

SP's



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PUBLISHER AND EDITOR-IN-CHIEF
Jayant Baranwal

SENIOR EDITOR
Air Marshal B.K. Pandey (Retd)

DEPUTY MANAGING EDITOR
Neetu Dhulia

SENIOR TECHNICAL GROUP EDITOR
Lt General Naresh Chand (Retd)

PRINCIPAL CORRESPONDENT
Ayushee Chaudhary

CONTRIBUTORS

India:
Air Marshal Anil Chopra (Retd)
Group Captain Joseph Noronha (Retd)

Europe: Alan Peaford
USA & Canada: LeRoy Cook

CHAIRMAN & MANAGING DIRECTOR
Jayant Baranwal

PLANNING & BUSINESS DEVELOPMENT
Executive Vice President: Rohit Goel

MANAGER - HR & ADMIN
Bharti Sharma

DEPUTY MANAGER - CIRCULATION
Rimpy Nischal

GROUP RESEARCH ASSOCIATE
Survi Massey

RESEARCH ASSISTANT
Sarthak Baranwal

DESIGN
Holistic Directions: Jayant Baranwal
Sr. Designer: Vimlesh Kumar Yadav,
Designer: Sonu S. Bisht

GROUP DIRECTOR - SALES & MARKETING
Neetu Dhulia

DEPUTY DIRECTOR - SALES
Rajeev Chugh

SP'S WEBSITES
Sr Web Developer: Shailendra P. Ashish
Web Developer: Ugrashen Vishwakarma

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E-mail: subscribe@spguidepublications.com
subscribe@sps-aviation.com

LETTER TO EDITOR
editor@sps-aviation.com; expert@sps-aviation.com

For Advertising details, contact:
neetu@spguidepublications.com
rajeev.chugh@spguidepublications.com

SP GUIDE PUBLICATIONS PVT LTD
A-133 Arjun Nagar, (Opposite Defence Colony)
New Delhi 110003, India.

Tel: +91 (11) 24644693, 24644763, 24620130
Fax: +91 (11) 24647093

E-mail: info@spguidepublications.com

Representative Office
BENGALURU, INDIA

204, Jal Vayu Vihar, Kalyan Nagar,
Bengaluru 560043, India.
Tel: +91 (80) 23682204

MOSCOW, RUSSIA
LAGUK Co., Ltd., (Yuri Laskin)
Krasnokholmskaya, Nab.

11/15, app. 132, Moscow 115172, Russia.
Tel: +7 (495) 911 2762
Fax: +7 (495) 912 1260

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Dubai Airshow saw a fascinating combined flypast by the IAF's Suryakiran Aerobatic Team and UAE's Al Fursan Display Team. Nine Hawk-132 of Suryakiran Team flew in sync with seven Aermacchi MB-339 of Al Fursan over important landmarks of Dubai.

(Cover Photo: Katsuhiko Tokunaga via IAF)

COVER DESIGN BY: SP's Team



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Indian Air Force, participating at Dubai Airshow for the first time, mesmerised the global audience gathered at the airshow with some enthralling manoeuvres and breath taking aerial display of scintillating flying skills by their Suryakiran, LCA Tejas and the Sarang teams during the Dubai Airshow

A MAJOR EVENT IN THE RECENT PAST ON THE GLOBAL CIVIL and military aviation scene was the Dubai Airshow, held from November 14 to 18 this year. Apart from projecting the latest developments in the domains of civil and military aviation, this international event symbolised a major turning point in the recovery of the international aerospace industry that had suffered a debilitating blow on account of the COVID-19 pandemic. In fact, the Airshow this year was larger than the previous one held in 2019 prior to the onset of the COVID-19 Pandemic in terms of visitors and the number of deals clinched. This year, the Airshow at Dubai had pavilions from more than 20 nations from across the globe with over 1,200 exhibitors that included 371 companies participating for the first time. Amongst these, there were more than 80 newly established companies or start-ups in the global aerospace and defence industry. On display at the Airshow were over 160 aircraft that included commercial and military aircraft as well as business jets. An interesting feature of the Dubai Airshow was that for the first time, the Indian Air Force took part with air display by the Surya Kiran aerobatic team, Light Combat Aircraft Tejas and the Sarang helicopter team.

In any global event of this kind, success is measured by an important feature which is the number of financial deals with customers concluded at the event. In the Dubai Airshow this year, the total value of both the civil and military contracts finalised, reached an impressive figure of Dh266 billion. The global business aviation industry is now anxiously looking forward to the Middle East Business Aviation Association (MEBAA) show that is scheduled to be held from December 6-8, 2022. This event serves as the leading business aviation platform in the Middle East as it showcases the latest technologies, insights and business opportunities shaping the future of business aviation in the Region as also across the globe. Over the next one year, the business aviation sector is expected to make a strong recovery which will help the MEBAA Show play an important role in restoring confidence,

driving collaboration and creating new opportunities for the sector. Ayushee Chaudhary has detailed reports on the Airshow at Dubai, the deals concluded therein and the MEBAA Show scheduled to be held in the first week of December next year.

One problem that is currently plaguing the world and has the ominous potential of becoming worse in the future is the level of pollution in the atmosphere caused by emission from engines of aircraft. Fortunately, the leading engine makers General Electric Aviation and Safran have launched a bold technology development programme targeting reduction of more than 20 per cent lower fuel consumption and CO2 emissions compared to engines that are in use or produced today. Known as the CFM Revolutionary Innovation for Sustainable Engines (RISE) programme, it will demonstrate a range of new, disruptive technologies for future aircraft engines that is expected to enter service by mid-2030s. This issue of *SP's Aviation* carries a detailed review by Air Marshal Anil Chopra (Retd) of efforts by the engine manufacturers across the globe to address this problem that is looming large over the horizon.

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

Jai Hind.

JAYANT BARANWAL
PUBLISHER & EDITOR-IN-CHIEF



NEWS

THE IAF 'ACTIVATES' ITS AGING JAGUAR FLEET

In what is an effort to sustain its existing fleet, the Indian Air Force (IAF) has signed a deal with Hindustan Aeronautics Limited (HAL) to purchase two simulators for Jaguar aircraft. This move is a departure from the statement by the IAF in 2019 that the Jaguar fleet which has been in service for over four decades, will be phased out starting in 2023. The aging fleet and high cost of engines for the Jaguar fleet were the reasons behind the decision. However, the IAF is now procuring two Fixed-Base Full Mission Simulators (FBFMS) including a five-year comprehensive maintenance contract at a cost of ₹357 crore. The simulators will be stationed at IAF airbases at Jamnagar and Gorakhpur for advanced training of fighter pilots.

VIEWS

THE JAGUAR IS A TWIN-ENGINE, GROUND-ATTACK AIRCRAFT designed, developed and manufactured by a joint venture between the French company Breguet and the British Aircraft Corporation. The joint venture company set up for this project was Société Européenne de Production de l'avion Ecole de Combat et d'Appui Tactique (SEPECAT). This was one of the first major joint Anglo-French military aircraft programmes. The platform was originally conceived in the 1960s to be a jet trainer aircraft with light ground attack capability. However, the platform was ultimately developed to be a nuclear capable deep penetration ground attack aircraft which was also known as Deep Penetration Strike Aircraft (DPSA). The first prototype of the Jaguar undertook its maiden flight on September 8, 1968 at Istres located in Southern France. Even while the aircraft was still under development, in 1968 itself, the original equipment manufacturer (OEM) had approached India that was seen as a likely customer for this platform. However, at that time, India had decided not to acquire this platform as it was not yet clear if France and Britain would select this platform for induction into their own Air Forces. Later on, when the aircraft had been fully developed, both Britain and France inducted over 200 Jaguars each. These aircraft saw action in the Persian Gulf War and in Kosovo.

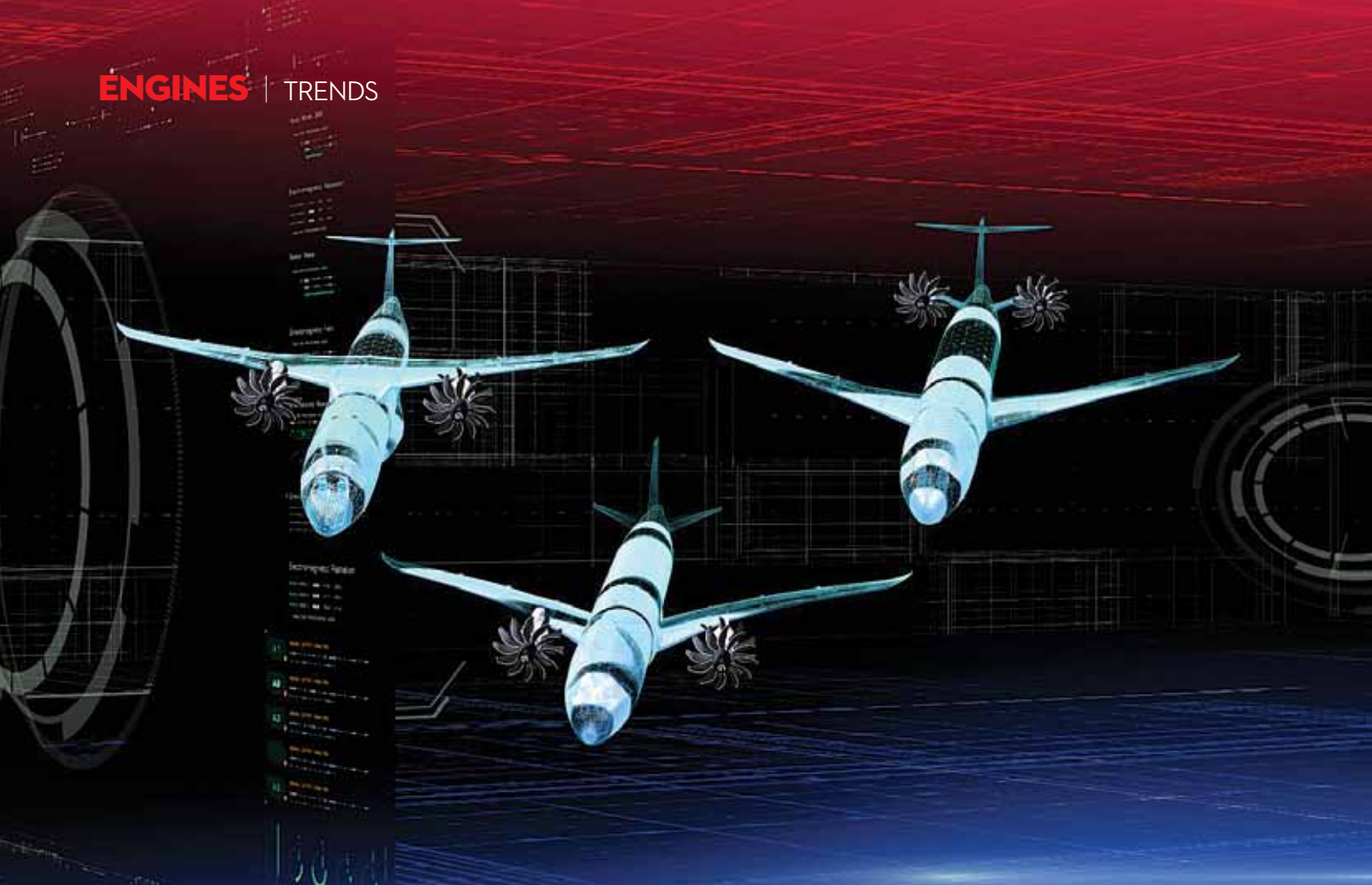
Subsequently in 1978, India finally decided to acquire this aircraft and placed orders for a total of 160 of which 40 were to be supplied in fly away condition that were to be built in Warton in Europe. The remaining 120 aircraft would be built under licence by the Indian aerospace and defence major Hindustan Aeronautics Limited (HAL) at their facility in Bengaluru. The Jaguar aircraft was given the local name of "Shamsher" or "Sword of Justice". The IAF has been operating two variants of the Jaguar, one of which is the deep strike version that is aimed at eliminating targets on the ground and the maritime version that is meant to attack and destroy the enemy's warships and sea-based threats by way of anti-ship missiles and their launch platforms. Along with the newly acquired Rafale jet and the Mirage 2000, the Jaguar fleet in the IAF is also capable of launching strikes by nuclear weapons. In the last four decades, the fleet of Jaguar aircraft in the IAF has rendered yeoman service.

However, the Jaguar fleet of the IAF has not been without problems. When inducted, the Jaguars came equipped with the first-generation inertial navigation and attack system named NAVWASS which was outdated and not very reliable. The Rolls-Royce Adour engines fitted on the aircraft were somewhat underpowered. The Jaguar also lacked autopilot which is a critical flying aid. To address these problems, the IAF and HAL launched the programme to upgrade the avionics of the aircraft. The first upgraded Jaguar aircraft fitted with DARIN III flew for the first time on August 10, 2017. It was also fitted with the state-of-the-art AESA radar, 28 new sensors, autopilot and more. To address the problem of the aircraft being underpowered, the IAF planned to replace the Rolls-Royce Adour engines on 80 Jaguars in its fleet with the more powerful F-125IN engines to be supplied by Honeywell. Unfortunately, the price of the engine quoted by Honeywell for the F-125IN engine was as described by the IAF to be so exorbitant that it was unaffordable. The plan to fit new engines on the Jaguar fleet was thus abandoned in 2019. With all the upgrades in Avionics and had the fleet been refitted with the more powerful Honeywell F-125IN engines, the Jaguar fleet of the IAF could have served for another two decades at the very least.

