defexpo INDIA 2020
MAKE IN INDIA
VAYU DAILY Day 3
7 February 2020

Future of (Indian) Aircraft Carriers

"There is immense potential for making India the hub for shipbuilding and export of naval vessels" stated Mr. Shripad Yesso Naik, Raksha Rajya Mantri. He was speaking at the international conference organised by PHD Chamber on 6 February during DefExpo 2020. The Minister emphasised that India "must also utilise its shipbuilding strength to help 'friendly countries'".

In his address during the same conference, Dr. Ajay Kumar, Defence Secretary (in the photograph) reiterated the government's drive to enhance export of Indian-manufactured defence items, including warships, both surface and under water as also unmanned systems. He said that the ministry has taken steps to "encourage the huge pool of talent and energy that exists in India for shipbuilding".

The proceedings that followed were on the 'Future of Aircraft Carriers' , chaired by Rear Admiral Devendra Sudan (Retd.) and included the present ACNS (Air) Rear Admiral Mukul Asthana IN, Capt. Chirs Bolt (Retd.) , Director, Strategic Development for Carriers, Surface Ships, General Atomics India and Mr. VP Shiraz, Project Manager, IAC at Cochin Shipyard Ltd. A range of presentations during this interactive session were made by the panel with lively questions and comments from the learned audience. On the dogged question "why aircraft carriers?" were straight answers from the professional naval aviators who have spent their lifetime operating from carriers at sea.

The Indian Navy has always maintained its need for three aircraft carriers and the present INS *Vikramaditya* is to be joined shortly by IAC-1, the new INS *Vikrant* built at the Cochin Shipyards. The Indian Navy is clear in its projection for the third carrier (IAC-2) which would be considerably larger and hence carrying more aircraft for credible projection of airpower at sea. IAC-2 would be of some 65,000 tonnes, having electric propulsion, embarking a mix of fighter, strike and AEW aircraft, launched by the revolutionary EMALS system.

The Cover Story – Live!

Vayu were delighted to welcome Capt. Shivnath Dahiya ('Dax') at their stand Q12 in Hall 3. The naval test pilot, presently with the National Flight Test Centre of the ADA at Bangalore has been strenuously involved with the LCA Navy and its flight testing including arrested landings and take offs from the INS *Vikramaditya*.

Vayu's DefExpo Issue cover has the LCA (Navy) Mk.1 flown by Commodore JA Maolankar making the milestone landing with 'Dax' as the landing signals officer (LSO), seen on right of the photograph.

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HAL receives modification document for Dornier 228 civil version from DGCA

Hindustan Aeronautics Limited (HAL) received the modification document for the HAL Dornier 228 (Upgraded) civil aircraft for 5700 kg all up weight (AUW) from the DGCA during DefExpo 2020 yesterday.

The document was handed over by Mr. G. Rajsekhar, JDG, DGCA to Mr. Apurba Roy, General Manager HAL Transport Aircraft Division, Kanpur in the presence of Mr. R Madhavan, CMD, HAL and senior executives from HAL and DGCA.

Two Civil Dornier 228s produced by HAL for services under the UDAN scheme, have state-of-the-art configuration certifications from the DGCA for MTOW of 6200 kgs. However, in order to meet the prospective operator's requirement for transport aircraft flyable under Commercial Pilot License (CPL) category, HAL undertook efforts to reduce the aircraft's weight to under 5700 Kgs.

Apart from this weight criterion, HAL Dornier 228-201(Upgraded) civil aircraft will also be equipped with a digital cockpit to ensure more accurate readings, precise information and ergonomic data displays with feedback loops and capability for self-check to alert pilots in emergencies. The Glass Cockpit architecture-enabled aircraft is poised to become most sought after in this new age of aviation technology.

Further, the incorporation of civil certified turbo-prop dash 10 engine gives more reliable torque sensing system, higher component life, is lighter in weight with higher time between overhaul (TBO) as compared with the earlier dash 5 engine.

Integration of a five blade propeller on the HAL Dornier 228-201(Upgraded) aircraft will also significantly reduce noise levels, enable faster engine starts with better damping characteristics.

Bharat Forge with Thales in cooperation for F90 rifles

Annouced at DefExpo yesterday is the collaboration of Bharat Forge with Thales for production of F90 rifles to serve with India's defence and law enforcement agencies as also abroad. This was at the Defexpo yesterday. "This cooperation is testament to the "Make in India" initiative of the Indian government and paves the way to a potential licensing agreement."

Seen in the photograph are Pascale Sourisse, Senior Executive Vice President – International Development, Thales, and Col. Rajinder Bhatia, President and CEO, Defence and Aerospace, Bharat Forge in presence of Mr. Baba Kalyani, Chairman and Managing Director, Bharat Forge

Walking around the Halls at DefExpo 2020

Situated in Hall 3, the Boeing F/A-18 E/F Super Hornet simulator

Now fly the Super Hornet!

The Hammer AASM at Safran's stand

Backbone of the Show: The RE Rogers team

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Rolls-Royce MT30: Powering Next-GenNaval Defence Capabilities

Rolls-Royce shares a rich heritage with the Indian Armed forces, dating back over eight decades when it powered the country's first military aircraft. The company has played an integral role in securing the nation's future with products that are aligned with India's defence policy in the army, navy and air force segments. As part of this partnership, Rolls-Royce today has a very well developed naval and maritime presence in India.

With over 50 years of naval propulsion experience, Rolls-Royce has pioneered some of the most important technical advances in marine propulsion including the use of aero gas turbines for surface ship propulsion. Today, with gas turbines on many key naval programmes, Rolls-Royce offers a world-leading range of integrated power and propulsion solutions for future fleets.

This portfolio includes the "mighty" MT30 marine gas turbine. It's just over ten years since the MT30 first powered the US Navy's Littoral Combat Ship (LCS) USS *Freedom*. Since then, and with a growing demand for power across the world's navies, the world's most power-dense in-service marine gas turbine is finding favour across the globe. Typically rated between 36MW to 40MW at 100 degrees Fahrenheit (depending on application), and with 100% power-retention through-life, the MT30 is powering some of the world's most capable and advanced naval ships.

MT30 offers a superior power-to-weight ratio, generating up to 40MW from a 30-tonne packaged unit, including most of the auxiliary systems. It gives navies more power in less machinery space than alternative engine types, and offers ship designers much more options and flexibility in designing the naval vessels of tomorrow. The MT30 also supports the 'lean manning' concept by virtue of its ultra-low on-board maintenance requirement.

The MT30 is derived from the Rolls-Royce Trent aero family and its aerospace parentage with over 100 million flying hours accumulated has played a key part in the success of the engine, not only in its selection by a growing number of navies, but also in the performance we've seen over the past decade.

With ten years of operation under its belt, the MT30 is developing a track record of high reliability, emulating the success of the aero-parent. Naval ship building is a very long-cycle business, and with today's new ships expected to operate for between 30 and 50 years, the propulsion system on a ship is there for the long haul and must be adequately future-proofed.

Choosing the right propulsion system is a crucial decision and it has to be the right decision to ensure a ship will still perform as its systems and capability are upgraded throughout its life. With growing demand for electrical power, for example, one needs a power source that can meet those future demands. The MT30 is operating or has been selected in all conceivable propulsion arrangements – mechanical, hybrid and integrated-electric with power delivered to water-jets, controllable and fixed-pitch propellers, depending on application.

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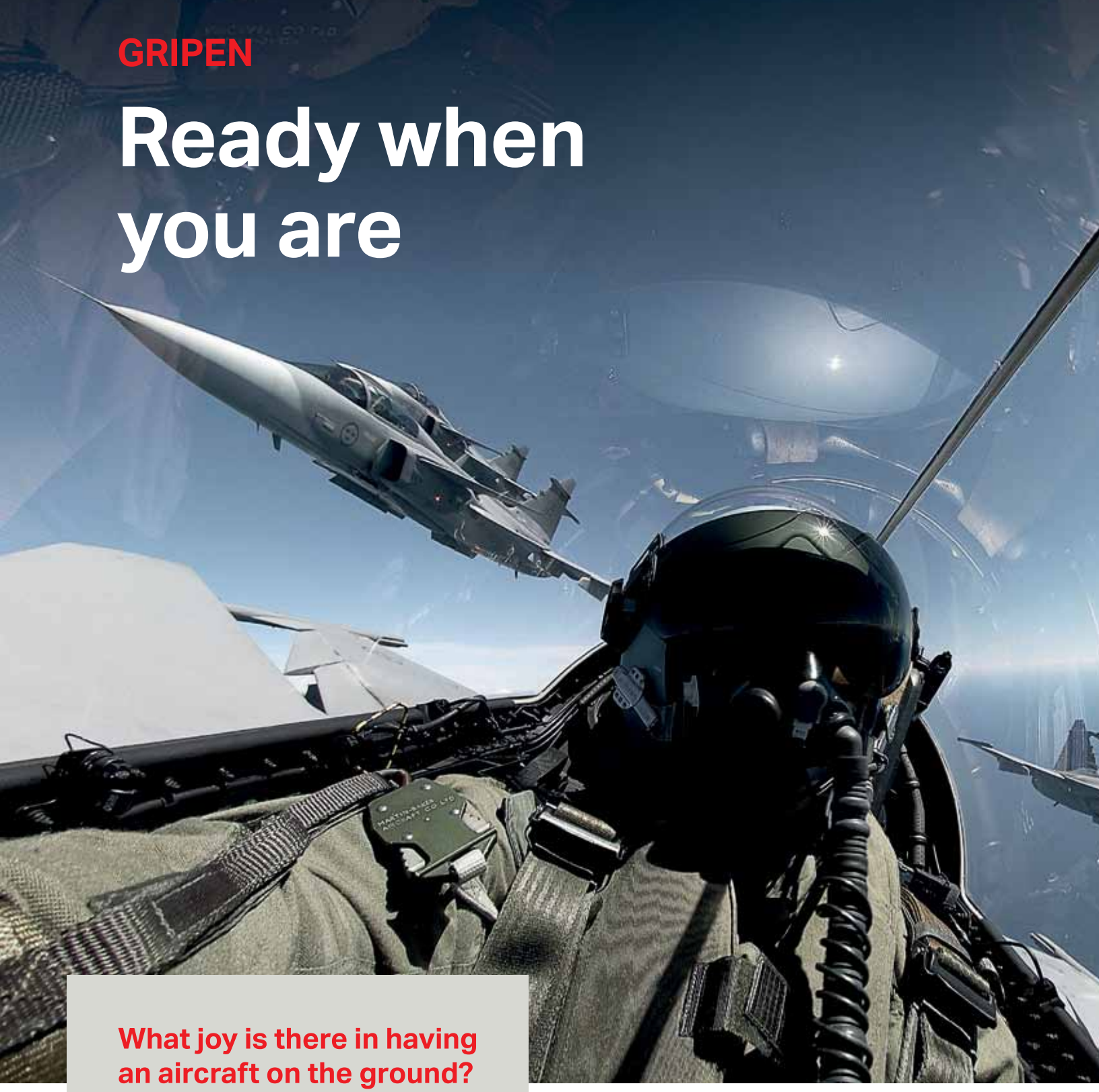

What joy is there in having an aircraft on the ground?

