurance (HALE) Remotely Piloted Aircraft Systems (RPAS) for Tri-Services from the USA through Foreign Military Sale (FMS) route. The AoN included the number of UAVs to be procured along with associated equipment.

Further, the Cabinet Committee on Security (CCS) also approved the acquisition of 31 drones last week. Out of 31 drones, India will receive 15 Predators, while the Air Force and the Army will each receive 8. There are already two drones on lease by the Indian Navy. As reported, there will be possibilities of adding combat capability by integrating air-to-air and air-to-surface missiles.

OVERVIEW OF MQ-9B PREDATOR

The MQ-9B drone is a variant of the MQ-9 "Reaper" a next-generation UAV designed to fulfil various military roles. In terms of endurance, it can remain airborne for over 35 hours with a payload which can carry four Hellfire missiles and around 450 kg of bombs.

The Predator has a top speed of 275 mph or 442 km/h at an altitude of around 50,000 feet above the ground which is higher than a commercial aircraft. Most importantly, it has the highest range of 2,000 miles without refuelling.

> India and the United States signed a deal worth ₹34,500 crore to acquire 31 Predator drones, with General Atomics set to establish a Maintenance, Repair, and Overhaul (MRO) facility in India

The aircraft is equipped with wide-range, advanced sensors, including electro-optical/infrared (EO/IR) cameras, synthetic aperture radar (SAR), and electronic warfare capabilities. Another key electronic is the multi-mode communication system.

IMPORTANCE OF MRO FOR MQ-9B

The operational effectiveness of the MQ-9B relies heavily on its MRO processes. Effective MRO ensures that the drone remains mission-ready, prolongs its service life, and reduces lifecycle costs.

Overall, the Indian MRO market is currently worth $1.7 billion for its commercial aircraft fleet (Source: Sec Research, DGCA). While the MRO potential, emphasizes the scope of the commercial sector, it adds to the concept of greater civilian-military fusion, leveraging the technologies. The MRO market is expected to increase at approximately nine per cent annually to reach $4 billion in 2031 with commensurate growth in the fleet.

However, only 15-20 per cent of this market is currently being serviced locally while 80-85 per cent is serviced overseas. Engine MRO accounts for about 50 per cent of this market and is almost exclusively serviced overseas.

While the single fact above illustrates significant value-added opportunities in the commercial spectrum, it outlines the need for addressing the MRO facility which suffices to justify the potential in the Indian MRO market. The key MRO components include preventive maintenance like regular inspections and scheduled maintenance are essential to identify potential issues before they escalate. This includes checks on airframe integrity, avionics, and propulsion systems.

PHOTOGRAPH: SPOKESPERSONMOD / X

SPECIFICATIONS

MQ-9B SKYGUARDIAN		
Characteristics		
Wingspan	79 ft	24 m
Length	38 ft	11.7 m
Power Plant	Honeywell TPE331-10 Turboprop	
Max Gross Takeoff Weight	12,500 lb	5,670 kg
Fuel Capacity	6,000 lb	2,721 kg
Payload Capacity	800 lb, internal 4,750 lb, external 9 external hardpoints	363 kg, 2,155 kg 8 wing-mount 1 centerline
Power	45 kVA	
Backup Power	2 kW	
Maximum Performance		
Altitude	40,000+ ft	12,200+ m
Endurance	40+ hr	
Airspeed	210 KTAS	
Range	6,000+ nmi	

MQ-9B SEAGUARDIAN		
Characteristics		
Wingspan	79 ft	24 m
Length	38 ft	11.7 m
Power Plant	Honeywell TPE331-10 Turboprop	
Max Gross Takeoff Weight	12,500 lb	5,670 kg
Fuel Capacity	6,000 lb	2,721 kg
Payload Capacity	800 lb, internal 4,750 lb, external 9 external hardpoints	363 kg, 2,155 kg 8 wing-mount 1 centerline
Power	45 kVA	
Backup Power	2 kW	
Maximum Performance		
Altitude	40,000+ ft	12,200+ m
Endurance	30+ hr	
Airspeed	210 KTAS	
Range	5,000+ nmi (depending on configuration)	

Source: GA-ASI

- **Corrective Maintenance:** Quick and efficient repair processes are critical for minimising downtime. This involves troubleshooting, fault isolation, and replacement of defective components.
- **Overhaul and Upgrades:** Periodic overhauls are necessary to restore the drone to its optimal operational condition. This may involve significant upgrades to avionics, sensors, and weapon systems to keep pace with technological advancements.