The possibility of the need to retire the Jaguar fleet of the IAF early has implications for the service in view of the fact that the IAF is currently facing a serious deficiency in the strength of the combat fleet. As against the strength of 42 combat squadron that is authorised by the government, even after the induction of two squadrons of the Rafale combat jet, the IAF will still be short by nine combat squadrons. With early retirement of the fleet of Jaguar aircraft, the deficiency in the combat fleet will increase to 15 squadrons. With practically no possibility of procurement of modern combat aircraft from foreign sources and the very low rate of production by HAL of the light combat aircraft Tejas, the IAF will be in a precarious state with heavily degraded combat capability. Under these circumstances, it is quite understandable that the IAF will adopt means to delay the retirement from service of the ageing combat fleets. SP

—BY AIR MARSHAL B.K. PANDEY (RETD)





THE CFM RISE (REVOLUTIONARY INNOVATION FOR SUSTAINABLE ENGINES) PROGRAMME TARGETS MORE THAN 20 PER CENT LOWER EMISSIONS AND WILL DEMONSTRATE A RANGE OF NEW, DISRUPTIVE TECHNOLOGIES LIKE OPEN FAN ARCHITECTURE AND HYBRID ELECTRIC CAPABILITY FOR FUTURE ENGINES

CIVIL AERO ENGINES — REVIEW OF TRENDS

Aircraft engines need to produce more power while consuming less fuel, produce less noise and reduce emission levels

By AIR MARSHAL ANIL CHOPRA (RETD)

THE CIVIL AEROSPACE INDUSTRY IS PRIMARILY BEING influenced by environmental issues and cost of operations. The key areas of attention are propulsion and autonomous systems. Top engine-makers are unveiling new technologies to cut CO2 emissions and yet boost the performance of aircraft engines. Aircraft engines need to produce more power while consuming less fuel, produce less noise and reduce emission levels. These performance parameters can be achieved by enhancing the efficiency of combustion engines and simultaneously exploring

electric and hybrid propulsion systems. Considering that large number of drones and Urban Air Mobility (UAM) systems are beginning to fly over populated areas, the aero-acoustics of these engines will also be a design focus. Benefits of research and technology in propulsion will shorten engine development cycle, reduce engine weight, increase engine performance, reduce engine fuel consumption, enhance reliability, reduce emissions and noise, increase component life and reduce maintenance requirements.

PROPULSION TECHNOLOGY NEW APPROACH

Past three generations of gas turbine engines have incorporated increased turbine inlet temperature, increased compressor pressure ratio, increased bypass ratio, improved fan and nacelle performance, reduction of noise and emissions as well as improved reliability. The new engine technologies will involve engine-airframe integration, new and improved materials and material-processing techniques, advances in turbo-machine technology, progress in combustion technology and vastly improved utilisation of Computational Fluid Dynamics (CFD) in engine design procedures. The carbon-fibre blades allowed high-bypass jet engines that helped in developing efficient long-haul jets such as the Boeing 777 and the Boeing 787 Dreamliner that could use just two engines rather than four. Novel technologies such as “smart engines” and the use of magnetic bearings will change the course of engine development. Additive manufacturing offers lighter, cheaper and quick-to-manufacture parts which will cut assembly costs and time, simplify maintenance and save on fuel.

GREENER ENGINE APPROACH

Reduced emissions and noise abatement has been possible through technological innovations. Newer models of the two most-widely used aircraft today - the Boeing 737 and the Airbus A320, not only carry more passengers, but also burn 23 per cent less fuel, through much better fuel burn efficiency. Lightweight low pressure turbofans using composite fan blades, high efficiency low pressure turbine, advanced engine externals and installations including novel noise attenuation, advancing high speed turbine design, aggressive mid-turbine interductand even a low emission combustion chamber are being developed for next generation rotary-craft engine. Ceramic Matrix Composites (CMC) have one-third the weight of steel; but can withstand temperatures as high as 2,400 degrees Fahrenheit, beyond the melting point of many advanced metallic super-alloys, thus improving the engine's thermal efficiency. 3D-printed components, hybrid-electric systems, advanced heat-transfer circuits are other breakthrough technologies.

AIRCRAFT AND ENGINE DESIGN FEATURES

Ultra-high bypass turbofans, open rotor engines, use of alternative fuels, relocating engines on the body of the aircraft such that engine noise is deflected upwards are some design considerations. Blended wing-body as in X-48B aircraft prototype and advanced electrical power technologies are being experimented with. Improvement in performance can be achieved by moving from a component-based design to a fully integrated design by including wing, tail, belly fairing, pylon, engine, and high-lift devices into the solution. Electric engines using lithium polymer batteries and solar-powered manned aircraft designed to fly both day and night without the need for fuel, are

already under development. Solar electric propulsion is also being evaluated and developed by NASA using the unmanned ‘Pathfinder’ aircraft.

HEAT RECOVERY CONCEPT

Two new engine concepts currently under investigation, include the ‘Combined Brayton Cycle Aero Engine’ and ‘Multi-Fuel Hybrid Engine’. Currently, over 50 per cent of the energy gets ejected as waste heat. A heat exchanger integrated in a turbofan core can convert recovered heat into useful power which can be used for onboard systems or to power an electrically driven fan to produce auxiliary thrust. A dual combustion chamber, wherein the high temperature generated in the first stage, allows ignition-less combustion in the inter stage, thus reducing CO₂ and NO_x emissions. Cryogenic bleed air cooling can enhance the engine's thermodynamic efficiency.

INNOVATIONS

The US Department of Defence's Adaptive Versatile Engine Technology (ADVENT) and Adaptive Engine Technology Development (AETD) programmes and the GE Adaptive Cycle Engine (ACE) are areas of action. Unlike traditional fixed airflow engines, the variable cycle engines automatically alternate between a high-thrust mode for maximum power and a high-efficiency mode for optimum fuel savings. Incorporating heat-resistant materials and additive manufactured components in the Pulse Detonation Engine (PDE), gives it the potential to radically increase thermal efficiency. These adaptive features also have additional stream of cooling air to improve fuel efficiency and dissipate aircraft heat load. Such engines will also increase combat aircraft engine thrust by up to 20 per cent and improve fuel consumption by 25 per cent



THE CFM RISE PROGRAMME WILL TAKE THE NEXT GENERATION OF SINGLE-AISLE AIRCRAFT TO A NEW LEVEL OF FUEL EFFICIENCY AND REDUCED EMISSIONS

to extend range by more than 30 per cent.

POWER EFFICIENCY – LARGE JETS

Early 2018, General Electric (GE) completed its first flight test of the world's largest jet engine GE9X being built for the new long-haul Boeing 777X. The engine has approximately the same diameter as the fuselage of a Boeing 737 and houses a 134-inch-diameter front fan. The engine certification was completed in September 2020. The 1,00,000-lbs thrust engine will be the most fuel-efficient engine the company has ever produced. The world record still belongs to the engine's GE predecessor, the GE90-115B, which generated 1,27,500 lbs of thrust.

SMART ENGINES

Computer technology and the microelectronics revolution allowed full-authority electronic digital controls on aircraft engines. Next stage was the active controls at the component or sub-component level within the compressor, gas turbines and

bearings. The smart engine has a huge magnitude of computational power. It incorporates real-time feedback control within the device. Active suppression of fan and compressor surge and stall, active combustor monitoring control, magnetic bearings control and active noise controls are some of the areas. Magnetic bearings suspend the rotating members in magnetic fields, eliminating friction and lubrication requirements. Specific advantages over rolling contact bearings include elimination of the lubrication system, active damping of shaft dynamics and vibration, greatly increased temperature capability up to 800°C and large increases of load capability.

REAL-TIME DIAGNOSTICS

Real time analysis is being used to drive faster and better decisions by processing the data as it comes in. The Internet of Things (IoT) helps achieve this. Flight data is tracked in real time and it helps making minor changes to flight plans and aircraft speed to reduce flight times and fuel consumption, improve engine efficiency, reduce maintenance time and costs between flights and also the 'Life Cycle Cost'. This can result in revolutionising flight efficiency and profitability.

DRONES AS MAINTENANCE TOOL

Drones combined with improved imaging technology are increasingly being used for aircraft/engine maintenance. They can be used to detect surface damage, such as from lightning or bird strikes. It reduces time and frees technicians for other tasks. Drone-based mobile 3D scanners can be used automated non-destructive scanning. Drones can also enter confined spaces within engines and difficult to access parts without having to strip the engine.

BIG DATA PREDICTIVE MAINTENANCE

The big data revolution and Information Technology now allows maintenance companies to amass the correct parts and technicians to make any repairs as soon as an aircraft lands. This certainly holds promise for increased safety and enhanced operational efficiency by cutting aircraft-on-ground time, which is estimated to cost the industry \$62 billion annually. Even a five per cent reduction in unplanned maintenance events could save the industry up to \$656 million per year.

ELECTRIC PROPULSION

Airbus, along with partners Rolls-Royce and Siemens, is developing its E-Fan X hybrid electric demonstrator, which had to be postponed due Covid. Boeing will initially develop an electrically powered ten-seater aircraft. New market entrants such as Wright Electric have the ambition of bringing into the market an electrically powered 180-seat short-haul aircraft by 2027. Roland Berger hopes that battery energy storage density of 400-450Wh/kg and near 1,000 Wh/lis reached in next two to three years. Remember, the jet fuel has the energy storage density of around 12kWh/kg. Hybrid-electric system would initially be heavier than the fossil fuel-based propulsion system. To compensate, it would need to reduce the airframe mass by around 20 per cent.

ADDITIVE MANUFACTURING

GE Aviation, a leading jet engines manufacturer recently produced its 1,00,000th 3D printed fuel nozzle tip for its CFM LEAP

engine. Technologies are being up-scaled and maintaining production quality. MRO organisations will also benefit from the additive manufacturing revolution. Spares on demand will save from costly inventories of spare parts. Capital costs to set up such a capability still remain an issue.

CFM RISE PROGRAMME

GE Aviation and Safran have launched a bold technology development programme targeting more than 20 per cent lower fuel consumption and CO2 emissions compared to today's engines. The CFM RISE (Revolutionary Innovation for Sustainable Engines) programme will demonstrate and mature a range of new, disruptive technologies for future engines that could enter service by the mid-2030s. The programme includes open fan architecture, hybrid electric capability, demonstrator ground and flight tests around middle of decade. It plans 100 per cent sustainable aviation fuel, and hydrogen capability. The companies also signed an agreement extending the CFM International 50/50 partnership to the year 2050, declaring their intent to lead the way for more sustainable aviation in line with the industry's commitment to halve CO2 emissions by 2050. Through the RISE technology demonstration programme, they plan to reinvent the

future of flight, bringing an advanced suite of revolutionary technologies to market that will take the next generation of single-aisle aircraft to a new level of fuel efficiency and reduced emissions. They also embrace the sustainability imperative. Deliver for the future is the mantra. Plan is to accelerate efforts to reduce our impact on the environment. Their LEAP engine already reduces emissions by 15 per cent compared to previous generation engines.

Central to the programme is state-of-the-art propulsive efficiency for the engine, including developing an open fan architecture. This is a key enabler to achieving significantly improved fuel efficiency while delivering the same speed and cabin experience as current single-aisle aircraft. The programme will also use hybrid electric capability to optimise engine efficiency while enabling electrification of many aircraft systems.

THE WAY AHEAD

Technology is already delivering an impressive one per cent per annum saving on fuel burn. Pratt & Whitney says its new engines will use an internal gearbox to lower the speed of the fan saving 20 per cent on fuel consumption. CFM International introduced advanced engine called the Leap, using lightweight composite materials which could achieve similar improvements without a radical break from existing technology. Efforts to introduce bio-fuels to power jet engines are on. Airbus/Rolls-Royce hybrid electric with gas-turbine engine will allow peak power for take-off and climb while for the descent, the engine is shut down and the electric fans recover. Research is on for plasma jet engines that will use electricity to generate electro-magnetic fields instead of fuel by compressing and exciting argon gas into a plasma similar to that inside a fusion reactor. New technologies will bring change, challenge and opportunity, too. This will comprise harnessing the benefits of connectivity and big data to drive predictive maintenance, changes to technology embedded onto aircraft, the coming revolution in full-electric or hybrid-electric power and other disruptors such as additive manufacturing. SP

MRO organisations
will also benefit
from the additive
manufacturing
revolution



SUSTAINABILITY A CLEAR AMBITION



Sustainability is at the heart of our business. From the beginning, we have invested in technologies to make our engines cleaner, quieter and more efficient. Our clear ambition is to push the limits of innovation, demonstrating uncompromising technologies that will help pave the way for an ever more sustainable future. A common mission, extraordinary together.

cfmaeroengines.com/sustainability

CFM International is a 50/50 joint company
between GE and Safran Aircraft Engines



GATEWAY TO AEROSPACE REVIVAL

The show featured 20 country pavilions, 1,200+ exhibitors, 371 new exhibiting companies, more than 80 startups along and an aircraft display of over 160 commercial, military, and private jets

By AYUSHEE CHAUDHARY

FASCINATING COMBINED FLYPAST BY THE IAF'S SURYAKIRAN AEROBATICS TEAM AND UAE'S AL FURSAN DISPLAY TEAM. INDIAN AIR FORCE TOOK OVER THE SKIES OF DUBAI WITH SWASHBUCKLING AERIAL MANOEUVRES BY SURYAKIRANS, LCA TEJAS AND THE SARANG TEAMS DURING THE DUBAI AIRSHOW.



EVER SINCE THE PANDEMIC, THE AIRSHOWS THAT USED TO be the life of the aviation industry were ceased into a coma. However, things are beginning to get back after the successful vaccination drives globally. The Dubai Airshow 2021 held from November 14-18, 2021 came as a sign of positive reinforcement for the industry as members from across the world came together in large numbers. The show featured over 20 country pavilions, 1,200+ exhibitors, 371 new exhibiting companies, more than 80 startups along with a captivating aircraft display of over 160 commercial, military, and private jets including the latest Boeing 777X, Bombardier's Global 7500 and many more. The event also hosted 387 senior military and civil delegations from over 140 countries along with 50+ hours of thought-leadership content across cargo, sustainability, air traffic management and aerial mobility presented by more than 250 industry speakers. This was the largest aerospace trade event to be held globally since the COVID-19 pandemic.

Dubai Airshow gave the industry a much needed boost with sustainable recovery being discussed, next generational aircraft making way, new countries entering the market, billions of dollars of deals being signed and much more. The show is being looked at as a major turning point in recovery and growth of international aerospace industry. The officials noted that Dubai Airshow 2021 was officially the biggest edition of the event since it first began in 1989, with an incredible \$78 billion worth of deals announced during the week. The event welcomed more than 1,04,000 attendees and witnessed a 50 per cent increase in trade visitors which included global senior executives from 148 countries. This evidently displayed the confidence that people are regaining towards travel. The airshow was bigger than the pre-pandemic 2019 edition in terms of visitor numbers and deals announced. It was also a significant milestone for the defence and space sectors which saw a range of deals and agreements declared. Almost 150 countries that were represented at this year's airshow included new additions from the Czech Republic, Belgium, Brazil, Israel, and Slovakia.