Every air force wants its aircraft in the air and available for as long as possible.

And when the Indian Air Force has the challenge of the huge airspace it must guard, over land and sea, it needs aircraft to be able to land and take off from the most rudimentary of airfields, maybe even roads in forward-operating bases, so that squadrons can be deployed anywhere, anytime.

For easy deployment, you also need logistic support that's small, flexible and easily moved. For the aircraft to be ready to fly, you always need the shortest turnaround before it is back in the air.

Gripen E has all of that. And when the Gripen pilot steps out, he always sees an aircraft that looks at him and says: **"Ready when you are!"**

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SAAB

At the Rolls-Royce interactive session at DefExpo 2020: Kishore Jayaraman, Louise Donaghey and GS Selwyn

MT30's growing reference list just demonstrates its unique versatility.2008 marked the entry into service for the MT30, powering the US Navy's first Littoral Combat Ship, USS Freedom, to increase its speed in excess of 40kts. MT30 alternator packages provide the power for the US Navy's Zumwalt class destroyers and the Royal Navy's new aircraft carriers with both vessels operating a full electric propulsion configuration. The Italian Navy's future flagship, the Landing Helicopter Dock, is powered by two MT30s. A single, uniquely power-dense MT30 is at the heart of the Republic of Korea Navy's new *Daegu* class frigates, the Royal Navy's innovative Type 26 City class, the Royal Australian Navy's new *Hunter* class, the Royal Canadian Navy's Canadian Surface Combatant and the Japanese Maritime Self Defence Force's new 30FFM frigates.

There is much potential for this product to power vessels of the Indian Navy. At the same time, Rolls-Royce's commitment to support India's goals of indigenisation and self-reliance remain as strong as ever. The company is well placed to support India's 'Make in India' campaign, demonstrated by successfully transferring whole-engine capability, knowledge and expertise in multi-national combat engine programmes.

Trusted and demonstrated partners in progress, cutting edge global product, emergent Indian naval need and the nation's priority of indigenisation make MT30 the ideal product of choice for the Indian Navy in the 21st century. "The company remains firmly committed to building on Rolls-Royce's rich heritage of partnership with the Indian defence forces.Rolls-Royce is ready to serve the needs of the Indian Navy and is keen to customise its advanced technology products to best serve the Navy's power needs."

Kishore Jayaraman, President, Rolls-Royce, India and South Asia at DefExpo 2020

MULTI-ROLE COMBAT-PROVEN BUILT FOR THE FUTURE

As the most advanced and lowest-cost fighter per flight hour, the F/A-18 Super Hornet will deliver next-gen superiority and survivability to India. By assembling, testing and certifying this aircraft at a state-of-the-art Factory of the Future in India, Boeing will help grow the country's aerospace ecosystem. And with a plan for growth, the F/A-18 Super Hornet will continue to outpace threats—and make India stronger.

BOEING

"Mission Readiness":

Boeing and India's Armed Forces

Over the past few years, Boeing has exponentially strengthened and grown its partnership with the Indian armed forces. From the C-17 Globemaster III to the P-8I and now, the AH-64 Apaches and CH-47 Chinooks,

Boeing's commitment to deliver capable platforms that meet the Indian armed forces modernisation and mission requirements spans across the spectrum. Its portfolio has a range of proven products that can fulfill a number of roles in present and future theatres of operations.

With the F/A-18 Super Hornet, Boeing can give both the Indian Navy and the Indian Air Force a fighter that offers true multi-role capability and a distinct combat advantage.

As India expands its air force and increases its capabilities, the KC-46 Pegasus is the perfect choice for a multi-role tanker-transport aircraft. The most reliable and economical tanker to operate, the KC-46 can provide India with the combat capability it needs for sovereign operations.

Boeing sees an opportunity to provide both the Indian Navy and the Indian Air Force with the F/A-18 Super Hornet, one of the world's preeminent multi-role fighter aircraft. The F/A-18 Super Hornet is a combat proven, supersonic, all weather multirole fighter with a defined flight plan to meet threats into the 2040s. The Super Hornet Block II is the most advanced aircraft of its kind in operation today with designed-in stealth (and best stealth performance), an AESA radar and many other advanced technologies. The AESA radar in particular is an exponential leap in technology needed for current and future missions. The Super Hornet not only has a low acquisition cost, but it costs less per flight hour to operate than any other combat aircraft in US forces inventory. Part of its affordability is because the Super Hornet is designed for far less maintenance, which translates into the high mission availability.

Over 160 Indian suppliers are part of the supply chain, providing parts and assemblies covering aerostructures, wire harness, composites, forgings, avionics mission systems, and ground support equipment for some of Boeing's most advanced defense platforms. Boeing's sourcing from India has quadrupled in the past few years and now stands at $1 billion. As part of this journey, Boeing's joint venture with *Tata Advanced Systems Limited, Tata Boeing Aerospace Limited (TBAL)* has already begun deliveries of fuselages for the AH-64 Apache, the world's most lethal combat helicopter. This centre is becoming the sole source of the fuselage globally.

Committed to evolving these partnerships and investments further, Boeing is proposing a world class advanced manufacturing facility in India involving the F/A-18 Super Hornet with the very latest technologies in place. Furthermore, the Super Hornet is the best aircraft as a step towards India's Advanced Medium Combat Aircraft (AMCA) programme. Boeing will work closely with Indian industry to ensure they have the very latest technologies, applying lessons learnt from the current Super Hornet production line.

The Indian Navy and Indian Air Force can be assured of achieving exceptional operational capability and readiness of their P-8I and C-17 fleet. Boeing aircraft have high mission readiness rates of >85%. Boeing's investments in services infrastructure, the build-up of local capability and workforce and local partnership models will accelerate the strategy. C-17 GISP programme has become a model for the future of sustainment.

The C-17 Simulator Training Centre, established by Boeing and Mahindra Defence Systems to provide training services to the Indian Air Force, completed over 1700 hours of training for aircrews and loadmasters that operate the C-17 Globemaster III.

Courtesy: Boeing

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Safran and the Indian Defence Sector

Safran continues its very long association with the Indian armed forces, since the 1950s, offering aerospace and land solutions.

The company is the leading supplier of inertial navigation systems for Indian combat aircraft. Sigma 95N navigation systems equip the Sukhoi Su-30MKI, Tejas LCA, MiG-27, MiG-29, Jaguar and the Hawk advanced jet trainer. The company develops and supplies the Automatic Flight Control System (AFCS) of the Dhruv helicopter, comprising APIRS Attitude and Heading Reference Systems, Autopilot Computers and actuators, all of which are manufactured and maintained in India.

More than 500 combat aircraft deployed by the Indian Air Force and Indian Navy are equipped with the Inertial Navigation Systems. Safran is a major contributor to the 36 Rafale fighters acquired by India in 2016. Safran companies provide a wide variety of systems and equipment on the Rafale, including the aircraft's M88 engines, power transmission system, landing gear, wheels and carbon brakes, ring laser gyro inertial navigation system, gyros for the fly-by-wire system, the auxiliary power unit (APU) and all wiring. In addition, Safran is prime contractor for the AASM Hammer modular air-to-ground weapon.

A key element of Safran's partnership is the Shakti / Ardiden 1H1. Certified in 2009, the 1,400 shp engine was co-developed by Safran and HAL and is now built in Bangalore, under the designation, *Shakti* mainly with Indian-made components. This engine was first selected to power HAL's Dhruv, now in service, and powers the Light Combat Helicopter (LCH) in final stages of qualification. Today, more than 350 Shakti engines have been produced.

Most recently the Ardiden 1U, a derivative of the Ardiden 1H1 specifically designed to power single-engine rotorcraft, was selected to power the Light Utility Helicopter (LUH), a new and unique three-ton, single-engine, multipurpose rotorcraft. This engine has a compact architecture featuring a gas generator made up of two centrifugal compressor stages, coupled to a single-stage high-pressure turbine and a two-stage power turbine. The first technical flight of the Ardiden 1U in the LUH took place in September 2016, in Bangalore, and met all its performance targets.

Inaugurated in October 2016 at Goa is the *Helicopter Engines MRO Pvt. Limited* (HE-MRO) a Joint Venture of Safran and HAL, dedicated to supporting of helicopter engines operated by national and international operators, primarily the Indian Air Force and Indian Army. It will be operational by early 2020, and provide maintenance repair and overhaul (MRO) services for both TM333 and Shakti engines installed on HAL-built helicopters.

Courtesy: Safran

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Thales: "Networking tomorrow's soldier for battlefield superiority"

Soldiers in conflicts, even relatively recent ones, would not be able to recognise today's – and especially tomorrow's – soldier on the battlefield. Why? Because of digital technologies that are changing the way the soldier sees, thinks and acts, being connected to other troops and support systems for information superiority over the adversary and precision engagement. "There's simply no comparison when you look at the next generation of soldiers" states Pascal Secretin, responsible for the imagers and sensors in optronics systems at Thales and a former French airborne combat unit commander himself. "In the past, the soldier on the ground might have wait twenty minutes for the arrival of support or approval to engage. Today, by sharing images instantaneously through cyber-secured communications, decisive moments get immediate response because combat decisions are collaborative, in real-time. And they are more precise because Artificial Intelligence is interpreting what is happening from information sent by the soldier's sensors and cameras, ground vehicles, as well as from drone, aircraft and satellite 'eyes in the sky', and pointing to the best response."

A key reason for Thales leadership in creating such tools for tomorrow's more effective fighting force is its ability to combine technologies to create unprecedented performance. To take just one example, how do you give a soldier near x-ray vision to "see" what formerly was invisible a target day or night? Thales does it by superimposing thermal images in Augmented Reality on classic vision. The tools that Thales is developing for the soldier on the ground are also lighter, more robust, more reliable and provide more autonomy.

Among the tools being provided today and perfecting for tomorrow are head-mounted information displays for laser-like focus on the essential, lighter and digitally-empowered rifles for rapid target acquisition and the 'Sophie' line of thermal imagers, making formerly 'invisible' objects capable of being targeted, day and night. Coupled with the other battlefield tools from Thales defence technologies, the connected and augmented soldier becomes key to a more effective fighting force on the ground.