MRO INFRASTRUCTURE IN INDIA

To support the 31 MQ-9B Predators, India must develop a robust MRO infrastructure, which could involve dedicated maintenance facilities. Establishing such specialised centres equipped with the latest technology for inspections, repairs, and modifications will add operation efficiency and save costs.

- **Skilled Workforce:** Training technicians and engineers in UAV maintenance practices, ensuring they are well-versed in the specific systems of the Predator.
- **Supply Chain Management:** Developing a reliable supply chain for spare parts and components to ensure quick availability and reduce lead times for repairs.
- **Collaborative Partnerships:** Engaging in partnerships with General Atomics or other global leaders in UAV technology can facilitate knowledge transfer and best practices in MRO.

> Collaborations with global UAV leaders like General Atomics can facilitate knowledge transfer and the development of robust local MRO infrastructure, ensuring the drones' operational efficiency and enhancing India's defence capabilities

Additionally, the government is also boosting several military MROs which are specific to aircraft in India. For Example, global aerospace OEMs, France's Dassault Aviation and the US' Lockheed Martin and Boeing planning to establish MRO facilities in India.

CHALLENGES AND SOLUTIONS

While establishing MRO for the 31 MQ-9B presents several challenges, there are also viable solutions.

In terms of technological complexity, the advanced technology of the Predator requires specialised knowledge. This requires implementing comprehensive training programmes and workshops that can enhance the skill set of the local workforce.

Ensuring the logistical support is about the availability of spare parts and components can be challenging. In the long run, it must strive to develop local manufacturing capabilities or establish long-term contracts with suppliers that can help mitigate supply chain issues.

The General Atomics Predator represents a pivotal asset for India's defence capabilities, particularly in enhancing ISR and strike capabilities. Establishing an effective MRO infrastructure is crucial to maximising the operational readiness and effectiveness of these advanced drones. By investing in training, technology, and partnerships, India can ensure that its UAV fleet remains at the forefront of modern warfare capabilities, contributing significantly to national security. SP

UAE-INDIA COLLABORATION IN THE AIR DEFENCE SECTOR: A STRATEGIC PARTNERSHIP FOR DEFENCE LOCALISATION

UAE and India are deepening their partnership through innovation, localisation, and self-reliance in strategic defence capabilities led by the UAE's EDGE Group collaborations with HAL and Adani Aerospace

AS GLOBAL DEFENCE STRATEGIES EVOLVE, THE UAE AND India have deepened their bilateral cooperation, creating a robust framework for innovation and capacity building across strategic defence domains. The UAE, with its growing influence in defence technology, and India, a rising industrial powerhouse, are now focused on leveraging each other's strengths to enhance security and self-reliance. Central to this cooperation is the air defence sector, where the joint efforts are driving advancements in localisation and innovation.

EDGE Group has played a pivotal role in advancing this collaboration, particularly through partnerships with Hindustan Aeronautics Limited (HAL) and Adani Aerospace & Defence. With HAL, EDGE entity AL TARIQ is working to integrate precision-guided munitions (PGMs) with the Tejas Light Combat Aircraft (LCA), significantly enhancing its operational capabilities.

EDGE's collaboration with Adani Aerospace & Defence expands this strategic effort. Together, the two companies aim to develop critical air defence technologies and establish joint research and development (R&D) and production facilities that serve both local and global markets. Such collaborations highlight a mutual commitment to localisation, reducing reliance on external supply chains while fostering indigenous capabilities that will benefit both nations in the long term.

A core pillar of these partnerships is the 'Make in India' initiative, which seeks to strengthen domestic defence manufacturing. EDGE's agreement with Bharat Dynamics Limited (BDL) to co-produce AL TARIQ's precision-guided munitions (PGMs) within India exemplifies a strategic approach to technology transfer and local production. This venture not only meets India's immediate defence needs but also paves the way for greater autonomy and innovation in the air defence sector.

Another significant driver of UAE-India cooperation is their shared commitment to joint R&D. By investing in collaborative R&D, both countries are positioning themselves to lead in the development of next-generation technologies. This approach is fostering the creation of advanced defence systems tailored to meet the unique operational requirements of each nation, while driving innovation that can be leveraged globally. The focus on co-developing solutions through shared resources ensures that the benefits of innovation are maximised, reducing time-to-market for new systems and enhancing both countries' defence capabilities.