The Boeing 777X caught the spotlight at the show as it made its debut. Some of the other firsts included the next generation Sukhoi Fighter Jet making its first international debut and Saab's GlobalEye that was seen for the first time as an operational asset of the United Arab Emirates (UAE) Air Force and Air Defence. Lufthansa Technik AG presented further details of its new wide-body VIP cabin concept EXPLORER. Among helicopters, apart from Airbus' vegan helicopter, the fourth and final prototype of Leonardo's AW609 also gathered attention with speed and maneuverability displays.

From aviation sustainability, advanced aerial mobility, space, cargo, air traffic management to the latest tech trends in aviation such as 5G, AI, big data and cybersecurity, the show presented a host of thought-leadership conferences based on current themes and future trends backed by leading experts and practitioners from the aerospace sector. The show featured The Fish Tank Talks where experts from the industry shared their views and insights. Other conferences that were hosted at the show included Advanced Aerial Mobility, Aviation Sustainability, Global Air Traffic Management, Space Forum, Cargo Connect, and Tech Xplore.

Some of the highlights included:

- The demand for cargo services has been rising, more so after the pandemic. The Cargo Connect at the Dubai Airshow aimed to discover the available technologies to ease capacity fluctuations, speed up cargo dispatch and improve safety throughout the supply value chain.



(LEFT - RIGHT) AERIAL DISPLAY BY LCA TEJAS PERFORMED FOR THE FIRST TIME IN THE SKIES OF DUBAI RECEIVED RAVE REVIEWS

- The Advanced Aerial Mobility Conference was also a highlight as it dug deeper into the disruptive technologies transforming how we travel and the new opportunities available to the aerospace industry. This was also significant as UAE prepares to promote itself as a hub for smart transportation.
- START-UP VISTA at the show proved to be a dedicated hub for startups from all over the world to gain face-time with investors, accelerators and mentors.
- Another dedicated programme titled, NextGen Leaders was held for organisations to engage and innovate with bright and talented students from leading universities to shape the future of aerospace and defence.
- The International Aviation Womens Association (IAWA) talks highlighted key achievements and advancement of women leaders in the aviation and aerospace industries.
- Dubai Airshow also featured the 'Future of Travel' on their TECH XPLORE Stage covering vast subjects, from flying cars to net-zero emissions.
- The Aerospace 2050 stage witnessed a full house as speakers took the centrestage to tackle how to build a better, greener aerospace industry as aviation sustainability becomes a more pressing issue in today's time.

**With more than
1,04,000 attendees,
the event witnessed a
50 per cent increase
in trade visitors
which included
global senior
executives from 148
countries**

around UAE's commitment to sustainability by creating a more sustainable circular economy. "Although important, aviation sustainability isn't just about the lifecycle of an aircraft and emissions produced. The production, manufacturing, end-of-life and supporting ecosystem should be reconsidered to create a unified environmentally friendly industry, achieve an even greater impact and put economic growth on a sustainable pathway," the officials noted.

The disruptive technologies accelerating sustainable aviation fuel (SAF) development were also discussed. It was duly noted that to scale up SAF, new technologies must be developed.

Apart from cost, operations, safety and supporting infrastructure also hold back implementation and should be worked upon. The presentation also uncovered the portfolio of solutions available to deliver SAF for aviation decarbonisation and identified technology barriers for accelerating SAF development. The session noted a rise in R&D into SAFs over

THE TEAM OF SURYAKIRANS ON THEIR ARRIVAL AT THE SHOW



AVIATION SUSTAINABILITY

After its successful virtual launch, Aviation Sustainability took place live at the Dubai Airshow, with the aim of expanding towards powering the skies with carbon-neutral flights. The show brought together aircraft manufacturers, airline operators, airports and suppliers to support the UAE's 2021 vision to accelerate sustainable development while preserving the environment, ultimately achieving the balance between economic and social development. Key themes discussed during this year's conference included sustainable aviation fuels (SAF); future energy: hydrogen & electric; reducing inefficiencies with data; government incentives; CORSIA; and streamlining aircraft engine design.

Some of the broader topics covered included discussions



the last few years, accelerated government and passenger demand, and the need for further government incentives and investment to scale production and reduce costs. This presentation uncovered the current barriers of sustainable success and how to combat future challenges to ensure we meet the 2050 goals. Credible sustainable strategies includes reducing emissions through new fleets, operational fuel efficiency, airport operations, optimal air traffic management, SAF and carbon offsetting.

Apart from SAF, hydrogen was also discussed. Hydrogen has become a buzz word in the energy world and the conference discussed about kick-starting demand for hydrogen energy and exploring the hydrogen value chain. The session also explored the storage, cost, and infrastructure required to welcome hydrogen into the aviation supply chain and how we can fast-track development.

SARANG TEAM ENTHRALLING THE AUDIENCE WITH THEIR BREATH-TAKING DISPLAY



From aviation sustainability, advanced aerial mobility, space, cargo, air traffic management to the latest tech trends in aviation such as 5G, AI, big data and cybersecurity, the show discussed it all

SPACE FORUM

Another highlight at the show was the Space Forum that explored if space services would be the game changer for the aviation sector in 2022. This year the Space Forum discussed about data services revolutionising passenger experiences, how satellite connectivity will change everything from entertainment to maintenance and how low cost access to space is going to enable your business to truly use space tech. Integrated solutions and applications, rapid innovation for mission fulfillment were underlined. The session also explored how adaptability and responsiveness are critical for successful mission delivery. UAE astronauts Hazza Al Mansouri and Sultan Al Neyani were also present at the show. Hazza is UAE's first astronaut.

UAE is advancing its journey into the space sector with consistent initiatives, collaborations and missions being surfaced.

Space sector's utilisation for inflight entertainment was also explored considering the rising demand for aero connectivity in broad terms. Inmarsat's 2018 survey suggests that about 67 per cent of the passengers are likely to rebook with an airline if inflight Wi-Fi were available. The use of satellite services for governments' networking needs was also talked about, alongside new space launches. Space launch services are expected to record strong growth in 2021, with the market forecast to grow more than 15.7 per cent year over year.

ADVANCED AERIAL MOBILITY

Drones, UAVs and eVTOLs are gearing up to take a larger portion of the industry. Drone deliveries to air taxis, the way cargo and people will be transported is changing with these disruptive technologies. Transport infrastructure in terms of cost, personal time, space consumption and carbon emissions would be pivotal with eVTOLs. Following the global trend, Dubai seeks to ensure a quarter of all journeys in the emirate are taken on autonomous transport by 2030, the show officials highlighted. Drone systems represent one of the most promising emerging technologies in the civil aviation and transport sector, the discussion identified

INDIA AT DUBAI AIRSHOW 2021

THE INDIAN AIR FORCE (IAF) TOOK OVER THE SKIES OF DUBAI during the inaugural day at the DWC or Dubai World Central Airport. IAF's Suryakiran Aerobatic team and light combat aircraft Tejas displayed their flying skills on the opening day. This was the first time in Dubai that the Surya Kirans and the Tejas flaunted their maneuvers. The Sarang Helicopter display team, consisting of the five Dhruv advanced light helicopters (ALHs) also participated in the show.

The IAF aircraft were joined by planes from the aerobatics teams of Saudi Arabia (Hawks), Russia (Knights) and the United Arab Emirates (Al Fursan), among others that included the Airbus 350, the US Air Force's F-16, the Mirage 2000 of the UAE Air Force and ended with the Russian Knights taking to the skies.

India's Defence Research and Development Organisation (DRDO) also participated, showcasing Advanced Defence Systems, Missiles, Radars, LCA-Tejas, AEW&C, Bridging Systems and more.

According to the Defence Ministry, five Dhruv advanced light helicopters (ALHs) of the Sarang team, 10 BAE Hawk 132 aircraft of the Surya Kiran team and three LCA Tejas aircraft participated in the Dubai Airshow.

India's most recent airline Akasa Air placed an order for 72 Boeing 737 MAX jets valued at nearly \$9 billion at list prices during the Dubai Airshow. This was followed by the Indian low-cost carrier SpiceJet and Boeing agreeing to settle outstanding claims related to the grounding of its 737 MAX aircraft.

IAF CONTINGENT AT THE SHOW

The India Air Force (IAF) contingent, consisting of Sarang, Surya Kiran and Tejas, gave a scintillating performance here. The IAF was invited by the Government of UAE to participate with the Sarang and Surya Kiran Aerobatic Teams. These teams performed along with some of the best aerobatics and display teams in the world, including the Saudi Hawks, Russian Knights and the UAE's Al Fursan. In addition, the IAF's Light Combat Aircraft (LCA) Tejas was a part of the aerobatics and static displays during the show.

IMPRESSIVE FLYING DISPLAY
BY LCA TEJAS



The induction of five Advanced Light Helicopters (ALH) Dhruvs of the Sarang Team, 10 BAE Hawk 132s of the Suryakiran Team and the three LCA Tejas was completed by 09th November 21. The induction was supported by the IAF's C-17 Globemaster IIIs and C-130J Super Hercules. On arrival, the contingent received a warm welcome by Staff Maj Gen Staff Pilot Ishaq Saleh Mohammed al-Balushi of the UAE Armed Forces and other officers of the UAE Air Force.

While the Sarang Team has previously participated in the Al Ain Grand Prix in UAE in 2005, the Dubai Air Show was the first occasion for the Suryakirans and the Tejas to show off their swashbuckling aerial manoeuvres here.

The Sarang Helicopter Display Team, which flies the Indian manufactured Advanced Light Helicopter (ALH) Dhruv, derives its name from the Sanskrit name for peacock, the national bird of India. Being the only four helicopter military display team in the world, Sarang has previously performed its daring manoeuvres at international venues like Singapore, UAE, Germany, UK, Bahrain, Sri Lanka and Russia. The team was led by Wing Commander Girish Komar.

how companies can capitalise on drone technology, calculate ROI and accelerate investment in air-mobility infrastructure to support drone development. Germany air-taxi startup Lilium, Florida based LuftCar, Israeli AIR, Airbus and Boeing were among the next-gen aircraft companies present at the show.

The disruption challenges faced during the pandemic has increased opportunities within the UAV sector. Worldwide lockdowns accelerated ecommerce activity, coupled with vaccine drives that are pushing capacity boundaries with traditional cargo and last mile delivery suppliers. This session extensively discussed how delivery drones can alleviate some of the ecommerce boom pressures and fast track vaccine distribution. Demand for last-mile logistics is voracious with deliveries expected to double by 2030. Commercial and cargo drones cannot truly take off without the physical infrastructure to support operations such as landing pads, charging points, and drone ports. The world's only city-wide drone network in Abu Dhabi was also showcased at the show to explore the initiative's value proposition for healthcare and how lightweight, emission-free drones will help pioneer sustainable Cities of the Future.

UAE AVIATION AHEAD

Speaking about the UAE aviation industry and the outlook for

Dubai airports, Sheikh Ahmed said Dubai International Airport (DXB) is set to return to full operational capacity by next week, with the reopening of Concourse A, in a development that will

THE TEAM OF SARANG HELICOPTERS DURING THEIR PRACTICE RUNS



PARTICIPATING IN THE AEROBATICS DISPLAY AT THE SHOW – (LEFT) SURYAKIRAN TEAM; (RIGHT) SARANG TEAM.



The Suryakiran Aerobatic Team (SKAT) operated the Hawk 132 aircraft and performs a nine aircraft aerobatics display. It was previously equipped with the Indian made Kiran Mk II aircraft and has performed internationally at Sri Lanka, Myanmar, Malaysia, Singapore, Thailand, Lao and China. The team was led by Group Captain Anoop Singh.

The indigenous Light Combat Aircraft (LCA) Tejas of the IAF carried out manoeuvres to enthral the crowd. The Tejas team was led by Group Captain Manish Tolani.

The contingent was visited by Air Marshal A.P. Singh, Senior Air Staff officer of the Shillong based Eastern Air Command. On arrival, the contingent commander briefed him on the contingent and introduced him to the officers and airmen of the participating teams. The Air Marshal interacted with them and wished them well for the air show. He also interacted with officers and personnel of the UAE Armed Forces working with the IAF contingent for the duration of the air show.

PERFORMANCE BY THE IAF CONTINGENT

The Dubai Air Show kicked off in style on November 14 at the Al Mak-



toum airport in UAE. The IAF's Sarang Helicopter Display Team and the Light Combat Aircraft (LCA) Tejas showcased their superior flying skills and left an indelible impression of the capabilities of the IAF and the rapid strides of the Indian aviation industry.

November 17, 2021, the penultimate day of the Dubai Air Show 2021 commenced with a fascinating combined flypast by the IAF's Suryakiran Aerobatic Team and UAE's Al Fursan Display Team. Nine Hawk 132 of the Suryakiran team flew in sync with seven Aermacchi MB-339 of Al Fursan over important landmarks of Dubai like Burj Khalifa, Palm Jumeirah and Burj Al Arab, in a display which signifies the deep camaraderie and bonhomie between the two Air Forces.

The Suryakirans also participated in a late afternoon aerobatics display which was highly appreciated by the crowd.

The ever increasing popularity of the Tejas was reinforced by the superb demonstration flight flown by the fighter in the afternoon. The aircraft manoeuvred effortlessly, showing off its agility and versatility; a testament to the rapid strides that the platform has achieved in recent times. **SP**

provide a positive impetus to the aviation sector in the country. He also expressed confidence that both Emirates and DXB will return to pre-COVID levels of activity in the next 12 months.

SARANG HELICOPTERS SHOWING THEIR SUPERIOR FLYING SKILLS



Efforts being made to coordinate with different countries and aviation authorities across the world will make this possible, he noted. "Dubai authorities are working to restore the high passenger numbers before the pandemic, which saw DXB handling 90 million international passengers annually, making it one of the world's busiest international airports, he added.

Alaa Elshimy, Managing Director & Senior Vice President of Enterprise Business Group, Huawei Middle East also added that the aviation sector has experienced unprecedented disruption from the COVID-19 pandemic. However, we are seeing a better than expected recovery, particularly in the Middle East. The recovery has been accelerated by accelerated technology adoption within the aviation sector. Contactless technology and AI-enabled video surveillance for enforcing social distancing protocols have effectively boosted confidence for travellers to return to the skies. Cloud technology has also enabled elasticity and resilience in COVID-enforced remote working environments and tight labor conditions. Another major trend is green airports and net-zero targets for the industry as sustainability takes hold.