With inputs from Thales

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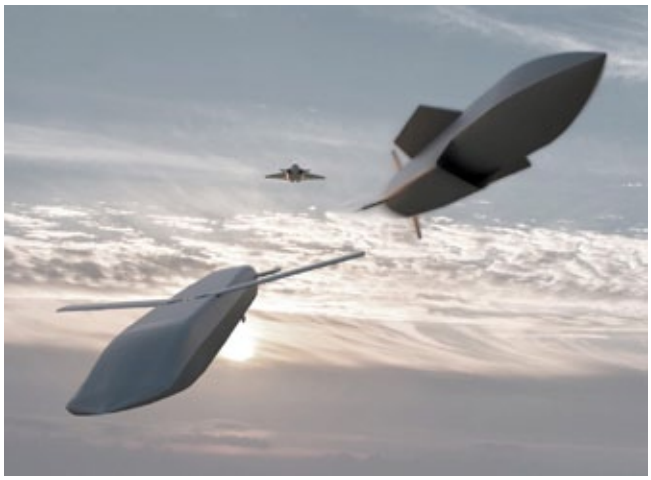
MBDA's vision of future air systems



MBDA has presented its vision of the capabilities that will be at the heart of the next generation of European air combat systems. "As threats evolve and access denial strategies become ever more complex, with diversified effects combining surface-to-air and air-to-air assets in large scale, air superiority will need to be created on a local and temporary basis. Aircraft will be able to enter denied areas, see threats before being seen, force hidden threats to uncover early enough to suppress them and to always react quicker than the adversary."

In these ever faster operations, networked effectors will take an essential part in the combat 'cloud', exchanging tactical information and target co-ordinates in real-time with platforms and other network nodes, in order to carry out the desired operational effects. These will also have to display robust survivability strategies in front of highly evolving threats. The fight will take place not only between platforms but between enemy networks, and only the most agile and adaptable will win. The engagement of these networked effectors will rely on resilience to any form of aggression (eg: Electronic Warfare, Cyber) as well as on rapid decision aids able to compute complex situations.

These concepts cover the whole field of key domains and comprise *Deep Strike*: with cruise missiles using the most advanced options in order to penetrate and open breaches in the most efficient A2AD (Anti Access Area Denial) deployments in the future.

Tactical Strike: with stand-off, networked and compact armament, delivering precision effects but also able to saturate enemy defences thanks to pack or swarm behaviours.

Air-to-Air Combat: with the game-changing Meteor which has no equivalent and will keep its lead and remain a powerful asset for next-generation fighter aircraft.

Self-Protection: with the 'Hard Kill' anti-missile system that will counter incoming missiles and so provide essential protection during 'stand-in' combat, when soft-kill counter-measures and decoys are no longer sufficient. Such a system is able to reverse the balance of power against saturating defences.

Enablers: for penetration of adversary defences thanks to the 'Remote Carriers' that deliver multiple effects, whether lethal or non-lethal, as well as new services for munitions such as intelligence, targeting, and deception of enemy sensors.

MBDA's stand-off weaponry

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DRDO's QRSAM successfully flight-tested off Odisha coast

The Quick Reaction Surface to Air Missile (QRSAM) system developed by Defence Research and Development Organisation (DRDO) was successfully flight-tested from Integrated Test Range, Chandipur off the Odisha coast on 23 December 2019. The missile was in full configuration in deployment mode intercepting the target mid-air, meeting the mission objectives. The entire event was monitored by Ground Telemetry Systems, Range Radar Systems, Electro Optical Tracking System etc.

The QRSAM weapon system, which operates "on the move," comprises the fully automated Command and Control System, Active Array Battery Surveillance Radar, Active Array Battery Multifunction Radar and Launcher. Both radars are four-walled having 360-degree coverage with search on move and track on move capability. The system is compact with minimum number of vehicles for a firing unit. Single stage solid propelled missile has midcourse inertial navigation system with two-way data link and terminal active seeker developed indigenously by DRDO. The missile successfully engaged the aerial target establishing its capability. Director General (Missiles and Strategic Systems) Shri MSR Prasad was present during the trial. With this mission, the developmental trials of the weapon system are successfully completed and the weapon system is expected to be ready for induction by 2021.

Nammo Framework Agreement with the Norwegian Armed Forces

Nammo has signed a four-year framework agreement with the Norwegian Defence Logistics Organisation (NDLO) for ammunition deliveries to the Norwegian Armed Forces. Worth more than NOK 1.7 billion, the agreement will support Norway's efforts to improve its levels of training and operational readiness. "We are honoured by the trust placed in us by such a demanding customer as the Norwegian Armed Forces," stated Morten Brandtzæg, President & CEO of the Nammo Group. Norwegian Minister of Defence, Mr. Frank Bakke-Jensen, emphasised the importance of the agreement in addressing the longstanding concern regarding ammunition supply. "It is absolutely crucial that the Armed Forces have sufficient ammunition both for day to day operations and for its readiness stores. This has been a challenge for several years, and I'm very pleased that we will now get this resolved," said Mr. Bakke-Jensen. Petter Jansen, CEO of the Norwegian Defence Logistics Organisation, also expressed his satisfaction with the agreement.

"Strategic partnerships with important industrial enterprises is a cornerstone of our approach to military logistics and supplies in peace, crisis and conflict. Nammo is a business we have a long-standing cooperation with and they are a trusted partner for the Norwegian Armed Forces. This framework agreement with Nammo takes us a long step forward in terms of preparedness, readiness and operational effect," stated Jansen. The framework agreement sets the terms for a series of subsequent agreements between Nammo and the NDLO. The first of these was also signed during this ceremony at Oslo's historic Akershus fortress, and it outlines the expected deliveries to the Norwegian Armed Forces over the coming four years. This not only allows Nammo to plan and deliver more efficiently, but also to secure long-term supplies of critical raw materials and components. "This is the kind of relationship we want with all our core customers, as we believe it delivers substantial benefits to both sides, both in terms of cost during peace time and security of supply in times of crisis and war," stated Mr. Brandtzæg.

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Hall 7
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Lockheed Martin : The F-35 Enterprise "Reducing Costs"

The F-35 Joint Programme Office and Lockheed Martin have finalised agreement for the production and delivery of 478 F-35s at the lowest aircraft price during the history of the Programme. This contract includes all US, International Partners and Foreign Military Sales aircraft in Lots 12, 13 and 14.

In the agreement, the F-35 Enterprise meets and exceeds its long-stated cost reduction targets for each variant – and the F-35A unit price, including aircraft and engine, which is now below $80 million. In both Lot 13 and Lot 14, the F-35A unit cost represents an estimated overall 12.8 percent reduction from Lot 11 costs for the conventional landing variant, and an average of 12.7 percent savings across all three variants from Lots 11 to 14.

"Driving down cost is critical to the success of this programme. I am excited that the F-35 Joint Programme Office and Lockheed Martin have agreed on this landmark three-lot deal. This agreement achieves an average 12.7 percent cost reduction across all three variants and gets us below $80 million for a USAF F-35A by Lot 13 - one lot earlier than planned," said Air Force Lt. Gen. Eric Fick, F-35 Programme Executive Officer. "This $34 billion agreement is a truly historic milestone for the F-35 Enterprise."

The agreement covers 291 aircraft for the US Services, 127 for F-35 International Partners, and 60 for F-35 Foreign Military Sales customers.

Variant	Lot 12	Lot 13	Lot 14	% Reduction from Lot 11
F-35A	$82.4M	$79.2M	$77.9M	12.8%
F-35B	$108.0M	$104.8M	$101.3M	12.3%
F-35C	$103.1 M	$98.1M	$94.4M	13.2%

"With smart acquisition strategies, strong government-industry partnership and a relentless focus on quality and cost reduction, the F-35 Enterprise has successfully reduced procurement costs of the 5th Generation F-35 to equal or less than 4th Generation legacy aircraft," stated Greg Ulmer, Lockheed Martin's, F-35 Programme VP and GMr. "With the F-35A unit cost now below $80 million in Lot 13, we were able to exceed our long-standing cost reduction commitment one year earlier than planned."

The sub $80 million unit recurring flyaway cost for an F-35 represents an integrated acquisition price for the 5th Generation Weapon System. With embedded sensors and targeting pods, this F-35 unit price includes items that add additional procurement and sustainment costs to legacy 4th Generation aircraft.

"With more than 450 aircraft operating from 19 bases around the globe, the F-35 is playing a critical role in today's global security environment. More than 910 pilots and 8,350 maintainers have been trained, and the F-35 fleet has surpassed more than 220,000 cumulative flight hours. Eight nations have F-35s operating from bases on their home soil and seven Services have declared Initial Operating Capability", stated company officials.

In addition to strengthening global security and partnerships, "the F-35 provides economic stability to the US and International Partners by creating jobs, commerce and security, and contributing to the global trade balance." The F-35 is built by thousands of men and women in America and around the world. With more than 1,400 suppliers in 46 states and Puerto Rico, the F-35 Programme supports more than 220,000 direct and indirect jobs in the US alone. The Programme also includes more than 100 international suppliers, creating or sustaining thousands of jobs.

Courtesy: LM

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Updates from Saab

New Electronic Attack Jammer Pod in the Air

Saab carried out the first flight tests with its new advanced Electronic Attack Jammer Pod (EAJP) with successful results on 4 November 2019. The pod's interfaces with the aircraft's hardware and software as well as cockpit control and monitoring were tested during the flight. The purpose of Saab's new EAJP pod is to protect aircraft against radars by sophisticated jamming functions, thereby blocking the opponent's ability to attack them. The first flight marks an important step of the pod's development programme.

Saab is sharpening its electronic attack capabilities and the new advanced pod is an important element of this development. The EAJP is a strong complement to the built-in electronic attack capabilities of the highly advanced on-board electronic warfare system on Saab's new Gripen E/F fighter. It can also be used on other aircraft types. The pod forms part of Saab's Arexis family of electronic warfare systems.