Additionally, knowledge transfer and skill development play a vital role in this collaboration. As EDGE and its Indian partners work together on advanced technologies, there is a concerted effort to exchange technical expertise and create opportunities for workforce upskilling. This exchange facilitates the transfer of technology while also nurturing a highly skilled workforce essential for maintaining the competitiveness of both countries' defence sectors. By investing in human capital development, the UAE and India are building a foundation for sustained growth in the defence industry, ensuring that their cooperation extends beyond technology into talent and capability building.

The UAE and India's work in the air defence sector represents a significant step in international defence cooperation. By focusing on joint development, localisation, and technology transfer, both countries are preparing to meet the challenges of a rapidly evolving security landscape. As they continue to collaborate, the focus will likely shift toward integrating new technologies, fostering innovation, and responding to global security needs with agility.

EDGE is committed to deepening these partnerships and sees tremendous potential for continued collaboration in next-generation technologies. By working together, the UAE and India are building an air defence sector that is resilient and adaptable to future challenges, reinforcing their leadership in the global defence industry. SP

LOCKHEED CONSTELLATION: "CALL ME CONNIE!"

In October 1961 the IAF's No. 6 Squadron "Dragons" added nine retired Air-India International Super Constellations to its fleet. Seven of these were modified for Maritime Reconnaissance. Two Super Connies served as freighters or troop carriers.

THE LOCKHEED L-049 CONSTELLATION WAS THE FIRST MODEL of the Constellation aircraft line. Designed by the famous Clarence "Kelly" Johnson, its first flight happened on January 9, 1943. It entered service in July 1943 as the C-69 military transport aircraft for the United States Army Air Forces. After the Second World War, it was also the first civilian variant of the family. Numerous stretched and improved versions followed over the next decade. Colloquially known as Connies, Constellations were among the most graceful aircraft of early commercial flight. The variant of particular significance for Indian aviation was the Lockheed L-1049 Super Constellation, affectionately called Super Connie. It was perhaps the only instance of an aircraft bought by an Indian airline – Air-India International – becoming a "hand-me-down" to the Indian Air Force (IAF) and finally going to the Indian Navy (IN).

It all began in 1939 when the top management of the Lockheed Corporation met with Howard Hughes, the legendary American billionaire aviator. Hughes wanted Lockheed to design a revolutionary aircraft capable of operating US commercial aviation's first coast-to-coast, non-stop service. He demanded total secrecy and specified that Lockheed could not sell the aircraft to any other airline until his carrier, Trans World Airlines (TWA), had received 35 of them. However World War II intervened and the US Military acquired the Constellation production facilities.

After the war, the Constellation was largely instrumental in ushering in high-altitude transport operations. At one stroke its pressurised cabin gave commercial aircraft the ability to fly above 90 per cent of weather disturbances – the "air sickness zone" – into a region of "smooth sailing". This immensely increased passenger comfort and revolutionised air travel. It also helped transform Lockheed, then a bit player, into a big guy in the aviation industry. Aside from its unique design, attractive curves, and ability to fly faster than many fighter aircraft of the time, the Constellation introduced several innovations like hydraulically-boosted power controls. It had three vertical tailfins, allowing it to enter the low-roofed hangars of the 1950s without sacrificing its tailfin surface area.

Howard Hughes publicised the plane by setting a transcontinental speed record on a Burbank, California, to Washington, D.C., flight in April 1944 flying nonstop in six hours, 57 minutes, and 51 seconds. The first commercial flight of the L-049 happened on February 5, 1946, when TWA's "Star of Paris" flew from New York City to Paris, with stops in Newfoundland (Canada) and Ireland. US President Eisenhower loved the Connie and a Constellation became his personal presidential plane, and the first to bear the "Air Force One" designation.

Earlier, in 1943, Lockheed began planning stretched variants of the Constellation family. Some of the better known ones were the L-749 and the L-1049 Super Constellation that entered service with Eastern Airlines in December 1951. It was stretched to 116 ft 2 in and equipped with more powerful Wright R-3350-DA3 Turbo-Compound 18-cylinder supercharged radial engines. It had a capacity of 62 to 95 passengers (109 in high-density configuration).

Air-India International was one of the first airlines to take delivery of three Lockheed Constellation L-749 aircraft, thanks to an order cancellation by another airline. It received these airliners in March 1948 and they helped launch its Bombay to London service. Later Air-India acquired some Super Constellations and they formed the backbone of its fleet right up to June 1962, when the last L-1049 was retired, and Air-India became the world's first all-jet airline. In the late 1950s, the Constellations were increasingly unable to compete with jet airliners such as the Boeing 707 and the Douglas DC-8 and began to slip in popularity. The final Constellation was built in 1959. By then, more than 800 aircraft had been produced and the planes had flown for most of the world's major airlines, including Pan Am, Air France, BOAC, KLM, Qantas, Lufthansa and Air-India.