Industry players have been quick to offer solutions to cater to rising demand and the show's occurrence at such a time is a high booster to drive the aerospace industry collectively towards a faster recovery. **SP**

DYNAMIC DEALS DEFINE DUBAI AIRSHOW



DUBAI AIRSHOW IS A MAJOR DRAW FOR AEROSPACE MAJORS FROM ACROSS THE GLOBE. THIS YEAR ALSO, UAE'S MINISTRY OF DEFENCE SIGNED CONTRACTS WORTH BILLIONS OF DOLLARS WITH SUPPLIERS DURING THE DUBAI AIRSHOW.

The total value of contracts awarded for commercial aircrafts and defence purposes during the Airshow reached Dh266 billion in the first three days

By AYUSHEE CHAUDHARY

DEALS HAVE ALWAYS BEEN SOMETHING TO LOOK FORWARD to in any airshow and Dubai Airshow 2021 was no different, rather it had more. The total value of contracts awarded for commercial aircrafts and defence purposes jumped by Dh63 billion on the third day itself of the Airshow, reaching Dh266 billion in the first three days. The Airshow further established the importance of international cooperation as critical for the global aviation sector especially to return to pre-pandemic levels.

Some of the notable deals which took place during the event included:

- The UAE's Ministry of Defence signed AED 22.5 billion worth of contracts with European, American and Asian contractors and suppliers at the Airshow. The UAE Air Force and Air Defence (Afad) on the first day awarded a contract worth Dh11 billion to Abu Dhabi-based advanced technology firm Edge Group's subsidiary GAL for the maintenance, repair and overhaul (MRO), and specialised support services for the UAE Airforce and Air Defence.
- Tawazun Economic Council (Tawazun) and Airbus signed a Memorandum of Understanding (MoU) under which the



latter will establish a wholly-owned facility in Abu Dhabi. The formation of the subsidiary is part of Tawazun's efforts to attract and promote long-term partnerships with major companies in the defence, aviation and aerospace sector. Tawazun also signed a Euro 216.9 million deal with Aeroter to purchase 100 VRT500 helicopters.

- Dubai Airshow and the UAE Space Agency signed a MoU on the second day of the event. The two parties will collaborate to further position Dubai Airshow as a key platform for companies and investors in the space sector. The partnership will support organisations looking to establish a presence at future editions of the event and will enable space companies to benefit from the participation, engagements, networking and agreements created at Dubai Airshow. The agreement will deliver an increased focus on the space industry for future editions of the event highlighting the continued growth and development of the international space sector. His Highness Sheikh Ahmed commented.
 - Honeywell appointed Wahaj, a Saudi Arabia-based company, as a strategic supplier for manufacturing commercial aerospace parts. Wahaj will be the first company from the Middle East to manufacture and export a large variety of original equipment manufacturer (OEM) aviation parts to Honeywell Aerospace sites in the United States, Europe, and Asia. Wahaj is one of the few AS9100-certified companies in Saudi Arabia involved in the manufacturing of high-precision, high-complexity machined components, kits, and subassemblies, for the aerospace and defence industries. As part of the seven-year agreement, Wahaj will supply OEM parts to Honeywell that go into products such as wheels and brakes, power systems, engines, air and thermal systems, and auxiliary power units (APUs) for several major platforms including the Airbus 350, 330 and 320NEO; Boeing 737MAX and 777; Dassault Falcon 8X/M1000 and 7X; and McDonnell-Douglas 11.
 - Overland Airways of Lagos, Nigeria, has placed orders for three new E175 E-Jets, plus three purchase right aircraft. The transaction was announced at the Dubai Airshow and is worth \$299.4 million, at list price with all options exercised. Deliveries are planned to begin in 2023. The new aircraft, the airline's first jets, will be deployed to increase scheduled flights on domestic routes and to expand its regional network. Each E175 is configured with 88 seats in Premium Class cabin configuration.
- Apart from these the key players like Boeing, Airbus, Etihad and Emirates among other had a significant share of dealings.

AIRBUS

Airbus gathered extensive attention both in the display as well as the deals' segment.

In the customers' display, Emirates Airline presented its A380 and Etihad Airways showcased the A350-1000. Airbus Helicopters displayed the Kuwait Air Force aircraft H225M, along with an ACH175 as well as a mock-up of the H145M, and

a scale model of the H175M. Meanwhile, Airbus Defence and Space presented a C295 and an A400M airlifter on the static display. The daily flying display included Airbus' own A350-900. Showgoers will also have the opportunity to see the ACH145 in flight as it performs customer demos at the South terminal.

Airbus Corporate Helicopters' (ACH) also designed and presented a fully vegan helicopter during the show, the ACH145. Its cabin is fitted with ACH's clean and modern ACH Line interior configuration in a grey theme but the leather elements essential to its luxury feel are replaced with Ultraleather which captures the visual and tactile leather experience with comparable durability. Items that had to be specially designed and fabricated in the replacement material include the six passenger seats, central storage cabinet, rear partition and cockpit controls cuffs.

Airbus' Flight Operations subsidiary NAVBLUE launched Mission+, the first Electronic Flight Assistant (EFA) that provides pilots with all the data and information that they need to perform their mission, via one modular digital solution. This mission-centric approach integrates flight management data

and documentation, cockpit check-list, navigation charts and airport maps, real time weather conditions, aircraft performance data - usually only available to pilots via multiple sources. Accessible through an interactive display, Mission+ is the first EFA on the market to gather all information sources together with one single point of entry. For pilots this means an integrated interface that allows quick, easy and seamless navigation.

- Wizz Air (Hungary), Frontier (United States), Volaris (Mexico) and JetSMART (Chile, Argentina), Indigo Partners portfolio airlines, have announced an order for 255 additional A321neo Family aircraft under a joint Indigo Partners agreement. The firm order was signed at the Dubai Air-

show. This order brings the total number of aircraft ordered by the Indigo Partners' airlines to 1,145 A320 Family aircraft. The aircraft ordered today are a mix of A321neos and A321XLRs, which will be delivered to the individual airlines as follows:

Wizz Air	: 102 aircraft (75 A321neo + 27 A321XLR)
Frontier	: 91 aircraft (A321neo)
Volaris	: 39 aircraft (A321neo)
JetSMART	: 23 aircraft (21 A321neo + 2 A321XLR)

In addition to this order, Volaris and JetSMART will up convert 38 A320neo to A321neo from their existing aircraft backlogs.

- Airbus Corporate Jets (ACJ) and Alpha Star Aviation signed a Letter of Agreement at Dubai airshow for the new and unique In-Flight Entertainment (IFE) technology - "The ACJ Smart LiFi Monitor" in presence of Abdulnaser Al Kheraif CEO, and Ibrahim Al Yaheyay VP-Tech, Alpha Star Aviation and Benoit Defforge, ACJ President.
- Akwalbom state government owned airline in Nigeria, Ibom Air has signed a firm order for ten A220s at the Dubai Airshow. The signing was done by Mfon Udom, the chief Executive Officer of Ibom Air, and Christian Scherer, Chief Commercial Officer and Head of Airbus International in the presence of the Akwalbom state Governor, Udom Gabriel Emmanuel.

The UAE's Ministry of Defence signed AED 22.5 billion worth of contracts with European, American and Asian contractors and suppliers at the Airshow

- Two new airline customers in Africa selected Airbus' Flight Hour Services (FHS) to support their respective Airbus fleets: Air Tanzania for its A220s and Uganda Airlines for its A330neos.
- Air Lease Corporation (ALC) has signed a Letter of Intent (LoI) covering all Airbus Families, highlighting the power of the company's full product range. The Indonesia Ministry of Defence placed an order for two Airbus A400M aircraft in multirole tanker and transport configuration.
- The United Arab Emirates Air Force & Air Defence formally ordered two additional Airbus A330 Multirole Tanker Transport (MRTT) aircraft increasing the country's MRTT fleet up to five aircraft.
- Airbus also signed a Memorandum of Understanding (MoU) with Jazeera Airways, the Kuwait-based carrier, for 20 A320neos and eight A321neos.
- Airbus' CityAirbus NextGen eVTOL aircraft is expected to gain EASA certification in 2025, Balkiz Sarihan, Airbus head of urban air mobility strategy execution and partnerships announced during a briefing at the Dubai Airshow.

BOEING

Boeing's 777X made its international debut at the Dubai Airshow. Captivating much of the attentions during the first flying day of the airshow, a Boeing 777-9 flight-test airplane took to the skies. While this remained as a major highlight of the show, there was much more that happened for the aerospace manufacturer. Boeing showcased its market-leading portfolio of commercial, defence and services products at the 2021 Dubai Airshow, along with the company's growing autonomous capabilities such as the Boeing Airpower Teaming System.

- In a headline making occurrence, Boeing and Akasa Air, a brand of SNV Aviation, announced the new Indian carrier has ordered seventy-two 737 MAX airplanes to build its fleet. Valued at nearly \$9 billion at list prices, the order is a key endorsement of the 737 family's capability to serve the rapidly growing Indian market.
- The 737 MAX family promises to deliver superior efficiency, flexibility and reliability while reducing fuel use and carbon emissions by at least 14 per cent compared to airplanes it replaces. India's growing economy and expanding middle class is expected to fuel strong demand for commercial flights, driving the need for more than 2,200 new airplanes in South Asia valued at nearly \$320 billion over the next 20 years, according to Boeing's 2021 Commercial Market Outlook forecast.
- Boeing and Sky One FZE announced a sales agreement for three 777-300 airplanes at the Dubai Airshow. Terms of the agreement were not disclosed. Sky One FZE is a privately held aircraft leasing company based in the United Arab Emirates. Sky One FZE has a diverse business portfolio, namely dry and wet leasing, Maintenance, Repair and Overhaul services, pilot training, operations, Air Operator's Certificate management as well as spares and logistics. The firm has a strong focus on growing airlines in Africa, the Commonwealth of Independent States and India.
- Air Tanzania announced order for Boeing freighter and passenger jets with an order for 787 Dreamliner, 767 Freighter and two 737 MAX airplanes.
- SAUDIA selected Boeing for a suite of services to improve their 787 Dreamliner and 777 fleets' operational efficiency through digital analytics, and to modify their 777 cabin interiors.



(TOP & ABOVE) BUSINESS AIRCRAFT ALSO FEATURED PROMINENTLY AT THE EVENT

- Emirates announced an order for two 777 Freighters, expanding the future capability of one of the world's largest cargo airlines at a time of significant global demand for air freight. The freighters will be operated by Emirates Sky-Cargo, which currently operates an all-Boeing fleet of 10

Key themes discussed during this year's aviation sustainability conference included SAF; future energy: hydrogen & electric; reducing inefficiencies with data; government incentives, etc.



(TOP) FIVE AEROBATIC TEAMS PARTICIPATED IN THE AEROBATIC DISPLAYS THIS YEAR; (ABOVE) THE RUSSIAN KNIGHTS AEROBATIC TEAM TOOK PART IN THE FLIGHT PROGRAMME

777 Freighters and also carries cargo on Emirates' 134 777 passenger airplanes.

- DHL Express placed its largest Boeing converted freighter order to date. The logistics company placed a firm order for nine more 767-300 Boeing Converted Freighters (BCF). Rep-

Dubai Airshow and the UAE Space Agency signed a MoU to collaborate to further position Dubai Airshow as a key platform for companies and investors in the space sector

resenting their largest single 767-300BCF order to date, the additional freighters will help expand DHL's long-haul inter-continental fleet in response to increased global demand for cargo capacity. DHL has taken delivery of seven of a batch of eight 767-300BCF, that have been leased to DHL partner airlines in the Middle East and Latin America to support its expanding regional networks. The manufacturer boasts 767-300BCF to be the world's most efficient medium widebody converted freighter and can carry up to 51.6 tonnes (113,900 pounds) up to 6,190 kilometers (3,845 nautical miles). 767 Freighters provide the lowest operating costs per trip with excellent payload and range capability. The 767-300BCF has more than 100 orders and commitments to date.

- Keeping up the global demand for freighters that continues to soar, Boeing announced plans to add three conversion lines for the market-leading 737-800BCF across North America and Europe. The company also signed a firm order with Icelase for eleven of the freighters as the launch customer for one of the new conversion lines. In 2022, the company plans to open one conversion line at Boeing's London Gatwick Maintenance, Repair & Overhaul (MRO) facility, its state-of-the-art hangar in the United Kingdom; and two conversion lines in 2023 at KF Aerospace MRO in Kelowna, British Columbia, Canada.

EMIRATES

Emirates has concluded the 2021 edition of the Dubai Airshow on a positive note, culminating a week of investment announcements and partnerships. This year, Emirates' presence at the show included participation in the opening flypast; aircraft static displays; an exhibition stand showcasing its latest cabin products, Emirates Flight Training Academy and the Emirates Aviation University; and offering its renowned hospitality for partners and invited guests in the Emirates Chalet.

Emirates' latest four-class configured A380 remained a popular draw, featuring the airline's recently introduced Premium Economy Class cabin. The Cirrus SR22 and Embraer Phenom 100 jets utilised for training flights by the Emirates Flight Training Academy were also on display to visitors.

The flypast was a large and colourful start to the Dubai Airshow flying display programme, and celebrated the UAE's advancements and leadership in civil aviation and aerospace. The Emirates B777-300ER display aircraft was emblazoned with the bespoke 'United Arab Emirates 50' livery, embodying the Golden jubilee of Emirates' home and hub, the UAE. The Emirates A380 featured the Expo 2020 Dubai livery with the special 'Dubai Expo' and 'Be Part of the Magic' messages running across both sides of the fuselage.

- The airline announced a significant investment to retrofit 105 of its Boeing 777 and A380 aircraft with its Premium Economy product, in addition to other cabin enhancements. The entire 18-month retrofit programme, starting in 2022, will take place in Dubai and reinforces the UAE's status as a centre of aviation excellence.
- At the end of the retrofit programme, Emirates will have a total of 111 Boeing 777 and Airbus A380 aircraft offering Premium Economy seats, including the six A380s that would have been delivered to the airline with four cabin classes by December 2021.
- On the Emirates Boeing 777, five rows of Economy class seats located just behind Business Class will be removed to install 24 Premium Economy seats laid out in 2-4-2 configuration. On the Emirates A380, 56 Premium Economy seats

will be installed at the front of the main deck also in 2-4-2 configuration.