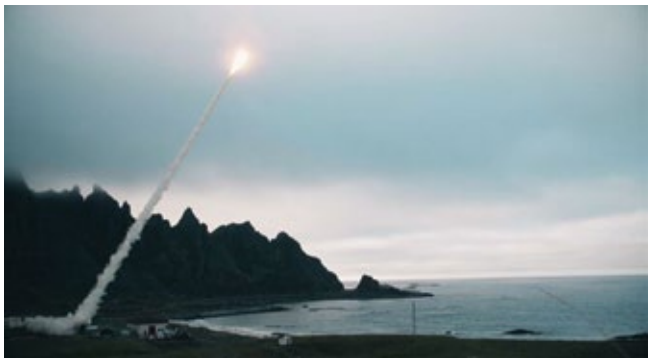
Order for Finnish 'Squadron 2020'

Saab has signed a contract with the Finnish Defence Forces Logistics Command, and received an order to provide and integrate the combat system for the Finnish Navy's new *Pohjanmaa*-class corvettes within the Squadron 2020 programme. This follows the previously announced selection on 19 September. The order value is 412 million Euro and the contract period is 2019-2027. The Finnish shipyard RMC Defence will build the Finnish Navy's four new corvettes, with construction 2022 to 2025. The corvettes will be fully operational by 2028. The contract includes, among other things, Saab's Combat Management System (9LV) and Saab's radars Sea Giraffe 4A Fixed Face and Sea Giraffe 1X. The communication system TactiCall as well as the remote weapon station Trackfire, are also included in the contract.

Guided Carl-Gustaf Series of flight tests

Raytheon and Saab have successfully completed a series of guided flight tests for the shoulder-launched, guided Carl-Gustaf munition. Tests were conducted at Saab's Bofors Test Centre in Karlskoga, Sweden, and at Mile High Range in Sierra Blanca, Texas. The Carl-Gustaf weapon system built by Saab is used by the US Army and ground forces of more than 40 other countries. The new semi-active, laser-guided munition will allow militaries to accurately engage stationary or moving targets at distances up to 1.2 miles (2,000 meters).

Saab and Boeing firing of Ground-Launched SDB



Saab has along with Boeing conducted successful long-range test firing of the Ground-Launched Small Diameter Bomb (GLSDB) in Norway. The objective of the test firing was to hit a predetermined target in the sea, 130 km away from the launcher. The launcher used at test firing was a custom made, fully autonomous, 20 foot container.

Dassault Falcon 8X Archange to serve the French Air Force

The French Defence Procurement Agency (DGA) has ordered the Archange airborne strategic intelligence programme, comprising three Dassault Aviation Falcon 8X aircraft equipped with the Thales new-generation payload CUGE (universal electronic warfare capability).

"The Archange Falcon will serve the French forces in the same way as the Falcons 10, 200, 50, 2000, 900 and 7X are already doing", stated Eric Trappier, Chairman and CEO of Dassault Aviation. "The special mission Falcons provide the perfect illustration of the dual competences of Dassault Aviation: our civil aircraft benefit from the cutting-edge technologies developed for our combat aircraft, which in return benefit from the industrial processes deployed for the highly competitive production of the Falcon aircraft".

The tri-jet Falcon 8X is the latest addition to the Falcon range. The business jet version can carry 8 passengers and 3 crew members over a distance of 6,450 nm (12,000 km). It has digital flight controls which stem directly from Dassault Aviation's experience acquired with the Mirage 2000 and Rafale. It is equipped with an EASY digital flight deck and the totally unrivalled FalconEye combined vision system (CVS). Exported to more than 90 countries, the Falcon aircraft are flexible and economic to fly. Their handling qualities, aerodynamics and versatility render them capable of fulfilling missions that go beyond civil aviation standards.

Collins Aerospace contract to support JSTARS aircrew simulators

After nearly two decades of providing sustainment support, Collins Aerospace Systems has received a 10-year extension from the USAF to provide services critical to maintaining the training system for the E-8C Joint Surveillance Target Attack Radar System (JSTARS) aircraft. The system includes full flight simulators and navigator training terminals located at Robins Air Force Base. Collins Aerospace is a unit of United Technologies Corp.

With a track record of 99% uptime over the life of the contract, Collins Aerospace will continue to help the USAF overcome obsolescence of the training system by providing cybersecurity updates, hardware upkeep as required and provide onsite logistics to assure maximum uptime.

The JSTARS training system is made up of two Collins Aerospace full-flight simulators as well as two navigator training stations that provide simultaneous training for both pilots and crew. Beyond the E-8C JSTARS, Collins Aerospace has been providing broad-scope, complex simulation and training systems for other platforms that include the E-2D Advanced Hawkeye, B-52 Stratofortress and E-6B Mercury for over 15 years.

Tactical Heron joins IAI/ Malat's UAS family

IAI's Malat has expanded the Heron Family of Unmanned Aerial Systems (UAS), adding a lighter weight variant optimised for tactical operations.

The T-Heron can fly at a maximum speed of 120 km/h, climb to a maximum altitude of 24,000 feet and remain on mission for 24 hours. With maximum takeoff weight of 600 kg, less than half the weight of the Heron I, the T-Heron can carry a useful weight of 180 kg, supporting multiple sensors for reconnaissance and intelligence surveillance and ongoing surveillance missions. On each mission, T-Heron can carry payloads including radars, EO/IR, SIGINT, COMINT, along with broadband datalinks, operating in line-of-sight and over a satellite terminal, supporting the simultaneous download of information from all payloads. Maintaining a cruising altitude of 21,000 ft., the T-Heron uses long-range EO/IR payloads looking 100 km deep across borders. This capability is unique to the T-Heron of all tactical UAS, providing valuable intelligence while remaining at standoff range from enemy's air defence.

The platform features a highly efficient design for tactical ISR missions. The retractable forward landing gear clears the view for the EO/IR and radar sensors, while placements for COMINT/SIGINT antennae are located on the wingtips and booms to minimise obstruction and maximise antennae separation for optimal performance. Wing-mounted pods carry additional electronic sensors or expendable payloads such as markers or lifeboats on search and rescue missions.

The T-Heron uses a 70 percent downscaled Heron I design. With 10-meter wingspan and low centre of gravity placed well within the large, rectangular payload bay, the T-Heron provides a robust, flexible platform carrying internal and external payloads to meet different payload configurations supporting various missions. The wings are reinforced and fitted with hardpoints supporting external carriage. The new variant is designed and built as a certifiable UAS, in compliance with STANAG 4671 standard. Addressing all the Standard's criteria, T-Heron uses a FAR33 certified Rotax 912iSC aviation engine, and fully redundant safety-critical systems including power distribution, flight control, and communications. The aircraft has an integral 'pilot window,' using a tail-mounted panoramic camera and provisions for deicing ensuring flight safety at high altitude and in icing conditions. To enable sharing the airspace with civilian aircraft, T-Heron also carries IFF/ TCAS for identification and collision avoidance.

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The T-Heron is designed to operate in extreme environmental conditions, including high altitude, a temperature range of -40 to +55°C, crosswinds of 20 knots, and rain flow of 50mm per hour.

IAI's standard iUCS mission control systems are used to conduct the mission from the ground. The iUCS supports all mission phases, platform, and payloads. The modular iUCS supports different configurations for tactical deployment in armoured vehicles or shelters, maritime and airborne platforms. The system is designed to operate with a single crewmember or stack several iUCS to support larger crews on more complex missions. The T-Heron's payloads can also be controlled from portable terminals, using the two-way remote terminal (RVT).

Built to operate from short, unpaved surfaces, T-Heron relies on integral brakes, power, and cooling, and is independent of specialised ground support equipment such as arresting cable, power and cooling carts. The system is stored and transported in two standard 20-foot ISO air-deployable containers, requiring two vehicles for field operation.On tactical deployment, the system can minimise the support crew, utilising the Heron family 'Long Runner' remote operation feature, forward-deployed T-Heron can be controlled remotely from a control centre, performing all functions, including takeoff, landing and taxing without relying on local support teams. IAI offers customers a full logistics package, providing flight line, intermediate and depot level (D level) maintenance and support, ensuring complete independence.

Boasting more than 1,700,000 operational flight hours in service with 50 countries worldwide, IAI's Heron Family now includes four variants. These variants perform missions spanning 24 hours and more, carry payloads of 180kg to 1 ton, support Intelligence, Reconnaissance and Surveillance (ISR) operations in strategic, operational, tactical missions,as well as Homeland Security (HLS), Search and Rescue (SAR), Maritime Patrol, and Anti-Submarine (MP/AS) missions.

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CONTROP announces enhanced capabilities for the iSea-50HD: a new HD thermal camera and SWIR channel

Controp continues to strengthen its technical capabilities, while participating in several maritime tenders in India.

Controp Precision Technologies Ltd., a company specialising in the field of electro-optics and infrared (EO/IR) for defence and homeland security solutions – is announcing new capabilities for its iSea-50HD, replacing the thermal camera with a new HD thermal camera, and adding a SWIR channel which enables clear observation in the harsh environmental conditions typical of the Indian maritime climate.

The iSea-50HD system provides maximum-range surveillance using highly sensitive sensors, including an HD Thermal Imaging (TI) Camera working in the 3-5µ band with a continuous zoom lens, a high-sensitivity colour day camera, a SWIR channel and a long-range Eyesafe Laser Range Finder (ELRF). Among its additional features are advanced image processing and unique video enhancement algorithms.

Providing a full solution for naval and maritime operational requirements, Controp's compact, lightweight iSea surveillance systems have been mission proven since the 1990s, integrated across the globe on a wide variety of vessels and in daily operation for maritime missions such as search & rescue, maritime surveillance, law enforcement, EEZ protection, counter piracy and special operations. In India, the iSea-30HD is already installed and active on multiple vessels belonging to the Indian Coast Guard. Controp is actively pursuing new contracts in this market and participating in local tenders for Indian shipyards, with the goal of continuing this successful cooperation.

"Controp continues to lead the development of customised technologies, tailored to meet customer demand and the challenging field conditions in which their forces operate," says Mr. Hagay Azani, CONTROP's CEO & President. "Being able to operate in harsh environments with limited visibility, at specific times of day and night, is critical to customers in this region."

Controp specialises in the development and production of electro-optical and precision motion-control systems for surveillance, defence and homeland security. Controp's main product lines include: high-performance stabilised observation payloads used for day/night surveillance onboard UAS, small UAS and aerostats/balloons, helicopters, light aircraft, maritime patrol boats, remote weapon stations and ground vehicles; automatic intruder-detection systems for coastal and border surveillance, port/harbour security, the security of sensitive sites, ground-troop security and anti-drone applications; thermal imaging cameras with high-performance continuous zoom lens and state-of-the-art image enhancement features and more. Controp's products are in daily operational use in many of the most critical surveillance, homeland security and defence programs worldwide.

Elettronica Group and its EuroDIRQM

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MIND IS THE FIRST DEFENCE

Elettronica Group and Indra have teamed up for development of a next generation Quantum Cascade Laser (QCL) based Direct Infrared Countermeasure (DIRCM) system for protection of rotary and fixed wing aircraft. Elettronica and Indra's approach is based on high level of the respective know-how and technological capabilities synergy with the objective to build an innovative DIRCM system, with proprietary technologies from several EU countries, to deliver a "truly European self-protection solution fully ITAR-free to facilitate international commercialisation". The system, first to be fully developed in Europe and one of the most advanced in the world, has been dubbed EuroDIRQM, to reflect its European roots and its application of QCL technology for DIRCM purposes.