In October 1961 the IAF's No. 6 Squadron "Dragons" added nine retired Air-India International Super Constellations to its fleet. Seven of these were modified for Maritime Reconnaissance (MR). Two Super Connies served as freighters or troop carriers. Super Connies participated in Operation Vijay that liberated Goa in December 1961, and transported troops in the 1962 Sino-Indian border conflict. In 1976, the Indian Navy took over the MR role. On November 18, 1976, five remaining MR-configured IAF Super Constellations went to newly-formed Indian Naval Air Squadron No. 312 "Albatross" based at INS Hansa, at Dabolim, Goa. By 1983, the Navy retired the Super Connies from active service, around the time the IAF retired its last two Super Connie freighters. India was the last military operator of the Lockheed Constellation. SP

— JOSEPH NORONHA

RAJESH KUMAR SINGH IS THE NEW DEFENCE SECRETARY, INDIA

RAJESH KUMAR SINGH TOOK over as Defence Secretary in New Delhi on November 1, 2024. He is a 1989-batch IAS officer from Kerala cadre, who had assumed the charge of the Officer on Special Duty (Defence Secretary-designate) on August 20, 2024.

Before taking charge, Rajesh Kumar Singh laid a wreath and paid homage to the fallen heroes at the National War Memorial, New Delhi. "The nation will remain forever indebted to our brave soldiers who make the supreme sacrifice in the service of the motherland. Their extraordinary bravery and sacrifice is a source of strength & inspiration for us to make India a safe and prosperous nation," he said.

RAJESH KUMAR SINGH, DEFENCE SECRETARY, INDIA

Earlier, Rajesh Kumar Singh was holding the charge of Secretary, Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry from April 24, 2023 to August 20, 2024. Prior to that, he held the post of Secretary, Department of Animal Husbandry & Dairying, Ministry of Fisheries, Animal Husbandry & Dairying.

The officer has held many other important positions in the Union Government as Director, Works and Urban Transport in the Ministry of Urban Development, Commissioner (Lands) - DDA, Joint Secretary - Ministry of Petroleum and Natural Gas, Joint Secretary - Department of Agriculture, Cooperation & Farmers Welfare and Chief Vigilance Officer – Food Corporation of India. He has also held important positions in the State Government as Secretary, Urban Development and lately as Finance Secretary, Government of Kerala. SP

CZECH REPUBLIC ORDERS TWO EMBRAER C-390 MILLENNIUM MULTI-MISSION AIRCRAFT

The Czech Republic becomes the fourth NATO member to acquire the C-390 Millennium

THE CZECH MINISTRY OF DEFENCE (MoD) signed a contract for the acquisition of two Embraer C-390 Millennium multi-mission transport aircraft. Along with Czech Republic, the C-390 has now been selected by the Netherlands, Hungary and Portugal, three NATO members, as well as Austria, Brazil, and South Korea.

These two NATO standard aircraft will modernise and enhance the operational capabilities of the Czech Air Force. They will be able to perform a wide range of missions, such as tactical transport of troops, vehicles, and equipment, medical evacuation, firefighting, disaster management, humanitarian support, and air-to-air refuelling.

This contract not only strengthens the Czech Air Force but also positively impacts the local aerospace industry, which will see a significant increase in its share of production for the programme.

"This order from the Czech Republic, a NATO member, is an invaluable mark of confidence for Embraer. With this order, Embraer will reinforce its ties with the local Czech aerospace industry, recognized for its expertise and product quality for decades," said Bosco Da Costa Junior, President & CEO of Embraer Defense & Security.

In addition to the aircraft, Embraer will provide a comprehensive training and support package for the Czech Air Force to ensure the smooth integration of the aircraft into their fleet.