- Emirates also signed an agreement with Panasonic to deliver a suite of in-flight entertainment (IFE) solutions for its Premium Economy retrofit programme.
- Emirates and Gulf Air signed a MoU to develop a deeper commercial cooperation between both carriers as they look to leverage each other's networks.
- To support its long-term cargo capabilities and help boost global supply chain connectivity, Emirates SkyCargo announced that it will introduce two new Boeing 777Fs into its fleet in 2022, and signed an agreement with Israel Aerospace Industries (IAI) for the conversion of four Boeing 777-300ER passenger aircraft into full freighters, starting in early 2023.
- Building on Dubai's global logistics hub status and emergence as a centre for e-commerce, Emirates SkyCargo also signed a milestone agreement with Emirates Post, to develop an e-commerce end-to-end global logistics platform, with a key focus on serving markets in the Middle East, Africa and West Asia. The first of its kind, this partnership between an airline cargo carrier and a national postal operator combines the global network and capacity strengths of Emirates SkyCargo with the last-mile delivery expertise of Emirates Post.
- Supporting its efforts to reduce its environmental footprint, Emirates signed an agreement with GE Aviation committing to develop a programme that will see an Emirates Boeing 777-300ER powered by GE90 engines conduct a test flight using 100 per cent Sustainable Aviation Fuel (SAF) by the end of 2022. The milestone collaboration is expected to demonstrate how widebody commercial aircraft using jet fuel made from alternative sources can lower lifecycle CO2 emissions.

ETIHAD

Etihad Airways has signed multiple partnership and collaboration agreements with the aviation industry's top manufacturers, suppliers and stakeholders at the 2021 Dubai Airshow, bringing aviation's leading organisations together under its strategic sustainability programme to drive decarbonisation creating the industry's most comprehensive multi-organisational partnership to reduce CO2 emissions globally. Etihad also managed to expand strategic sustainability programme uniting industry leaders in the most comprehensive, cross-organisational aviation sustainability initiative ever undertaken, the airline stated.

The airline's sustainability programme, which to date has been focused on the airline's fleet of GENX powered Boeing 787's under the Greenliner Programme, will now be complemented by a similar programme focussed on maximising the opportunities presented by the inclusion of the Rolls Royce XWB powered Airbus A350 fleet. The first of Etihad's A350's, launched at the Dubai Airshow as the "Sustainability50", carries a unique "UAE50" livery in recognition of the 50th anniversary of the federation of the UAE and the airline's commitment to the 2050 target of net-zero carbon emissions.

Etihad's work with partners including Boeing, GE, Airbus and Rolls Royce supports the organisation's strategic objectives to achieve a 20 per cent reduction in emissions intensity in its passenger fleet by 2025, cut 2019 net emissions by 50 per cent by 2035, and reach net zero emissions by 2050.

The introduction of the Rolls-Royce XWB engine powering the A350 fleet is yet another credential in Etihad's drive for sustainable operations, given the renowned fuel efficiency of this modern engine. Etihad's agreement with Rolls-Royce is built around



(TOP) AIRBUS SIGNED A MAJOR DEAL FOR 255 AIRCRAFT WITH INDIGO PARTNERS
(ABOVE) BOEING 777X MADE ITS INTERNATIONAL DEBUT AT THE SHOW

maximising the enormous potential of this engine, and beyond, targeting the application of electrification technologies and hybrid systems, together with the use of electric motors for commuter aircraft and the fast-emerging urban air mobility (UAMs) sector.

Emirates SkyCargo signed a milestone agreement with Emirates Post, to develop an e-commerce end-to-end global logistics platform, with a key focus on serving markets in the Middle East, Africa and West Asia



(TOP) EMIRATES ANNOUNCED A MAJOR RETROFIT PROGRAMME. THE ENTIRE 18-MONTH PROGRAMME WILL TAKE PLACE IN DUBAI
(ABOVE) ETIHAD SIGNED MULTIPLE PARTNERSHIPS AND COLLABORATIONS AT THE SHOW

Etihad's partnership with Airbus established a formal framework to collaborate for sustainability across a number of core areas on Etihad's A350 fleet, in line with the organisations' respective sustainability programmes to improve aviation's environmental performance. Key areas for collaboration include the promotion and commercialisation of sustainable aviation fuel, waste and weight management, and the development of data driven analysis.

The multitude of partnerships which have made up the Etihad Greenliner Programme to date demonstrate the airline's agile and comprehensive approach to sustainability, proven by the inclusion of Airbus A350 and Rolls-Royce and subsequent expansion to Sustainability50; an evolution certain to further signify the power of the Etihad Greenliner call to arms, and Etihad Airways commitment 'For the World'. At the Dubai Airshow in 2021 Etihad signed many other sustainability-focused agreements:

- Etihad and Lufthansa Technik AG signed a MoU regarding a comprehensive partnership on the exploration of digital solutions that is set to further optimise the airline's technical fleet and operations management. The field of cooperation will encompass several products from Lufthansa Technik's industry-leading AVIATAR digital operations suite. Focusing on digital and sustainable tech-ops, it covers the use of Fuel Analytics, Condition Monitoring and automated Line Maintenance Planning in the beginning. To further boost its fuel efficiency and hence reach its sustainability goals, Etihad will be one of the first airlines to take advantage of AVIATAR's innovative Fuel Analytics app.
 - SATAVIA and Etihad Airways signed a MoU to form a partnership focussing on reducing the airline's non-CO2 footprint via advanced flight planning optimisation. The collaboration will help to eliminate the creation of aircraft-generated clouds that account for up to 60 per cent of aviation's total climate impact. In a world-first trial targeting contrail formation, the two companies collaborated on the airline's EY20 Sustainable flight on the 23rd October 2021. SATAVIA's DECISIONX capability enables airlines to prevent condensation trails (contrails), which cause a net climate warming effect almost double that of direct engine emissions. By exploring the potential for integrating SATAVIA's DECISIONX flight plan contrail optimisation into the airline's flight planning systems, Etihad hopes to implement navigational contrail prevention in day-to-day flight operations.
 - Etihad and Tadweer (Abu Dhabi Waste Management Center) signed a Joint Project Development Agreement (JOP) on waste to fuel initiatives, as part of the nation's targets to divert 75 per cent of waste from landfills by 2025 and the sectors compliance with CORSIA, toward decarbonisation through utilisation of Sustainable Aviation Fuels. The project seeks to explore the processing of commercial, industrial, and municipal solid waste to fuel, fulfilling the airline's stance on the development, production and integration of a valuable biofuel supply chain in the region.
 - Etihad Airways and The Storey Group signed a MoU. Following the operation of the Etihad Sustainable Flight, the airline adopted a mangrove for each passenger on board the flight from Abu Dhabi's Jubail Mangrove Park to support the development of mangrove conservation projects in the nation. Collaboration with Jubail Mangrove Park, The Storey Group and Environmental Agency Abu Dhabi is especially significant, in ensuring the preservation and maintenance of natural habitats, the mangroves not only reduce pollution from water and the atmosphere, but increase their potential to avoid release of CO2 into the atmosphere with mangroves currently holding up to 6.4 billion tonnes of CO2 globally.
- Etihad Engineering, one of the world's leading aircraft maintenance, repair, and overhaul (MRO) services provider based in Abu Dhabi, UAE, showcased its comprehensive range of aircraft maintenance and engineering solutions. It also managed to get some significant deals in its pocket. The company has successfully completed complex maintenance projects over the years for airlines from across the world.
- Etihad Engineering, was awarded a heavy maintenance contract by Virgin Australia for its Boeing 737 fleet. The scope of the contract covers heavy maintenance and modifications on more than 30 nose to tail aircraft for the largest airline by fleet size under the Virgin brand.

THE SIGNIFICANT EFFORTS OF ALI ALNAQBI, FOUNDER OF MIDDLE EAST BUSINESS AVIATION ASSOCIATION (MEBAA) AS WELL AS THE CHAIR OF THE GOVERNING BOARD OF INTERNATIONAL BUSINESS AVIATION COUNCIL (IBAC) HAVE CONTRIBUTED SUBSTANTIALLY TO BUSINESS AVIATION'S SWIFTER RECOVERY AND THAT MIDDLE EAST HAS COME THROUGH AS A MAJOR RESILIENT REGION WHEN IT COMES TO BUSINESS AVIATION



PHOTOGRAPHS: MEBAA

MEBAA DRIVES MIDDLE EAST'S ROAD TO RECOVERY

Even though international traffic remained almost standstill, the Middle East, specifically the United Arab Emirates (UAE) remained very resilient for business jet travel, especially Dubai

By AYUSHEE CHAUDHARY

IT HAS BEEN ALMOST TWO YEARS SINCE THE PANDEMIC TOOK the world on a ride like never before. The effects that the virus had on the aviation industry are well established. There is no region that did not face the aftermath. While the aviation industry is on its journey back, business aviation has had an interesting curve. Even while dealing with the harsh blows, there have been optimistic signs of recovery in certain regions. Apart from the United States (US) and Europe, the Middle East has come through as a major resilient region when it comes to business aviation.

Ali Alnaqbi, who is the founder of Middle East Business Aviation Association (MEBAA) as well as the chair of the governing board of International Business Aviation Council (IBAC) also highlighted business aviation's swifter recovery. The nature of business and private aviation that incorporates social distancing and privacy quite organically allowed easier resumption of operations, he noted. The region has hence fared well with early data even suggesting its return to pre-pandemic levels.

Earlier this year, Alnaqbi had expressed concerns about the industry's growth. With regards to business aviation flights, he had underlined airspace closure as a major problem. He noted that movements were idled in Saudi Arabia and that several European countries were barring access or changing rules on a frequent basis. He had also stated the survival strategy of many Bizav operators, including ground handlers, FBOs and flight support companies who were directing more and more attention to cargo operations because even with the closure of airspace, cargo aircraft were in continuous operation.

However contrary to the concerns, things have been on the upper side lately for the region. According to

WingX Advance's data in August this year, there were mixed trends in recovery in the largest markets for business jets. Even though international traffic remained almost standstill, the Middle East, specifically the United Arab Emirates (UAE) remained very resilient for business jet travel, especially Dubai. By the end of September, the UAE had seen tremendous growth in activity, going up 70 per cent on 2019, WingX noted. Ultra Long Range departures from the UAE were up 24 per cent this year, while heavy Jet sectors were up over 150 per cent, Legacy 600/650 emerging as the most prolific. The Middle East continued seeing a lot of growth through October starting as well, noting 23 per cent more business jet sectors than two years ago, with the UAE breaking historical records in both domestic and international traffic.

Ending October, some markets also saw gains in charter and fractional operator flights including the Middle East that had gains of better than 20 per cent week-over-week, according to private jet card comparisons. UAE also made to the list of countries that showed the strongest growth in the last week of October compared to 2019 are with Brazil, India, Colombia, Nigeria and Egypt.

"The Middle East region's role as a global connecting hub continues to be important for developing markets to and from Southeast Asia, China and Africa. The region has been a leader in restoring confident passenger travel through multi-faceted initiatives that aid international travel recovery," said Randy Heisey, Boeing managing director of Commercial Marketing for the Middle East.

Dubai surely stood out, with Dubai International Airport seeing 77 per cent increase in flights compared to November 2019, Al Maktoum Airport record-

"All recent indications suggest that the business aviation sector will make a strong recovery next year and the MEBAA Show will play an important role in restoring confidence, driving collaboration and creating new opportunities for the sector."

**—Ali Alnaqbi,
Founder of MEBAA**



MEBAA SHOW, SCHEDULED TO TAKE PLACE FROM DECEMBER 6-8, 2022 WILL BE A FURTHER ADDITION ON THIS UPSWING IN MIDDLE EAST BUSINESS AVIATION

ing over 200 per cent growth; year to date, Al Maktoum outbound business jet traffic being 135 per cent up compared to 2019. Emirates Group came back strongly with 81 per cent gain in H1-21 revenues to Dh24.7 billion.

And all this is when the Middle Eastern BizAv industry is not even very large. Though, it certainly promises expansion in the times ahead. According to Aviation Week's 2022 Business Aviation Fleet & MRO Forecast, globally the Middle East region accounts for a small proportion of the business-aviation fleet. The Forecast includes the Middle East in its Asia-Pacific figure that comes to a total of just 3 per cent of anticipated aircraft deliveries over the next decade. At present there are about 379 aircraft active in the region and a detailed forecast of the region's bizav fleet by age expects about 60 additions over the next decade. Beyond BizAv, according to Boeing's 2021 Commercial Market Outlook (CMO) forecast, the Middle East region is positioned to capitalise on the recovery of regional and international travel and cargo demand. Boeing forecasts 3,000 new aircraft deliveries to Middle East airlines over the next 20 years. Middle East passenger traffic and the region's commercial fleet are projected to more than double over the 20-year forecast period, according to the CMO.

The usual concern of avoiding the crowd to stay away from the virus has certainly helped Middle East as much as it helped other regions across the world when it comes to business aviation. This has made way for many first time bizav travelers. In addition to that, the unavailability of some of the routes on scheduled airlines due to restrictions has also nudged travelers towards private aviation with the complementary benefits of saving time, efforts and ensuring safety. Dubai especially gained traction by these. Along with this, Dubai's pandemic policy of timely vaccinations and early removal of travel restrictions also helped the city to revive, attracting many tourists from across the

world. The lifting of restrictions also allowed many international events to take place in Dubai. Apart from the glorious Dubai Airshow, other large scale international conferences like International Astronautical Congress (IAC), events like Indian Premier League (IPL) Dubai Airshow, Expo 2020 also added to the footfall.

MEBAA SHOW 2022

Amid this, the MEBAA Show scheduled to take place from December 6-8, 2022 seems to be a further addition on this uprising journey. The show aims to bring together thousands of regional and global business aviation professionals to support the community in propelling towards post-pandemic recovery and achieving business priorities.