The two companies have already completed development of a first EuroDIRQM prototype system, with QCL operational ground tests successfully performed in 2018 with cooperation of the Italian Air Force. The EuroDIRQM is conceived as "all-in-one" equipment usable for multi-platform and multi-mission that will provide self-protection capabilities to all aircraft, from helicopters to transport/tanker to fighter aircraft.

"The EuroDIRQM solution will bring together about 30 years of combined experience in the DIRCM field by the two companies and the collaboration will benefit from their long term cooperation in other international successful programmes". Indra and Elettronica have successfully applied their DIRCM capabilities on different platforms and scenarios. The new QCL technology will expand Indra DIRCM capabilities, already consolidated with the InShield DIRCM system, contracted by OCCAR for the A400M fleet and operationally demonstrated in a CH-47 Chinook in 2017. In the same manner, Elettronica DIRCM portfolio, with the ELT/572 DIRCM, contracted by Italian Air Force and operative on-board its C-130J aircraft, AW101 helicopters in Combat Search And Rescue configuration as well as operationally demonstrated in a C-27J in 2016, will also be enlarged with this QCL based solution.

MANPADS (Man Portable Air Defence Systems) are the main cause of military aircraft losses in conflict. MANPADS pose an international threat and are a global concern because of their proliferation and use by terrorist and possible uncontrolled groups.

DIRCM systems are self-protection airborne solutions to protect aircraft from heat-seeking missiles and specially required for protection against MANPADS missile attacks. The concept is based on detection of an incoming threat during missile launch and countermeasures of the missile guidance using a directed laser beam that deviates trajectory of an missile. The process is rapid and automatic, the system reading against attacks of any IR seeker with a jamming sequence that ensures successful countermeasures.

Elettronica Group has been on the cutting edge of electronic warfare for more than 60 years, supplying armed forces and governments of some 30 countries with more than 3000 high technology systems. Privately controlled by Benigni's family, with Leonardo and Thales as shareholders, the Group is composed of three industrial organisations Elettronica S.p.A, the headquarters, based in Rome, leader in EW capabilities, CY4GATE, a joint venture with Expert System, specialising in Cyber EW, Cyber Security and Intelligence, and Elettronica Gmbh, the German subsidiary specialising in EW signal processing design and production and Homeland Security solutions. Elettronica's systems are deployed for a variety of key operational missions, from strategic surveillance, to self protection, SIGINT, electronic attack and operational support for airborne, naval and ground applications. The Elettronica Group boasts a strong record of successful domestic and international collaborations on key modern military platforms such as the Italian PPA, the Eurofighter Typhoon, the NFH-90 helicopter, various Italian and French warships *Horizon* and FREMM, and a wide range of applications in the Middle East and Asia.

In line for Canada, Switzerland, Germany, Finland – and India !

The Formidable F/A-18 Super Hornet

According to Boeing, the company sees an opportunity to sell more than 350 F/A-18 Super Hornets across six major fighter competitions, and is in discussions with other unspecified countries. Finland has also been cleared by the US government to possibly obtain the EA-18G Growler electronic warfare variant of the type for its HX fighter procurement, which is aimed at replacing its 62 Boeing F/A-18C/Ds. This is only the second time that the EA-18G has been approved for export, the only international operator of the EA-18G being the Royal Australian Air Force, which has 11 examples.

There have been important updates for the Block III over the Block II, which include conformal fuel tanks for longer range, better connectivity with other assets, an infrared search and track (IRST), an advanced tactical data link and a new distributed targeting processor. The Block III also has a lower radar cross-section and its airframe life has also been extended to 10,000hr, up from 6,000hr for the Block II. In March 2019, Boeing secured a three-year contract from the US Navy for 78 F/A-18E/F Block III Super Hornets, with a total contract value of about $ 4 billion and also has a programme to upgrade the navy's existing Block IIs to the Block III standard.

Apart from the US Navy, the Royal Australian Air Force also places immense trust on the Super Hornet as a multi-role,frontline fighter of choice. All 24 of the Australian Super Hornets were delivered by Boeing to the customer, ahead of schedule in October 2011. Further proof of the continued edge this fighter brings to armed forces globally can be gauged from the order recently placed by Kuwait for 22 F/A-18Super Hornets.

A robust roadmap has been laid out to ensure that the F/A-18 Super Hornet is capable of dealing with future threats. The US Navy's continued investment is proof of the fact that this aircraft will continue to have the technologies needed to outpace threats for decades to come. Boeing and the US Navy have laid out and maintained a robust spiral development approach to the Super Hornet that provides updates to the aircraft's subsystems and software every two years.

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"One Fighter, Many Benefits"

The Boeing Super Hornet brings the latest generation of technologies, the AESA radar in particular, is an exponential leap in technology for current and future missions. The Advanced Targeting Forward Looking Infrared system, Joint Helmet Mounted Cueing System, Multifunctional Information Distribution System, advanced high capacity computer system, and state-of-the-art cockpit provides the fighter pilot with intuitive situational awareness and capability far into the future.

The F/A-18 is highly capable across the full mission spectrum, a true multirole aircraft, able to perform virtually every mission in the tactical spectrum, including air superiority, day/night strike with precision guided weapons, fighter escort, close air support, suppression of enemy air defences, maritime strike, reconnaissance, forward air control and tanker missions. It has the right level of stealth, the right sensors and the right number of missiles for the Indian Air Force's spectrum of missions.

Boeing has also completed extensive analysis and testing on the F/A-18 Super Hornet's compatibility with Indian aircraft carriers. Results show that the Super Hornet is capable of launching off a ski-jump carrier and could be operated from Indian carriers with a meaningful fuel and weapons load.

Boeing is committed to expanding its partnership by producing Super Hornets in India thereby further developing the country's aerospace ecosystem. Boeing is proposing a world-class advanced manufacturing facility in India with the very latest technologies in place.

With designed-in stealth and robust capability growth plan, the Super Hornet is also relevant to India's Advanced Medium Combat Aircraft (AMCA) programme. Boeing will work closely with the Indian industry to ensure they have latest technologies and apply lessons learnt from the current Super Hornet production line. Working towards this goal, in 2018, Boeing announced a partnership with Hindustan Aeronautics Limited (HAL) and Mahindra Defence Systems (MDS) for manufacturing the Super Hornet in India and pursuing the joint development of future technologies.

"Boeing is confident that its partnership with HAL and Mahindra will enable it to optimise the full potential of India's public and private sector to deliver next-generation fighter capabilities. Boeing envisions that this partnership can deliver an affordable, combat-proven fighter platform for India, while adding growth momentum to the Indian aerospace ecosystem with manufacturing, skill development, innovation and engineering. The partnership will transform India's aerospace and defence ecosystem, further building on its 'Make in India' success".

Future production of the Super Hornet in India, with Indian partners, will involve maximising indigenous content and producing the F/A-18 in India for its armed forces thereby creating a 21st century aerospace ecosystem.

Courtesy: *Boeing* (photos: Simon Watson)

Lockheed Martin and "Start-up India"

With a presence in India for over 25 years, Lockheed Martin opened its India subsidiary in New Delhi back in 2008 and has supported and aligned itself with various initiatives of the Government of India. "Lockheed Martin continues to explore opportunities for closer collaboration and partnerships, including supporting the *Digital India* initiative."

As a part of its larger commitment to enhance the growth and development of India's innovation, Lockheed Martin has sponsored and supported the *India Innovation Growth Programme* (IIGP) since 2007 in partnership with the Indian Department of Science and Technology, Indo-US Science and Technology Forum, Federation of Indian Chambers of Commerce and Industry, Stanford Graduate School of Business, and the IC2 Institute at the University of Texas.

Resonating with Prime Minister Narendra Modi's 'Start-up India' call, the IIGP has pioneered an initiative that has supported more than 400 innovators and start-ups with in-depth technology commercialisation training and handholding support to commercialise and scale their ventures in India and across the world, particularly in the United States. To date, the revenue generated for the Indian entrepreneurs through this programme is approaching $1 billion, and it is a flagship innovation programme in the Department of Science and Technology.

The C-130J in India

The C-130 programme represents a strong legacy of partnership between the US and India. All C-130Js delivered to operators around the world have major aerostructure components from India included in their build through partnership with Tata Advanced Systems Limited (TASL) in Hyderabad, India. This partnership with TASL also includes an on-the-job training element that supports the broader "Skills India" initiative.

The Indian Air Force operates a fleet of five C-130J-30s and it will receive an additional six C-130J-30s as well. India is one of 16 countries operating the C-130J Super Hercules, which is the world's choice for tactical airlifters. The IAF uses its C-130Js to support a variety of missions, from cargo delivery to providing vital humanitarian aid. The Super Hercules is also part of India's C-130J Roll-On/Roll-Off University Design Challenge. Through this initiative, Lockheed Martin provides research grants for teams from Indian universities to work with local industry partners and mentors from India's Defence Research and Development Organisation to develop design specifications for proposed modules that could be used on a Lockheed Martin C-130J Super Hercules cargo aircraft.

The F-21 for India

Adding on to Lockheed Martin's successful programme of C-130J empennage, S-92 cabin, and now F-16 wing manufacturing in India, the F-21 will be a step function in furthering technology insertion, indigenous manufacturing and global export opportunities. The F-21 is the optimal platform to meet the Indian Air Force's near and long-term capability and affordability requirements. No other fighter in the competition goes further, stays longer or delivers more ordnance per mission than the F-21. A partnership with Lockheed Martin also positions Indian industry to become a key part of the world's largest fighter and sustainment ecosystem.

HAL deliver's 150th gun bay door for Boeing F/A-18 Super Hornet

Hindustan Aeronautics Limited has marked a milestone in delivering the 150th gun bay door for the Boeing F/A-18 Super Hornet. HAL has been Boeing's long-term supplier for over 25 years, having been awarded the contract to manufacture gun bay doors for the Super Hornet in 2007. Boeing India stated, "our investments in India are robust and ongoing, spanning technology, hi-tech innovation, production capacity, establishing a supply chain network, and developing skilling centres for aerospace manufacturing in India."

DRDO conducts repeat trials of AAM Astra

DRDO has successfully flight tested the Astra Beyond Visual Range Air-to-Air Missile (BVRAAM) from a Su-30MKI platform off the coast of Chandipur, Odisha, conducted by the Indian Air Force against a Banshee target aircraft simulating various threat scenarios. The five trials conducted during this period tested missiles in different configurations, three missiles launched in combat configuration with warhead and manoeuvring targets to establish the end game capability of the missile. The trial campaign also included a direct hit by the telemetered missile at maximum range. All the subsystems performed accurately meeting all the mission parameters and objectives. The Astra BVRAAM has range of more than 100 kms with modern guidance and navigation techniques, with midcourse guidance and RF seeker based terminal guidance.