With a maximum payload of 26 tonnes, a top speed of 470 knots, and state-of-the-art technology, the C-390 is the leading aircraft in its class. Its powerful engines, large cargo hold with a rear ramp, and robust landing gear allow it to handle the most demanding missions, including operations from unpaved runways. SP

PHOTOGRAPHS: PIB, EMBRAER

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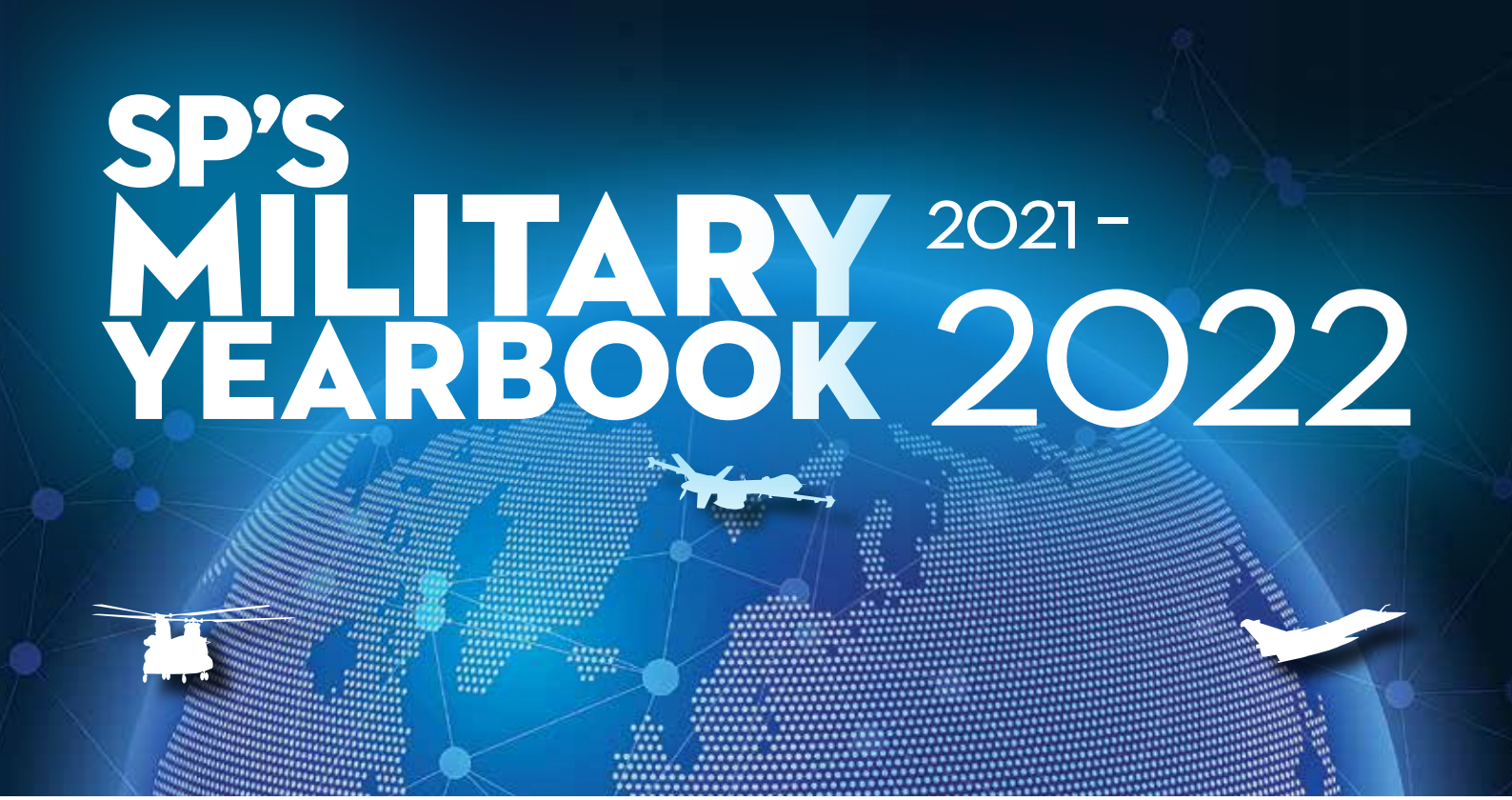

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UNBEATABLE COMBINATION FOR INDIA

We salute the Indian Air Force for their service to the nation

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Embraer and Mahindra Group are joining forces to offer the Indian Air Force the best global solution for its MTA (Medium Transport Aircraft) program – the C-390 Millennium. This new generation aircraft offers an unbeatable combination of unrivalled mobility, outstanding performance, operational flexibility and low lifecycle costs in a single platform. Three countries are currently operating the C-390 Millennium: Brazil, Portugal and Hungary, with the aircraft accumulating 14,000 flight hours over five years and achieving a 93% mission capability rate. Embraer have a strong track record fostering partnerships in this part of the world – 45+ Embraer jets currently operate in India covering the Defense, Commercial and Executive Aviation sectors.

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