"All recent indications suggest that the business aviation sector will make a strong recovery next year and the MEBAA Show will play an important role in restoring confidence, driving collaboration and creating new opportunities for the sector," said Alnaqbi. There has been a less than one per cent decline in five-year purchase plans, so despite the short-term effects of the pandemic, he believes that the industry will show tremendous resilience and the ability to go from strength to strength in coming years. "The MEBAA Show, the Middle East's leading business aviation platform, will showcase the latest technologies, insights and business opportunities shaping the future of business aviation in the Middle East and across the globe," added Alnaqbi.

ACJ President Benoit Defforge commented: "We expect the business jet market to grow and we have invested in new technology to meet the demand and delight our customers. We look forward to attending the MEBAA Show which will be an important event next year that will help bring industry organisations together to witness the latest developments in our sector and support the continuing recovery and growth of the business aviation segment." SP



THE LIST OF EMBARGOED ITEMS COMPRISES OF NOT JUST SIMPLE PARTS BUT ALSO SOME HIGH TECHNOLOGY WEAPON SYSTEMS LIKE HELICOPTERS AND OTHERS

MOD REVISES ITS IMPORT BAN DECISION

In case the domestic industry is unable to supply equipment urgently needed by the armed forces, in the stipulated time frame, or quantity or where there are any other technical issues, specific cases of imports could be taken up to meet immediate requirement

By RANJIT KUMAR

IT WAS OFFICIALLY TOUTED AS A MAJOR PUSH TO ATMANIRBHAR Bharat (self dependent India) and promotion of indigenisation, but it seems that the defence ministry seems to have realised its follies in imposing strict ban on import of defence systems which were likely to be made available from domestic sources. According to reports, the defence ministry has revised its major policy decision taken last year on August 9, to impose restrictions on import of specified items, for which a negative list of 101 items was finalised and released to the public.

Later, on May 31 this year, the MoD had further expanded this with a new list of 108 items. This was announced by Defence Minister Rajnath Singh himself. The restrictions on the import of 108 items that figured in the second expanded list was supposed to have come into effect from December 2021 to December 2025.

According to reports the defence ministry has updated its last year's policy decision of imposing ban on import of 101 items which was subsequently expanding this year in the end of

May. Defence Minister Rajnath Singh is reported to have okayed the ministry's proposal to allow imports of certain items after due scrutiny by a select committee of Defence Indigenisation Committee (DIC) which will be chaired by the Chief of Defence Staff (CDS) consisting of all relevant stake holders which will decide on specific requests of the armed forces. A notification was prepared for this purpose

According to this notification, in case the domestic industry is unable to supply equipment urgently needed by the armed forces, in the stipulated time frame, or quantity or where there are inadequacies in the equipment affecting safety of the troops or in case of any other technical issues, specific cases of imports could be taken up to meet immediate requirement, based on the recommendations of the DIC. According to sources, care has been taken to not allow the dilution of efforts to curb imports, but will be useful to meet urgent requirements of the armed forces in case of non-delivery or delays by domestic manufacturers. Also, a new DIC is also being constituted to draw up negative import lists and five exceptions to the armed forces. The DIC will oversee the implementation of the negative import list and will progressively expand it to cover more products and services. The DIC will also prepare new negative import lists which has been described as positive indigenisation list by the MoD. The DIC will also consult industry and other stakeholders to identify more systems that should no longer be imported by the forces.

Defence Minister Rajnath Singh had announced on August 9, 2020 that there will be an import embargo on 101 items and described it as a measure to boost defence indigenisation. However, according to sources, the forces were feeling handicapped because of non-availability of negative listed defence items from domestic sources urgently needed by them. In view of the rising tension on the northern and western borders, forces readiness in fighting the battle was being impacted by this decision as domestic manufacturers were unable to supply them on time and imports were not allowed. The armed forces were facing a great dilemma. In the name of Atmanirbhar Bharat, their combat readiness was being adversely impacted. Hence, the MoD had to take this policy changing decision.

Prime Minister Narendra Modi in his address to the Nation on May 12, 2020 had given a clarion call for a self-reliant India based on the five pillars, i.e., Economy, Infrastructure, System, Demography & Demand and announced a special economic package for Self-Reliant India named 'Atmanirbhar Bharat'. Taking cue from that evocation, the Department of Military Affairs (DMA), Ministry of Defence (MoD) had prepared a list of 101 items for which there was an embargo on the import beyond the timeline indicated against them, as indicated in the Annexure released by the MoD.

This was described as a big step towards self-reliance in defence. It also offered a great opportunity to the Indian defence industry to rise to the occasion to manufacture the items in the negative list by using their own design and development capabilities or adopting the technologies designed and

developed by Defence Research and Development Organisation (DRDO) to meet the requirements of the Armed Forces in the coming years.

The list was prepared by MoD after several rounds of consultations with all stakeholders, including Army, Air Force, Navy, DRDO, Defence Public Sector Undertakings (DPSUs), the then Ordnance Factory Board and private industry to assess the current and future capabilities of the Indian industry for manufacturing various equipment within India.

Almost 260 schemes of such items were contracted by the Tri-Services at an approximate cost of ₹3.5 lakh crore between April 2015 and August 2020. With the declared embargo on import of 101 items, it was estimated that contracts worth almost Rs 4 lakh crore will be placed upon the domestic industry within the next five to seven years. Of these, items worth almost ₹1,30,000 crore each are anticipated for the Army and the Air Force while items worth almost ₹1,40,000 crore are anticipated by the Navy over the same period.

The list of 101 embargoed items comprises of not just simple parts but also some high technology weapon systems like artillery guns, assault rifles, corvettes, sonar systems, transport aircrafts, light combat helicopters (LCHs), radars and many other items to fulfil the needs of our Defence Services. The list also includes, wheeled armoured fighting vehicles (AFVs) with indicative import embargo date of December 2021, of which the Army is expected to contract almost 200 at an approximate cost of over ₹5,000 crore. Similarly, the Navy is likely to place demands for submarines with indicative import embargo date of December 2021, of which it expects to contract about six at an approximate cost of almost ₹42,000 crore. For the Air Force, it was decided to enlist the light combat aircraft LCA MK 1A with an indicative embargo date of December 2020. These are anticipated at an approximate cost of over ₹85,000 crore. Hence, there are highly complex

platforms that were included in the list of 101 items, of which details of three examples are given.

According to MoD, the embargo on imports was planned to be progressively implemented between 2020 to 2024. The aim behind promulgation of the list was to apprise the Indian defence industry about the anticipated requirements of the Armed Forces so that they are better prepared to realise the goal of indigenisation. The MoD has adopted many progressive measures to encourage and facilitate 'Ease of Doing Business' by the defence production entities. All necessary steps would be taken to ensure that timelines for production of equipment as per the Negative Import List are met, which will include a co-ordinated mechanism for hand holding of the industry by the Defence Services.

Defence officials had them indicated that more such equipment for import embargo would be identified progressively by the DMA in consultation with all stakeholders. A due note of this was also made in the Defence Acquisition Procedure (DAP) to ensure that no item in the negative list is processed for import in the future. **SP**

In the name of Atmanirbhar Bharat, the combat readiness of the armed forces was being adversely impacted as domestic manufacturers were unable to supply them on time and imports were not allowed



ON ARRIVAL IN THE COUNTRY, THE ENHANCEMENT SPECIFIC RAFALE WILL ONCE AGAIN BE TESTED BY THE IAF TO THEIR SATISFACTION UPON WHICH THE ENTIRE FLEET OF 30 RAFALE COMBAT JETS WILL BE RETROFITTED IN THE YEAR 2022 WITH THE SAME ENHANCEMENTS THAT THE LAST BATCH OF SIX RAFALE JETS WILL BE ENDOWED WITH.

RAFALE WITH INDIA-SPECIFIC ENHANCEMENTS

With the India-specific enhancements on the fleet of 36 Rafale combat jets on the flight line, the IAF will undoubtedly achieve a higher level of operational potency

By AIR MARSHAL B.K. PANDEY (RETD)

OVER THE NEXT TWO MONTHS I.E. IN THE PERIOD DECEMBER 2021 to January 2022, the Indian Air Force (IAF) is scheduled to receive the last batch of six Rafale multi-role combat jets from the French aerospace and defence major Dassault Aviation. This will be last batch to be delivered against the order for a total of 36 platforms for which India and France had signed

an inter-governmental agreement in September 2016 after due clearance from the Indian Cabinet Committee on Security (CCS). The first Rafale squadron, the No. 17 Golden Arrows, is based at Ambala under Western Air Command and the second Rafale squadron numbered as 101 Squadron is based at the Hasimara under the Eastern Air Command of the IAF.

According to sources in the IAF, the nation is set to get the final lot of six Rafale multi-role jets with India-specific enhancements in operational capability. While the India-specific enhancements in the capability of the Rafale jet is a classified matter, it is understood that these relate to long range air-to-air missiles, low band frequency jammers, advanced communication system, more capable radio altimeter, radar warning receiver, flight data recorder, high-altitude engine start-up, synthetic aperture radar, ground moving target indicator and tracking, infra-red search and track, helmet-mounted display, missile approach warning systems and very high-frequency range decoys. A high level team from the IAF is already in France to assess the India-specific enhancements carried out on one of the last batch of six Rafale jets to be delivered to the IAF.

The first three Rafale combat jets with the enhancements specific to the IAF will arrive in December this year from Istres-Le Tube air base, North West of Marseille, a port city in Southern France, while the last three of multi-role fighters ordered will be flown into Ambala air base in January 2022. On arrival in the country, the enhancement specific to the IAF will once again be tested by the IAF to their satisfaction under the operating conditions in India. In addition, the related claims by the original equipment manufacturer (OEM) will also be duly verified by the service. Once these are done to the satisfaction of the IAF, the fleet of 30 Rafale combat jets that are already in service with the IAF, will be retrofitted in the year 2022 with the same enhancements that the last batch of six Rafale jets will be endowed with. The exercise to upgrade the Rafale jets would be carried out at the Air Force base in Ambala which is the first air base in the country to host the Rafale combat jets.

BRIEF HISTORY OF THE INDUCTION OF THE RAFALE JETS

The IAF had initiated a programme in the year 2002 to induct 126 medium multi-role combat aircraft (MMRCA) to replace the platforms in its fighter fleet that were due for retirement from service in the near future. The tender for 126 MMRCA was issued in August 2007 to which there was response from six global aerospace and defence majors offering their latest fourth plus generation combat platforms. As per the announcement by the Ministry of Defence (MoD) of India on January 31, 2012, from amongst the six combat platforms that were in the race, the Rafale fighter jet emerged as the preferred platform. There also was an in-built option in the tender for 63 additional aircraft. As per the terms of contract, the first 18 aircraft were to be supplied fully built in France by the winning firm Dassault Aviation and the remaining 108 aircraft were to be manufactured under licence by the Indian aerospace and defence major Hindustan Aeronautics Limited (HAL) with a transfer of technology from the OEM Dassault Aviation. However, the contract negotiations were rather prolonged on account of some unforeseen impediments, the primary one being that the firm awarded the contract for the 126 aircraft would be required to ensure the quality of aircraft produced by HAL and stand guarantee for it. Unfortunately, but quite understandably, Dassault did not agree to stand guarantee for the aircraft produced by HAL despite the fact that the terms of contract against which the French aerospace giant had bid for, carried this precondition. The Indian MOD too refused

to budge on this issue leading to a stalemate situation that finally resulted in the cancellation of the tender in 2015 soon after the NDA government had come into power.

Soon after the cancellation of the tender for 126 Rafale fighter jets, in response to an urgent requirement projected to the Government by the IAF, during a visit to France on April 10, 2015, Prime Minister Narendra Modi personally projected a request to Francois Hollande, President of France, for the direct purchase of 36 Rafale combat jets to which he readily agreed. A Memorandum of Understanding was formally concluded in January 2016 and in September 2016, an inter-governmental agreement with France was concluded for the procurement of 36 Rafale fighter jets valued at around ₹58,000 crore.

Thus it was that the acquisition of the 36 Rafale fighter jets for the IAF was finalised as a direct deal between the Governments of India and France thus eliminating the need for a middleman or any other procurement agency which obviated the possibility of allegations of a scam in the deal which appears to have become a frequent occurrence in recent times in deals with foreign companies for the purchase of military hardware. Unfortunately, even in a direct deal with the Government of France, the political parties in India in the opposition did not refrain from making allegations of corruption in the purchase of 36 Rafale jets. Such political conduct is decidedly detrimental to the morale of the Indian armed forces for whom urgently required military hardware is procured.

Compared to other types of combat jets currently in the inventory of the IAF, the operational capability of a single Rafale combat jet is considerably higher

REVAMPING THE COMBAT FLEET OF THE IAF

As it stands today, the number of fighter squadrons authorised in the combat fleet of the IAF stands at 42 squadrons. Over the years, as the IAF has not been successful in its efforts at inducting modern combat aircraft in the numbers required both from foreign and domestic sources, the size of the combat fleet had dwindled to 31 squadrons. With the induction of two squadrons of the Rafale jets, the strength of the combat fleet has gone up to 33 squadrons as against the required strength of 42 squadrons. However, the increase in the strength of the combat fleet to 33 squadrons is only marginal and the IAF continues to be short of nine combat squadrons. With the retirement of the ageing fleets of MiG-21 Bison and Jaguars, there will be a drastic reduction in the strength of the combat fleet of the IAF. As the procurement of combat aircraft from foreign sources is proving to be extremely difficult, the IAF has no option but to depend primarily on indigenous capability that is in a position to provide the light combat aircraft (LCA) Tejas Mk 1A of which 83 have been ordered. This will be followed by the Mark 2 version of the LCA which is still under development and by all assessments, its operationalisation is still a long way off.