Debut of Elbit Hermes 45

Hermes 45 offers a "unique combination of extended range and duration with point launch and recovery, to and from land and maritime platforms thus enhancing Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) capabilities at the brigade and division levels and also for naval units." Hermes 45 features flight range of 200km or an extended Beyond Line of Sight range (via Satellite Communication) and an internal payload bay that supports multi-payload operation, including EO/IR, Marine-Radar, Terrain Dominance, Electronic Warfare (EW) and communications. The Hermes 45 is operated by a two-person crew, launched from a short onboard platform rail, and recovered by an automated spot landing system.

HAL Dornier 228s with Glass Cockpit

Integration of the Glass Cockpit in a Navy Dornier 228 (IN-255) aircraft has been certified, being the fifth aircraft of 12 additional Dornier 228s ordered by the Indian Navy. High speed taxi trials of IN-255 were carried out on 5 September, 2019. The IAF's first Glass Cockpit configured Dornier 228 (KD-720) has also completed high speed taxi trials and integration of two more IAF aircraft (KD-710) (retro fitment) and KD-722 (line compliance) have been completed and the aircraft signaled out.

Rafael's Spice 1000 receives the 'Israel Defence Prize'

President of Israel, Reuven Rivlin, Prime Minister and Minister of Defence Benjamin Netanyahu and Chief of Staff Lt. Gen. Aviv Kochavi, have awarded the *Israel Defence Prize* to projects and operations "that have contributed to the security of Israel and to its qualitative military edge and technological superiority." The Prize for 2019 was awarded to the Rafael Spice 1000 weapon system, which is part of the company's wider air-to-surface Spice Family (250, 1000, 2000) of stand-off, autonomous, air-to-ground weapon systems that attack targets with pinpoint accuracy and at high attack volumes, without depending on GPS navigation in GPS-denied environment. The Spice is combat-proven with the Israeli Air Force and is in operational service with a number of international users (including the Indian Air Force).

Rafael acquires Aeronautics

Rafael Advanced Defense Systems Ltd., has completed, with its partner, Mr. Avichai Stolero, the acquisition of Aeronautics Ltd., one of Israel's leading developers of unmanned aerial systems. Heading an industry group focused on unmanned systems and subsystems, Aeronautics Ltd. provides integrated turnkey solutions based on unmanned systems platforms, payloads and communications for defense and civil applications. Rafael will hold 50% of Aeronautics, with partner Mr. Avichai Stolero, holding the balance. This is part of Rafael's long term strategy to evaluate and implement new areas of growth, including by M&A of unmanned platform companies.

Aeronautics will take part in some of Rafael's innovation projects, "to increase mutual growth, explore new markets, and provide end-to-end solutions in the low-tier aerial domain, relying on best practices, mutual expertise and capabilities, to create new synergies and solutions."

French Air Force Rafale (in this photo) but soon to be with the IAF as an operator of the type, is seen here with two MBDA Meteor's and four MICA AAMs. (photo: Dassault)

MBDA: "strong partner of the Indian Air Force"

With its reputation as a reliable partner that has supported the Indian Air Force for over 50 years, European missile firm MBDA understands the importance of operational capability and sovereignty for the IAF. For these reasons, the company has strongly committed to *Make in India* to deliver the best of military equipment to India. Local firms now supply key components for new missiles which are enhancing combat power of the IAF. MBDA continues to deepen its relationship with Indian industry, as seen by the recent joint venture with long-standing partner Larsen & Toubro on a series of important missile programmes under the *Make in India* category.

With exciting times ahead as the next gen. Rafale joins the IAF's inventory, these new aircraft come armed with a potent suite of weapons from MBDA. Unquestionably the most vital is the Meteor, the ramjet powered and network-enabled beyond visual range air-to-air missile that is widely recognised as a game changer for air combat. Meteor's throttleable ramjet engine provides sustained high-supersonic power, making it the only missile able to chase manoeuvring enemies at even long of ranges.

No less game-changing for the IAF is the Scalp stealthy air-launched cruise missile that also forms part of the Rafale weapons package. This potent weapon will give the IAF an unrivalled and flexible tool to conduct deep strike missions at long ranges against the most protected hostile targets. MBDA also manufactures the Brimstone and Spear strike missiles. Both lightweight missiles (Brimstone weights 50 kg and Spear 100 kg), feature advanced dual-mode guidance that allow them to engage moving, manoeuvring targets in all weather

Meteor BVRAAM


The ASRAAM

conditions, either autonomously or with operator in the loop control.

Brimstone is well-known as the leading anti-armour missile able to be salvo fired against multiple targets and defeating even the best protected armoured vehicles with latest defensive aid systems. It's also unique for being truly multiplatform, being able to arm fast jets, helicopters, UAVs, land platforms and naval vessels.

Spear builds on the capabilities of Brimstone, and this mini-cruise missile is able to strike targets over 140km away. With an enhanced seeker and two-way datalink, this truly intelligent and networked enabled weapon defeats even the most sophisticated of air defence systems be they on land or sea.

Another MBDA weapon, MICA provides both the Rafale and the newly upgraded IAF Mirage 2000 aircraft with a uniquely flexible approach to air combat. MICA is the only missile featuring two interoperable seekers (active radar and imaging infrared) makes MICA highly countermeasure resistant and therefore highly effective.

The IAF is also getting a major boost with addition of the ASRAAM as its Next Generation Close Combat Missile. With its large rocket motor and clean aerodynamic design, ASRAAM has unrivalled speed and resultant aerodynamic manoeuvrability and range. ASRAAM gives it a high kinematic capability that delivers superior end-game performance for within visual range air combat. MBDA's ASRAAM missiles are significantly enhancing the battle capability India's Jaguar strike fighters giving them unrivalled self-protection ability and enhanced ability to penetrate hostile airspace.

Working with HAL, integration of the Mistral ATAM system on the Dhruv helicopter and the Light Combat Helicopter (LCH) has been very successfully completed. Key to many of MBDA's offerings are their ability to be fitted to multiple platforms. By utilising the same weapon across different platforms, not only do various aircraft benefit from these capabilities, but there are major cost savings and operational benefits in maintaining common equipment inventories not to mention the training and logistics benefits. For example, utilisation of the Mistral missile on India's helicopter platforms provides ground based VSHORAD role, where the missile is fully compliant with India's requirements.

Courtesy: MBDA

Estonia orders Rafael Spike

At a ceremony in Tallinn, Estonia, the Estonian MoD signed a 40m. Euro Framework agreement with Eurospike (a European Joint Venture between Rafael Advanced Defence Systems, Diehl Defence and Rheinmettal Defence) for the supply of Spike LR ATGMs, launchers and associated maintenance and training. The contract included ICLU (Integrated Control Launch Units) launchers and live Spike rounds. Spike is a cutting-edge precise, multi-platform, multi-mission and multi-range electro-optical missile Family, with capabilities of fire-and-forget, as well as fire, observe and update, allowing attack of hidden targets. Estonia is the 32nd user nation of the SPIKE missile, and the 19th user among the EU and NATO.

MBDA Mistral on ALH Mk.4 Rudra

The procurement of 450 Mistral missiles worth around Rs 3,000 crore for the ALH Mk.4 (Rudra) have reportedly been delayed over the price of storage shelters, located at 11 forward bases across the country, subsequently reduced to five locations. The MoD negotiating team is believed to be close to getting approval from the defence minister to revise the benchmark price and so in the deadlock.

Tata Power SED ship-borne 3D Air Surveillance Radars

Tata Power Strategic Engineering Division (Tata Power SED) have signed contracts with the Ministry of Defence to supply 23 ship-borne 3D Air Surveillance Radars to the Indian Navy over the next 10 years. The contract, estimated at Rs 1,200 crore, was signed under the *Buy & Make (India)* category of the Defence Procurement Procedure (DPP) 2013 that will be offering the Indian Navy a proven solution, with a production arrangement in India under Transfer of Technology (ToT). The contract will be executed by Tata Power SED as the prime contractor with the foreign OEM (Original Equipment Manufacturer) partner Indra Sistemas of Spain.

Tata's combat management system for IAC-I

Combat Management System (CMS) for the Indigenous Aircraft Carrier (IAC), developed by Tata Power Strategic Engineering Division (TPSED), in collaboration with Weapon and Electronics System Engineering Establishment (WESEE) and MARS of Russia was handed over by Sukaran Singh, CEO and MD, Tata Advanced Systems Ltd. to the Indian Navy's Chief of Materiel, Vice Admiral GS Pabby on. This is the first CMS developed by Private Industry for the Indian Navy.

(photo: Angad Singh)

Tests of Pinaka missiles in salvo mode

As part of the series of flight trials of Pinaka missile system, two test firings have been conducted by Defence Research and Development Organisation (DRDO). The first trial was conducted on 19 December 2019, wherein one missile was fired at 75 kilometre range. The second trial was successfully conducted a few days later from Integrated Test Range, Chandipur, off the Odisha coast. The mission objective of the latest trial was to test low range, functioning of live warhead along with its proximity initiation and salvo launch. The Pinaka missiles were launched in salvo mode with 60 seconds interval between two firings, both missiles fired to engage a target located at 20 kilometre range and high accuracy was achieved. The missile was integrated with live warhead with proximity fuse and was tracked by multiple range systems viz. telemetry, radars, Electro-Optical Tracking System (EOTS), which confirmed the text book flight performance.

The Pinaka MK-II Rocket is modified as a missile by integrating with the navigation, control and guidance system to improve the end accuracy and enhance the range. The Navigation system of the missile is also aided by the Indian Regional Navigation Satellite System (IRNSS). The missile system has been jointly developed by various DRDO Laboratories such as Armament Research & Development Establishment (ARDE), Research Centre Imarat (RCI), Defence Research and Development Laboratory (DRDL), Proof & Experimental Establishment (PXE) and High Energy Materials Research Laboratory (HEMRL).

Developments at Safran

Safran Helicopter Engines for greener vertical flight

Airbus Helicopters and Safran Helicopter Engines have teamed to prepare the future of cleaner, quieter and more efficient vertical flight, ahead of the upcoming Horizon Europe research programme which should be carried out during the next decade. A Letter of Intent (LoI) was signed at the Paris Air Show between the two companies which formalised their willingness to jointly demonstrate future technologies that will significantly contribute to the reduction of CO2 emissions and sound levels for future vertical take-off and landing (VTOL) platforms. A number of technological streams will be investigated, including various levels of electrification, higher-efficiency gas turbines or alternative fuels, as well as advanced engine architectures to further reduce the acoustic footprint of turbines.