In these circumstances, induction of the fleet of Rafale jets has been a significant development for the IAF. Compared to other types of combat jets currently in the inventory of the IAF, the operational capability of a single Rafale combat jet is several times higher. Thus for the time being, even with the induction of just 36 Rafale combat jets to equip two squadrons, there will be significant enhancement in the overall operational capability of the IAF. With the India-specific enhancements on the fleet of 36 Rafale combat jets on the flight line, the IAF will undoubtedly achieve a higher level of operational potency. SP



(LEFT) MI-171SH ATTACK-TRANSPORT HELICOPTER; (RIGHT) YAK-130 ADVANCED COMBAT TRAINER

ROSOBORONEXPORT EXTENDS RANGE OF PRODUCTS

ROSOBORONEXPORT JSC (ROSTEC STATE CORPORATION subsidiary) has substantially enlarged the line of products for the international defence market. The military and dual-purpose hardware have been developed by the national leading companies such as the Almaz-Antey Air and Space Defense Concern, the Kronstadt Company, as well as Rostec's Kalashnikov Concern, United Aircraft Corporation (UAC), High Precision Weapons, Russian Helicopters among the many. The latest runway to meet the top samples of the Russian defence technology was the SITDEF-2021 at the capital of Peru, the city of Lima this October. The country is one of the long-time strategic partners of the Russian military-industrial complex to prove the mutually beneficial character of the Russian bilateral ties with any independent state.

"Rosoboronexport highly appreciates the level of military-technical cooperation between Russia and Peru. This country is our long-standing and reliable partner that successfully operates Russian aircraft and helicopters, armored vehicles and anti-tank systems," said Alexander Mikheev, Director General of Rosoboronexport. "We are ready to further develop mutually beneficial cooperation in the interests of the Armed Forces of Peru, as well as other law enforcement agencies of the country, including the police and special operations forces. During the exhibition, we will also discuss with our partners, cooperation in training personnel to operate Russian weapons, as well as the issues of after-sales service of previously purchased equipment."

During SITDEF-2021 about 300 pieces of military hardware were on display at the Rosoboronexport stand. The company showcased scale models of the Yak-130 combat trainer, Mi-

28NE attack helicopter, Pantsir-S1 anti-aircraft gun/missile system and the BTR-82A armored personnel carrier, which have high potential in any part of the world.

In addition, Rosoboronexport provided comprehensive information on the Russian weapons and military equipment. In particular, Su-35, Su-30SME, and MiG-35 fighter aircraft, Mi-35M, Mi-171Sh, Ansat helicopters, as well as advanced aerial weapons.

Visitors to the company's stand saw a wide range of air defence and electronic warfare systems of various ranges, including the S-400 Triumph and Antey-4000 air defence missile systems, Viking, Buk-M2, Tor-M2KM SAM systems, as well as Igla-S and Verba MANPADS.

The Tigr and Typhoon-K armored vehicles, Khrizantema-S, Kornet-E and Kornet-EM ATGM systems, BTR-80A and BTR-82A armored personnel carriers, which have proven their reliability and effectiveness during real combat operations, as well as new K-16 and K-17 wheeled fighting vehicles, based on the Boomerang common combat platform, were of interest to representatives of the ground forces and special operations forces of the countries in the region.

The Orlan-10E unmanned aircraft system from the Special Technology Center attracted special attention from potential customers. Russia-made UAVs has become extremely popular among the Russia's partners in the global arms market.

Apart from the ready-made materials, Rosoboronexport is keen to promote modern training sets and systems from leading Russian manufacturers as well as various offset programs and industrial partnerships with defence enterprises from various nations. The «Make-in-India» program is among the Rosoboronexport top priorities. **SP**



RUTH NICHOLS (1901 - 1960)

In 1939, Nichols found a way to combine her love for flying with her humanitarian instincts by forming Relief Wings – a private airborne ambulance corps that could be deployed during war

RUTH NICHOLS WAS AN AMERICAN AVIATION PIONEER AND holder of more than 35 women's aviation records. She is the only woman ever to hold simultaneous world records in flying for speed, altitude and distance. Nichols flew every type of aircraft, including dirigibles, gliders, autogyros, seaplanes, biplanes, triplanes, transport aircraft and even a supersonic jet. During a 12,000-mile tour across the United States (US) to promote aviation country clubs, she became the first female pilot to land in all 48 contiguous US states. In 1929, together with Amelia Earhart and others, she co-founded the Ninety Nines, an international organisation of women pilots.

Ruth Rowland Nichols was born on February 23, 1901, in New York City. To mark her graduation from high school in 1919, her father arranged for a special treat – a plane ride. Although she was terrified when the pilot suddenly did a loop, she developed a lifelong love for flying. While in college, she secretly took flying lessons and earned her pilot's licence after graduating. She became the first woman in the world to gain a seaplane licence and only the second in America to be awarded a Department of Commerce transport licence.

Ruth first became famous in January 1928 as co-pilot for Harry Rogers on the first non-stop flight from New York to Miami, Florida. Due to her socialite status and aristocratic family background, Nichols became known in the press as the "Flying Debutante", a name she detested. In 1929, she was one of the competitors in the Women's Air Derby (also known as the "Powder Puff Derby"), the first official women-only air race in the US. The 20 women took off from Santa Monica, California on August 18 for Cleveland, Ohio. However, Ruth crashed and had to drop out of the contest. In 1930, she was loaned a Lockheed Vega by the millionaire industrialist Powel Crosley. She used it to break several records in quick succession.

In December 1930, Ruth Nichols beat Charles Lindbergh's record for a transcontinental flight, completing the trip in 13 hours, 21 minutes. In March 1931, she set a women's world altitude record of 28,743 feet. Wearing long underwear, four sweaters, a leather flying suit, fur-lined boots, helmet and heavy mittens, she accomplished the flight in the freezing, unpressurised plane. To survive in the thin atmosphere, she breathed oxygen from a tank under her seat through a tube

clasped between her teeth. In April 1931, she set a women's world speed record of 210.7 miles per hour.

In June 1931, Ruth attempted to become the first woman to fly solo across the Atlantic. After months of planning and preparation, she took off from New York in the Lockheed Vega for a refuelling halt at New Brunswick, Canada. But when she reached overhead, she found to her horror that it was a rudimentary airstrip, totally unsuitable for the Vega. With night drawing on she had no choice but to attempt a landing. Blinded by the setting sun she made an overshooting approach and crashed. She was severely injured with five broken vertebrae, a dislocated knee and serious internal injuries. The aircraft was a wreck. She was confined to a hospital bed for two months with her lower body in a plaster cast.

Just four months later, only partly recovered, Ruth resumed flying in the rebuilt Vega using a steel corset to support her painful back. In October 1931, she set a women's distance record of 1,977 miles on a flight from Oakland, California to Louisville, Kentucky. The very next day, tragedy struck again as she was getting ready to fly to New York. A faulty valve in the Vega started leaking fuel and it exploded in flames. Thankfully no one was hurt. However, in October 1935, a private plane Nichols was flying in, crashed shortly after take-off, killing the pilot. The accident threw Nichols from the plane, critically injuring her. She was unable to fly for nearly a year afterwards. It is proof of her indomitable spirit that she flew at all.

In 1939, Nichols found a way to combine her love for flying with her humanitarian instincts by forming Relief Wings – a private airborne ambulance corps that could be deployed during war. After the war, she organised a mission of support for UNICEF, including piloting a round-the-world tour in 1949. In 1958, at age 57, she co-piloted a TF-102A Delta Dagger and reached 1,000 miles per hour and an altitude of 51,000 feet, setting new women's speed and altitude records.

This was her final feat. Afflicted by severe depression, she died of an overdose of barbiturates at her home on September 25, 1960. Ruth Nichols once said, "It takes special kinds of pilots to break frontiers and in spite of the loss of everything, you can't clip the wings of their hearts." SP

— JOSEPH NORONHA

MILITARY

ASIA PACIFIC

AIRBUS SIGNS CONTRACT WITH BEL RELATED TO C295 AIRCRAFT PROGRAMME



As part of its offset commitments under the C295 aircraft programme of the

Government of India and in line with the 'Make in India' policy, Airbus Defence and Space has signed a contract with Bharat Electronics Limited (BEL) on November 17, 2021 for the manufacture and supply of Radar Warning Receiver (RWR) and Missile Approach Warning System (MAWS). This export order worth \$93.15 million, is the biggest received till date by BEL. The contract was signed on November 17, 2021 by Vinay Kumar Katyal, Director (Bengaluru Complex), BEL, M.V. Raja Sekhar, Director (Research & Development), BEL, Dominique Arnal, Senior Vice President (Procurement, Supply Chain & Logistics, Airbus Defence & Space) and Annika Mulder, Vice President (Procurement Structure, Materials & IT, Airbus Defence & Space)

EMBRAER DISPLAYS WORLD'S MOST EFFICIENT & SUSTAINABLE SINGLE-AISLE COMMERCIAL JET



MAKING ITS APPEARANCE AT THE first edition of the Selangor Aviation Show was Embraer's E195-E2, the world's most efficient and sustainable single-aisle jet. Showcasing a stunning "TechLion" livery that covers the entire aircraft's fuselage, the E195-E2's presence at the Selangor Aviation Show comes after the aircraft's presence at the Dubai Air Show. Featuring Embraer's two by two passenger seating, the commercial jet sits up to 146 passengers.

In its 2021 market outlook, Embraer foresees a demand of 60 new commercial aircraft under 150 seats in Malaysia over the next 10 years. Driving this demand is the opportunity for aircraft under 150 seats to complement larger aircraft prevalent in the country and enhance the viability of establishing new routes or increasing the

frequency of existing routes. This includes the boosting of direct connectivity within Peninsula Malaysia, as well as connectivity between cities in Peninsula Malaysia to East Malaysia (Sabah and Sarawak).

"We see potential for domestic and regional connectivity to multiply in Malaysia. It's a win-win for all, domestic tourism thrives and passengers get to travel to new destinations with the comfort of a modern commercial jet," said Arjan Meijer, President & CEO of Embraer Commercial Aviation. "Airlines can deploy these regional jets with the assurance of its low operating costs and superior aircraft performance, coupled with its green credentials. Incorporating the E-Jets E2's new technologies and enhanced operations is a key step on the path to a more sustainable aviation industry."

QUICKROUNDUP

BAE SYSTEMS

The Defence Logistics Agency has executed a \$316 million contract option for BAE Systems' advanced M-Code GPS modules, raising the contract funding to \$641 million. The modules provide dependable positioning, navigation and timing for ground troops, vehicles, aircraft and precision munitions. Under the contract option executed in November, BAE Systems will manufacture CGMs for future ground, airborne, and weapon GPS receivers for the US Department of Defence and its allies.

BOEING

The Norwegian Defence Materiel Agency (NDMA) on November 18, 2021, accepted the first of five Boeing P-8A Poseidon maritime patrol aircraft that will be operated by the Royal Norwegian Air Force. Norway is responsible for large maritime areas in a strategically important part of the world and the new P-8A Poseidon will represent a tremendous improvement in their surveillance capability.

Bangladesh's Us-Bangla airlines has added two more Boeing 737-800 aircraft to its fleet, taking its total to 16. The Us-Bangla Airlines, the country's largest private air carrier, is also going to start flights from Dhaka to Colombo, Sharjah and Delhi with these two newly inducted Boeing 737-800 aircraft that have 189 economy class seats.

Boeing and Akasa Air, a brand of SNV Aviation, announced on November 16, 2021 that the new Indian carrier has ordered 72 Boeing 737 MAX airplanes to build its fleet. Valued at nearly \$9 billion at list prices, the order is a key endorsement of the 737 family's capability to serve the rapidly growing Indian market. Akasa Air CEO Vinay Dube said, "We are delighted to partner with Boeing for our first airplane order and thank them for their trust and confidence in Akasa Air's business plan and leadership team."

Boeing won a \$212.6 million contract for modification of six MH47-G renew rotary wing aircraft and eight spare shipsets in support of US Special Operations Command (US-SOCOM). The Boeing MH-47G belongs to the family of CH-47 Chinook multi-role heavy lift helicopters.

LOCKHEED MARTIN

Lockheed Martin reported on November 17, 2021 that in 2020, US Government requested them to accelerate efforts to produce more of the world's most advanced air defence missile than ever before and it has recently completed production of its 1000th PAC-3 Missile Segment Enhancement (MSE) interceptor. Lockheed Martin has steadily increased production of PAC-3 MSE since achieving a full rate production decision in 2018 and is expecting to increase to annual production of 500 PAC-3 MSEs by 2024.

Lockheed Martin reported on November 15, 2021 that it has demonstrated significant milestones for the PAC-3 programme, including the first integration of the PAC-3 Missile Segment Enhancement (MSE) with the US Army Integrated Air and Missile Defence Battle Command System (IBCS) during flight tests. During the flight test series, two PAC-3 MSE mis-

QUICK ROUNDUP

siles successfully engaged from IBCS and intercepted tactical ballistic missile threats.

Lockheed Martin and Keysight Technologies Inc a leading provider of 5G solutions, has announced a collaboration to advance 5G in support of mission-critical communications for aerospace and defence applications. The companies are actively collaborating on a 5G.MIL™ testbed that Lockheed Martin teams will use to advance 5G capabilities for multiple applications.

IAI

It was announced on November 15, 2021 that Israel Aerospace Industries (IAI) has signed an agreement to convert four B777-300ER passenger aircraft to cargo configuration for Emirates. The aircraft will be converted at the new site established in Etihad Engineering's MRO centre in Abu Dhabi and the first conversion of the Emirates plane is expected to begin in early 2023.

It was announced on November 18, 2021 that EDGE, middle East's leading technology company for defence and IAI have signed an MoU to establish a maintenance centre for IAI's systems in the UAE. The agreement covers electro-optics advanced systems including IAI's systems for surveillance payloads for land, naval and air applications.

NORTHROP GRUMMAN

Northrop Grumman Corporation reported on November 22 that it has been awarded a contract by the US Air Force to provide dynamic in-flight rerouting for RQ-4B Global Hawk. The software update, known as Dynamic Mission Operations (DYNAMO), will enhance Global Hawk's ability to provide critical intelligence, surveillance, and reconnaissance data to geographic combatant commanders. The DYNAMO flexible mission planning capability enables in-flight rerouting of Global Hawk, allowing operators to respond to changing real world conditions and will be fielded in 2023.

NASA awarded Northrop Grumman Corporation a booster production and operations contract valued at \$3.19 billion to support the Space Launch System (SLS) rocket through 2031. The award includes follow-on production and flight sets for Artemis IV through Artemis VIII, as well as production of the Booster Obsolescence and Life Extension (BOLE) boosters for Artemis IX.

Northrop Grumman Corporation has received a \$153 million contract award on November 30, 2021 from the US Navy for full rate production of lots 10 and 11 of the AGM-88E2 Advanced Anti-Radiation Guided Missile. The contract includes production of missiles for the U.S. Navy and German Air Force.

Nanoracks, in collaboration with Voyager Space and Lockheed Martin, has been awarded a \$160 million contract on December 2, 2021 by NASA to design its Starlab commercial space station as part of the agency's Commercial Low-Earth Orbit Development programme. Starlab will enable NASA's initiative to stimulate the commercial space economy and provide science and crew capabilities prior to the retirement of the International Space Station.

APPOINTMENTS

LOCKHEED MARTIN

On November 30, 2021, Lockheed Martin announced the appointment of Robert Lightfoot as the new Executive Vice President of the company's Space business area. The appointment is effective January 1, 2022.

NORTHROP GRUMMAN

On November 18, 2021, the Board of Directors of Northrop Grumman Corporation announced that it had elected Tom Wilson as Corporate Vice President and President of Space Systems, effective January 1, 2022.

PRATT & WHITNEY

On November 16, 2021, Pratt & Whitney announced the appointment of Graham Webb in the newly created position of Chief Sustainability Officer.

in the presence of other senior executives from both the companies. Airbus Defence and Space is rigorously working towards the 'Make in India' dream of the Indian Government.

DAC APPROVES PROPOSAL WORTH ₹2,236 CRORE FOR THE IAF

The Defence Acquisition Council (DAC) in its meeting on November 23, 2021, Chaired by Defence Minister Rajnath Singh accorded Acceptance of Necessity for GSAT-7C Satellite and Ground Hubs for real-time connectivity of Software Defined Radios (SDRs) at a cost of ₹2,236 crore (about \$0.3 billion) for the IAF. The project envisages complete design, development and launching of satellite in India. Induction of GSAT-7C Satellite and Ground Hubs for SDRs will enhance the ability of the Indian Armed Forces to communicate beyond Line of Sight among one another in all circumstances in a secure mode.

ISRAEL AEROSPACE INDUSTRIES' (IAI) SCORPIUS ELECTRONIC WARFARE SYSTEM

IAI unveiled the Scorpion family of Electronic Warfare (EW) systems which is claimed to be the EW system in the world capable of simultaneously targeting multiple threats, across frequencies and in different directions as it is based on the Active Electronically Scanned Array (AESA) technology. With AESA's multi-beam capability, Scorpion can simultaneously scan the entire surrounding region for targets and deploy narrowly focused beams to interfere with multiple threats across the electromagnetic spectrum. The system is able to target a range of threats, including Unmanned Aerial Vehicles (UAVs), ships, missiles, communication links, low prob-

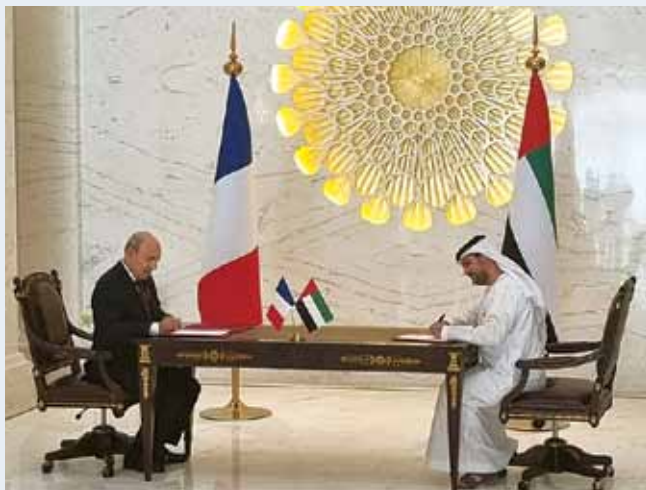
ability of interception (LPOI) radars and more. It is available in Land, Sea, Air and Training version. The Air version has Scorpion SP, a self-protection pod for combat aircraft and the Scorpion SJ, a standoff jammer that disrupts enemy aerial and ground-based electromagnetic operations across a vast sector.

LOCKHEED SUCCESSFULLY CONDUCTS MISSILE WARNING SYSTEM'S CRITICAL DESIGN REVIEW



Lockheed Martin and the US Space Force conducted the system level CDR for the Next Generation Overhead Persistent Infrared Geosynchronous Earth Orbit (NGG) Block 0 space programme. This marks another significant step toward the first NGG satellite launch in 2025. NGG is the Space Force's new, advanced space-based missile warning system that incorporates improved warning capabilities as well as enhanced resilience and cyber hardening. Dubbed by the US Department of Defence as a "Go Fast" acquisition programme, NGG will provide early warning for the defensive "kill chain" that protects the nation and the armed forces from missile threats. The NGG programme is embracing digital transformation including artificial intelligence and machine learning technologies as a way to deliver next generation capabilities quicker and faster.

HISTORICAL CONTRACT FOR THE ACQUISITION OF 80 RAFALE F4 BY THE UNITED ARAB EMIRATES



IN THE PRESENCE OF THE PRESIDENT OF THE FRENCH Republic, Emmanuel Macron, and Sheikh Mohammed bin Zayed Al Nahyane, Crown Prince of Abu Dhabi and Vice-Commander of the Armed Forces of the United Arab Emirates (UAE), Eric Trappier, Chairman and CEO of Dassault Aviation, signed a historical contract with Tareq Abdul Raheem Al Hosani, CEO of Tawazun Economic Council, in charge of security and defence acquisitions, for the acquisition of 80 Rafale F4, worth Euro 17 billion (\$19 billion), for the United Arab Emirates Air Force & Air Defence (UAE AF & AD). The Rafale F4, for which the Emirates Air Force will be the first user outside France, will provide the Emirates armed forces with a tool capable of guaranteeing sovereignty and operational independence. This contract is the result of total mobilisation by Dassault Aviation alongside the Emirates Air Force and comes on the back of a more than 45-year long relationship of trust between the United Arab Emirates and our company, built on the Mirage family of fighter aircraft, notably the Mirage 2000-9, the modernisation of which began two years ago.

Eric Trappier, Chairman and CEO of Dassault Aviation, said: "The sale of 80 Rafale to the UAE Federation is a French success story: I am very proud and very happy as a result. I wish to thank the authori-

ties of the Emirates for their renewed confidence in our aircraft. After the Mirage 5 and Mirage 2000, this Rafale contract consolidates the strategic relationship that binds our two countries and the satisfaction of the Emirates Air Force, a long-standing and demanding partner of our company. I wish to underline the quality and effectiveness of the relationship between the French authorities and industry, which contributed to this success by team France. This contract is excellent news for France and for its aeronautical industry, for the entire ecosystem of 400 companies, both large and small, which contribute to the Rafale: this represents thousands of guaranteed jobs in our sector for the coming decade. This contract, which is the largest ever obtained by the French combat aeronautics industry, consolidates a national industrial base, which is without doubt unique in Europe, comprising as it does major groups and SME/SMLs, around a company which has been the prime contractor for all the generations of military and civil aircraft for the past 70 years.

The success of the Rafale with our armed forces and its sale to the UAE Federation, as well as its export to five other countries who are already customers, clearly shows that French combat aviation is an internationally recognized centre of excellence on the national industrial landscape." **SP**

SCHIEBEL IMPRESSES AT SEARCH AND RESCUE TRIALS



Schiebel, together with Andøya Space Defence, successfully demonstrated the

capabilities of the CAMCOPTER S-100 on board the coastguard vessel KV Nordkapp in Norwegian waters.

The purpose of the trials was to demonstrate the embarked Search and Rescue (SAR) and maritime surveillance capabilities of the CAMCOPTER S-100 in the environmental conditions of the Arctic in latitudes above 75 degrees north. The aim was to demonstrate that Unmanned Air Systems (UAS) ideally supplement manned helicopters, greatly enhancing SAR efforts in this remote part of the world. The CAMCOPTER S-100 proved that it can operate in adverse

weather conditions, where manned helicopters can be at higher risk.

IAI TO CONVERT PASSENGER AIRCRAFT TO CARGO

Israel Aerospace Industries (IAI) signed an agreement to convert four B777-300ER passenger aircraft to cargo configuration for Emirates. The aircraft will be converted at the new site established in Etihad Engineering's MRO center in Abu Dhabi, and the first conversion of the Emirates plane is expected to begin in early 2023. The agreement has potential to provide passenger-to-freighter conversion services to more aircraft. **●**

MAJOR BOOST



The LCH will definitely enhance the operational capability of the Indian armed forces considerably particularly in the mountainous regions of the country as also boost self reliance

By AIR MARSHAL B.K. PANDEY (RETD)

ON FRIDAY NOVEMBER 19, 2021, PRIME MINISTER NARENDRA Modi formally handed over the indigenously built light combat helicopters (LCH) to Air Chief Marshal V.R. Chaudhari, Chief of the Air Staff (CAS), Indian Air Force (IAF). This was done in a ceremony known as 'Rashtra Raksha Samarpan Parv' held in Jhansi to celebrate the 193rd birth anniversary of Rani Laxmi Bai. Prime Minister Narendra Modi also laid the foundation stone for a plant under Bharat Dynamics, which will be established at a cost of ₹400 crore to make propulsion system for anti-tank guided missiles in Jhansi and laid the foundation stone for the 600 MW ultra-mega solar park. The Prime Minister also handed over the Advanced Electronic Warfare suite to the Indian Navy. The formal handing over on November 19, 2021, of the LCH by Prime Minister Modi to the CAS, was a gesture that would inspire the nation's defence industry to enhance the capability for indigenous development and production of high-end military equipment to achieve a high degree of self reliance. This is a goal set by the Modi Government that is described as "Aatmanirbhar Bharat" programme for the defence industry of India.

It was during the brief but intense war with Pakistan in 1999 known as the Kargil War, that revealed some major shortcomings in the Indian armed forces especially that of an attack helicopter. As the Kargil War was fought in the high mountainous region along the North Western border with Pakistan, the availability of an attack helicopter with the Indian armed forces involved in the conflict that would have made a lot of difference and would have made the operations in the high mountainous region of Ladakh a lot easier for them. It was this experience that inspired the Indian aerospace and defence industry for the indigenous development of an attack helicopter.

Soon after the Kargil war, in 2004, the Indian aerospace and defence major Hindustan Aeronautics Limited (HAL) initiated a dialogue with the Indian armed forces on the issue of development of an indigenous attack helicopter. The Indian armed forces had already initiated a project to procure attack helicopters from foreign sources. However, in response to the initiative by HAL, at the end of 2004, the Indian armed forces decided to discontinue their effort to procure this platform from abroad and switched their focus on to the plan for indigenous production of this platform by the Indian aerospace and defence industry. Two years later, in 2006, HAL came up with their plan to develop a new

platform in this category which was referred to as the Light Combat Helicopter (LCH). Plans by HAL to develop this new rotorcraft was most appropriate as the LCH was a derivative of an indigenous transport helicopter known as the Dhruv that was designed, developed and manufactured by HAL earlier on. This not only cut down the time that HAL took to roll out the LCH, it also reduced significantly the overall cost of the programme to develop a new platform. The cost of the LCH worked out in 2018 to around ₹231 crore per aircraft which is less than half the cost of the AH-64E Apache attack helicopters that the IAF acquired later from Boeing. But of course, the Apache is more heavily armed and has the sophisticated Longbow fire control radar which the LCH currently lacks. However, HAL intends to develop one before the commencement of mass production of the platform. One advantage of the LCH is that the IAF can afford to build up a larger fleet than with the Apache which is far more expensive.

The project to develop the LCH moved forward quickly and the first prototype of the platform undertook its maiden flight on March 29, 2010. In the flight trials conducted in the course of its development, the LCH landed at several high altitude helipads located at heights ranging between 13,600 feet (4,145 meters) to 15,800 feet (4,815 meters). Later on, the LCH set a record of being the first attack helicopter to land in Siachen, the world's highest helipad on the glacier at Point Sonam that is located at an altitude of 21,000 feet (6,400 metres). By the middle of the year 2016, the LCH had completed its performance trials, clearing the route to the certification of its basic configuration by the regulatory authority. Limited series production of the LCH was formally inaugurated on August 26, 2017, by Arun Jaitley the then Minister of Defence.

The excellent performance of the LCH at high altitudes is attributable to the two Shakti engines that power the platform. The Shakti engine was designed for HAL by the French helicopter engine maker Turbomeca which is now known as Safran Helicopter Engines and was built in Bengaluru. While the performance of the Shakti engine at low altitudes is comparable to other engines of its size, it outperforms them significantly at altitudes above 5,000 feet. In the final analysis, the LCH will definitely enhance the operational capability of the Indian armed forces considerably particularly in the mountainous regions of the country as also boost self reliance. SP

STRONG SUPPORT



IL-78MK-90A
Tanker aircraft



ROSOBORONEXPORT

Russian Defence Export

27 Stromynka str., 107076,
Moscow, Russian Federation

Phone: +7 (495) 534 61 83
Fax: +7 (495) 534 61 53
E-mail: roe@roe.ru

www.roe.ru

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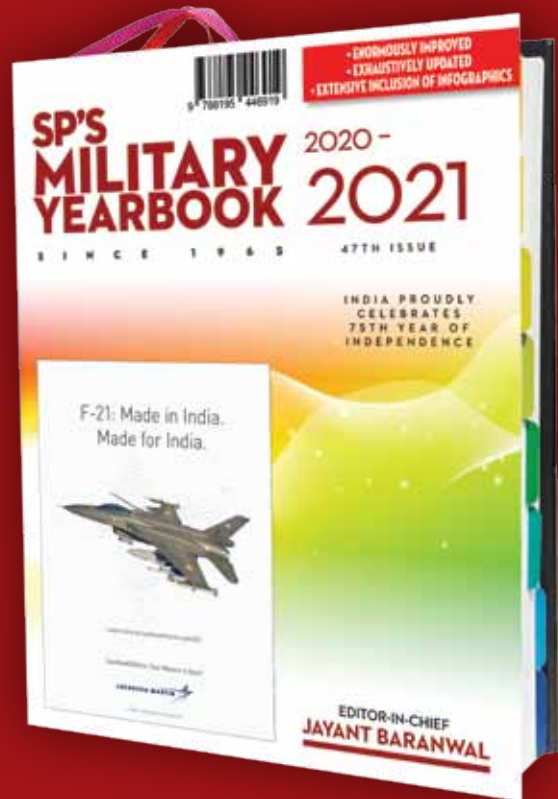
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