CFM in $1 billion agreement with China

In conjunction with French President Emmanuel Macron's state visit to China, Colorful Guizhou Airlines finalised a 12-year Rate-Per-Flight-Hour (RPFH) Agreement for the LEAP-1A engines that will power the airline's future fleet of up to 35 Airbus A320neo aircraft, along with five spare engines. The agreement is valued at approximately $1.0 billion. RPFH agreements are part of CFM's portfolio of flexible aftermarket support offerings. Under the terms of the agreement, CFM Services guarantees maintenance costs for the airlines LEAP-1A engines on a dollar per engine flight hour basis.

CFM and the LEAP engine

CFM International's advanced LEAP engine continues to set a new industry standard for fuel efficiency and asset utilisation as the fleet continues the most rapid buildup in commercial aviation history, with the fleet logging nearly five million engine flight hours through May 2019, less than three years after commencing commercial service. The first LEAP-powered commercial flight happened in August 2016 on a Pegasus Airlines flight from Istanbul to Antalya. Since then, more than 825 LEAP-1A and LEAP-1B-powered aircraft have been delivered to a total of 104 operators on five continents.

Arrius engines mark 10 million flight hours

Safran celebrated a major achievement for its Arrius engine range; 10 million flight hours flown since its introduction in 1996. With more than 3,800 units delivered to 430 customers in 60 countries, the Arrius family covers a power range of 450-750 shp and flies in both single and twin-engine light helicopters. Over the years, the Arrius range has maintained its status as the 'most competitive and robust engine solution for the light helicopter market', and it continues to be selected for new models. First installed in the EC135 in 1996, the latest Arrius 2B2Plus variant entered service on the Airbus H135 in 2014.

Another variant, the Arrius 2G1, powers the Russian Helicopters Ka-226T. It is in service in Russia, and part of a major military contract currently under negotiation between Russia and India. These latest models make the Arrius range as competitive as ever, and it will remain at the forefront of Safran propulsion offer for the next 20 years.

Russian Helicopters presents its civilian line at Defexpo

Russian Helicopters Holding Company is exhibiting a line of its latest civilian helicopters here at Defexpo.

The light multipurpose Ansat helicopter, as well as heavy Mi-171A2 and Mi-38, are available to the show guests and participants for viewing at the Russian Helicopters stand. In addition, the holding company experts are presenting an after-sales service system for Russian-made helicopters to potential customers.

"India is one of the largest operators of Russian-made rotorcraft, and Defexpo provides an excellent opportunity to discuss further steps in developing our cooperation. Besides the project aimed at localising the Ka-226T helicopter production, such issues as the supply of new civilian helicopters and maintenance and repair of previously delivered rotorcraft are becoming increasingly important. Today, the fleet of Russian and Soviet-made helicopters in India exceeds 400 units," stated Igor Chechikov, head of the Russian Helicopters delegation, Deputy Director General of the Russian Helicopters Holding Company for Aftersales Service.

The light multipurpose Ansat helicopter is equipped with two engines and can be used for passenger transportation, cargo delivery, environmental monitoring and as an ambulance aircraft. Ansat has successfully passed high-altitude tests, which proved that it is suitable for use in mountainous terrain at up to 3,500 meters of altitude, as well as climatic tests, which confirmed its operability in a temperature range between -45° and +50°C.

Mi-171A2 is the newest multipurpose heavy class helicopter which combines the 'unparalleled' experience of operating Mi-8/17 type helicopters and cutting-edge technical solutions. The rotorcraft is equipped with new engines with a digital control system, a high-performance carrier system featuring composite blades and an improved aerodynamic layout.

The heavy multipurpose Mi-38 helicopter can take on board up to 30 passengers, or up to 12 passengers in a VIP cabin configuration.

Rosoboronexport signs first export contract for the Mi-38T

Rosoboronexport JSC has signed first export contract to supply a foreign customer with the Mi-38T medium-range multi-purpose helicopters manufactured by the Kazan Helicopter Plant, a subsidiary of Rostec's Russian Helicopters Company

The Mi-38T is designed for an around-the-clock airlift of up to 40 people with landing on unprepared sites, evacuation of the wounded (up to 12 lying-down or up to 30 sitting cases, accompanied by 2 medical attendants), transportation of goods weighing up to 5000 kg in a cargo compartment or up to 5000 kg on an external sling. The capability to move up to a platoon of infantry to a distance of up to 800 km is provided. The helicopter is also adapted for search-and-rescue operations and is capable of hoisting in persons and cargo weighing up to 300 kg from the ground or water in hover mode. Its rear cargo hatch is equipped with a hydraulically powered loading ramp, and there is a starboard hatch with a wide sliding door. The ramp is adapted for quick loading and unloading, including rolling of wheeled and tracked vehicles.

Thales: "A Perfect Match"

Emmanuel de Roquefeuil, VP & Country Director, Thales in India

Making substantial progress and business reforms over the past few years, India as a country provides tremendous opportunities for business partnerships and bilateral investment projects across sectors. According to the latest World Bank's ease of doing business 2020 report, India jumped to 63rd position vis-a-vis 77th rank in the previous year. This clearly indicates the favourable prospects India offers to foreign OEMs like us to explore business opportunities and form new relationships with local partners in the country. The ecosystem created by government not only facilitates ease of doing business but also attracts foreign investors and creates job opportunities.

Over the years, Thales has played a major role in strengthening the industrial and defence base of the country through the government's '*Make in India*' programme. By offering its expertise and strengths in defence, transport, aeronautics, and digital identity and security markets, Thales has been "a perfect match" for India's various ambitious objectives. The organisation today has over 1600 employees currently working with Thales and its joint ventures (JVs) in India.

Reinforcing its presence in the country, and with over 65 years of strong legacy, Thales continues contribute towards *Make in India* as well as exports from India. The company has formed various co-operative partnerships with public and private sector industries, bringing in its expertise in delivering high-end technology solutions. Thales has been working closely with Hindustan Aeronautics Limited (HAL) for over five decades and has successful JVs with Bharat Electronics Ltd (BEL) dedicated to radars, Samtel, which isdedicated to military avionics and Reliance Aerostructure Limited for electronic warfare and radar. Currently Thales is working with over 75 local supply chain partners in the country, engaged in its global supply chain across defence and civil markets.

Aiming to go beyond production and support innovation, the company is now operating two engineering competence centres located in the National Capital Region (Gurugram and Noida) and Bengaluru. The Bengaluru engineering competence centre specialises in defence, aerospace and transportation, while the one in Noida and Gurugram is focused on Digital Identity and Security including cybersecurity, IoT, biometric as well as big data analytics solutions. Going forward, Thales seeks to continue developing capabilities for local engineering, procurement from India and strengthen its local partnerships.

Thales is enthusiastic about its participation at DefExpo India 2020 – the biennial premiere defence exhibition of India, this mega event supports innovative solutions and offers a platform for stakeholders to foster partnerships and raise the level of technology in the country. In alignment with DefExpo 2020's focus – 'Digital Transformation of Defence' – Thales is showcasing defence technologies that are digitally driven and future focused. With the display of such unique digitally driven technologies across four categories - Land, Naval& Air defence, Digital Transformation and Security –Thales not only reiterates its commitment towards *Make in India* but also showcase its upcoming plans towards the development and modernisation of the Indian armed forces.

As a global technology leader, Thales remains committed to India and helping its operators prepare for tomorrow, but today! The company stays on the drive to offer cutting edge technology solutions to help operators master their decisive moments in an increasingly complex world.

IAI's Vigilant Heron

Heron

The Indian Army (IA) was the first to acquire Unmanned Aerial Vehicles (UAV) in form of Israel Aerospace Industries (IAI) Searcher Mark I, followed by the Searcher Mark II and finally the Heron. The Searcher Mark II is being successfully used in the mountainous region as also in the plains and semi deserts. The Indian Air Force (IAF) was swift to build up similar inventory while the Indian Navy (IN) acquired the Searcher Mark II and notably Heron Medium Altitude Long Endurance (MALE) UAV for long range maritime surveillance missions, operating them from Kochi and Porbandar. More recently, the Heron UAV fleet provided excellent intelligence during strikes performed by IAF on terrorist camps and military assets inside Pakistan in February 2019.

Pride of the fleet is the fourth generation GPS-enabled Heron/Machatz 1 MALE UAV, designed and manufactured by Israel Aerospace Industries (IAI) at its Malat division, Israel. Heron incidentally entered operational service in Indian Air Force (IAF) roundels in high-altitude land surveillance near mountainous Chinese and Pakistani borders, and in IN service in maritime patrol missions. Heron proved to be capable of fully automated take-off and landing, even under adverse weather conditions, and flying at a height of 30,000-ft, the UAV provides its operators real-time information on enemy battlefields/activities by performing Information, Surveillance, Target Acquisition and Reconnaissance (ISTAR) roles over wide areas to national agencies, theatre commanders and lower echelons using multiple sensors and Satellite Communications (SATCOM) for extended-range capture and transfer of critical data. The UAV is also capable of providing reliable Battle Damage Assessment (BDA). IAI is set to supply around 60 Heron MALE UAV to the various branches of Indian Armed Forces that now also includes the latest Heron TP/Eitan UAV. India subsequently has emerged as the largest importer of UAV platforms in recent years.

Powered by a single 85.79 kW Rotax 914 turbo aircraft engine manufactured by Austria›s BRP-Rotax, Heron UAV can climb at the rate of 150 m a minute and fly at a maximum speed of 207 km/h to a range of 350 km and has demonstrated 52 hours of continuous flight with modular space up to 250 kg for customer furnished equipment that may include Electro-Optical (EO) and Infra-Red (IR) sensors (supplied by Tamam Division of IAI), thermal surveillance equipment and laser designator. While the EO sensor converts light rays into electronic signals for capturing images, real-time data and videos, the laser designator is applied for targeting the enemy on battlefield. Thermal surveillance equipment is used to capture high resolution images during night by penetrating through clouds, rain, smoke, fog and smog. Communications are established through direct Line-of-Sight (LoS) data-link, UAV airborne data relay for beyond LoS missions and ground-based data relay for communicating with the Ground Control Station (GCS). Additionally, Electronic Support Measures (ESM) helps the Heron in threat detection and examines the area to determine signals emitted from the surrounding radars.

For maritime roles, the AIS gather details of ships such as vessel type, vessel name and destination. The ELTA Maritime Patrol Radar (MPR) identifies vessels from very long distances by applying silhouette target acquisition procedures. MPR also provides Synthetic Aperture Radar (SAR) images and near coastline detects ground vehicles using its Ground Moving Target Indicator (GMTI) mode.

Heron can be controlled either manually from the GCS or operate in autonomous mode. As mentioned earlier, it is fully equipped with automatic launch & recovery (ALR) system which helps in automatic safe landing during

communication failure with the GCS. The processing, retrieving and storing of the real-time data provided by Heron UAV is undertaken by the GCS to convert the sensor data such as live and stored images, imagery and spatial information, including EO, SAR, MTI maps, SIGINT and ESM, into actionable intelligence.

An enhanced variant of Heron; Heron TP/Heron 2/ Eitan; developed under an Israel Ministry Of Defence (IMOD) programme can carry multiple payloads and perform multiple missions such as Communication Intelligence (COMINT), Signal Intelligence (SIGINT) and Image Intelligence (IMINT), have entered service in Israeli Defence Forces (IDF). Heron TP can fly at 45,000 ft with an endurance of approximately 36 hours. Apart from long range, long endurance Intelligence, Surveillance and Target Acquisition Reconnaissance (ISTAR) missions, Eitan is designed to execute a large variety of operational missions, including aerial refuelling and strategic missile defence. Eitan made its maiden flight on 15 July 2006. The new UAV will provide the Israel Air Force persistent, high altitude, long endurance (HALE) ISR capability which is well beyond the reach of enemy air defences, far beyond the Israeli borders. Heron TP is powered by a single 1,200 hp Pratt & Whitney Canada PT6A Turbo-Prop engine, powering a four blade propeller. The use of such powerful turbo-prop engine enables the aircraft to climb and operate at altitude above 40,000 ft avoiding any airspace conflict with commercial aircraft traffic. Using on board fuel and power resources, Heron TP is able to sustain continuous missions for over 36 hours with full mission payload and is also equipped with de-icing systems protecting the aircraft when flying through icing conditions.


Heron

With maximum takeoff weight of 4,650 kg, Eitan can carry over 1,000 kg of sensors in its forward section, main payload bay, and the two bulges located at the end of each tail boom, offering optimal separation for specific systems. Other stores can be mounted along the wing, in internal and external positions. Eitan could be fitted with wing hard-points for external stores. The aircraft is equipped with multiple data-links, supporting LoS and Beyond Line-of-Sight (BLoS) links via satellite communications. The giant drone maintains the twin tail boom principle offering stable and redundant design and large payload bay located around the aircraft centre of gravity, uninterrupted by the landing gear. This configuration allows for quick and simple payload reconfiguration on the flight line.

Meanwhile, IAI unveiled the new tactical Unmanned Aerial System (UAS) of the Heron Family, the T-Heron at Paris Air Show to be operated by Ground Forces, Coast Guard as well as other protection forces. T-Heron is designed for tactical missions on the battlefield and features a high level of flight safety and reliability and highly resistant to extreme weather conditions. With its advanced, certified and Rotax engine, the drone can reach a maximum altitude of 24,000 feet and a top speed of 120 knots. The new UAV is capable of carrying several payloads simultaneously of up to 180 kg. The T-Heron will use the same automatic take-off and landing capability as its family members, but will also be able to deploy from unprepared runways, so will not have to rely on being operated from airfields and can instead be forward deployed as required.

IAF is also planning to purchase the Harop loitering weapon system designed to explode itself on a high value pre-programmed target both on land and sea and is an ideal candidate for Suppression of Enemy Air Defences/Destruction of Enemy Air Defences (SEAD/ DEAD) missions.

Sayan Majumdar


Heron TP

Two more AWACS for IAF

After remaining dormant for nearly a decade after the first three Phalcon AWACS were received by the Indian Air Force in 2009-2011 under the contract between India, Israel and Russia, the MoD has reportedly moved the procurement case for three more such aircraft. Integrated in the Beriev A-50, by Israel Aircraft Industries is the EL/W-2090 airborne early warning and control (AEW&C) radar system developed by IAI and Elta Electronics Industries of Israel, for air dominance and long range airborne surveillance. The EL/W-2090 is further development of EL/M-2075 and EL/W-2085, which uses an active electronically scanned array (AESA) radar. The first A-50 (Phalcon) AWACS aircraft was received in May 2009 going into service with No.50 Squadron, IAF.

Launch of INS *Vela*, fourth Scorpene submarine

INS *Vela*, the fourth *Scorpene*-class submarine being constructed by Mazagon Dockyard and Shipbuilders for the Indian Navy, was launched on 6 May 2019. The submarine was towed to Mumbai Port Trust for separation from the pontoon, after which she will undergo rigorous trials and tests, both in harbour and at sea before delivery to the Indian Navy. The contract for series construction and Transfer-of-Technology for six *Scorpene*-class submarines has M/s Naval Group (formerly DCNS) of France as 'Collaborator' and built by MDL at Mumbai.

464 more T-90s for Indian Army

The Indian Army is to induct an additional 464 Russian-origin upgraded T-90 'Bhishma' main-battle tanks at a cost of Rs 13,448 crore in the 2022-2026 time frame.

According to MoD sources, the "indent" to manufacture the additional T-90 tanks would be placed on the Avadi Heavy Vehicle Factory (HVF) under the Ordnance Factory Board following the Cabinet Committee on Security clearance of the acquisition in March. The Indian Army has some 1,070 T-90 tanks as well as 2,400 of the earlier T-72 version equipping 67 armoured regiments. After the first 657 T-90 tanks were imported for Rs 8,525 crore from Russia from 2001 onwards, another 1,000 are being progressively licence-built by the HVF.

Elbit Systems launches Condor MS

Elbit Systems has launched the Condor MS, a new Long Range Oblique Photography (LOROP) system that introduces Multi-Spectral (MS) sensing capability and Artificial Intelligence (AI) analytics to stand-off strategic intelligence gathering missions. Condor MS integrates three high resolution Electro Optic (EO) sensors into the Company's certified and widely operational Condor2 system: Visible and Near Infra-Red (VNIR), Medium-Wave Infrared (MWIR), and Short-Wave Infrared (SWIR). The unique combination of multi-spectral sensing, high level of stabilisation and auto image enhancement enables the new system to dramatically extend coverage area in day, night and adverse weather conditions thereby improving the strategic reconnaissance output while increasing the survivability of the platforms. Deep learning algorithms and precise geo-location enable the Condor MS to identify a large number of targets at extremely high rates, hence significantly shortening the time frame needed to close sensor-to-shooter loops.

Thales exhibits STARStreak – High Velocity Missile (HVM)

Military commanders around the world are increasingly concerned about the serious threats being posed to their forces and civilians by low level FGAs, Un-manned Air Vehicles (UAVs) and attack helicopters. Thales' STARStreak has been designed to defeat these threats quickly and effectively and provide a vital capability in force protection.

It was designed to provide close air defence against conventional air threats such as fixed wing fighters and late unmasking helicopter targets. Thales has addressed the needs of military users around the world and introduced major improvements to provide increased range beyond 7 km, increased coverage and altitude and improved guidance precision against small targets.

The STARStreak configuration remains based on the proven STARStreak principles of high velocity to defeat targets with short unmasking times. The three dart payload maximises levels of lethality and accurate line of sight; laser beam riding guidance enables engagement of the smallest signature targets, which are extremely difficult to defeat and lock onto by traditional fire and forget missiles.

The STARStreak missile is capable of being launched from lightweight land, sea and air platforms, from either automatic fire control systems such as the RAPIDRanger or the STARStreak Lightweight Multiple Launcher (LML).

STARStreak is a 'truly versatile missile' and is most effective when dealing with targets with short exposure times. As soon as a target is detected the operator presses the trigger and launches the missile. (There is no waiting for lock on). The rocket motor system accelerates the missile to greater than Mach 3 in a fraction of a second. The missile then releases the three laser guided hittiles towards the target. The laser beam riding guidance, which enables precision engagement of the smallest of targets, is immune to all known counter-measures. The hittiles in flight cannot be decoyed by even the latest flares or Electronic Countermeasures (ECM).

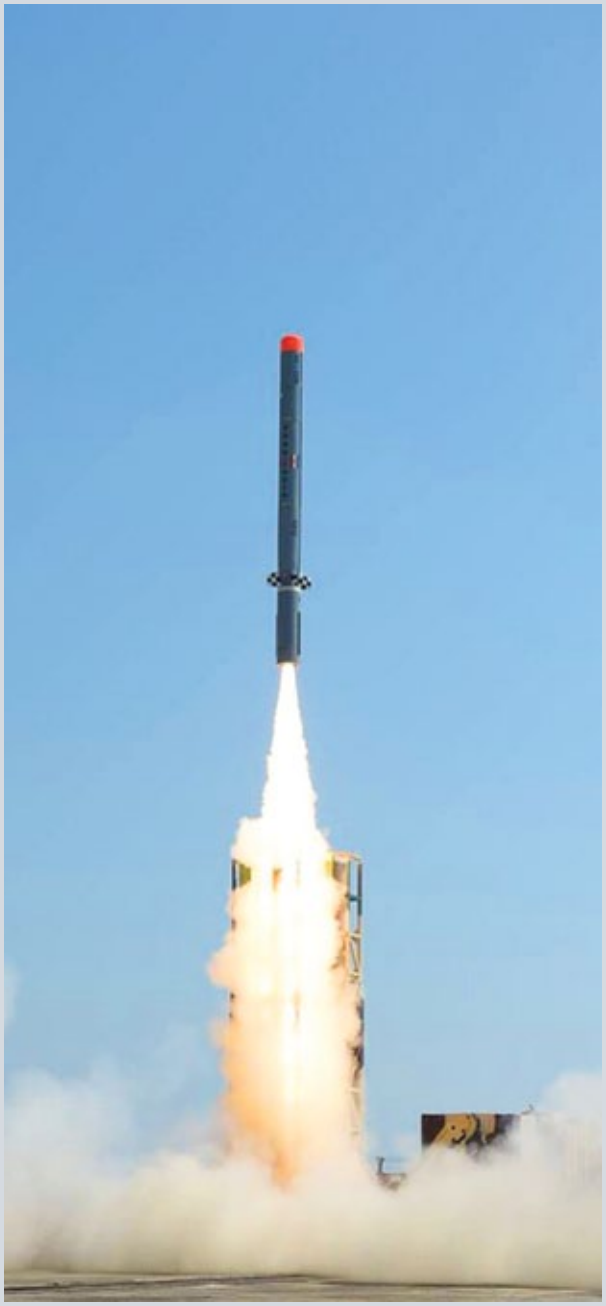
DRDO tests the HSTDV

The Defence Research and Development Organisation has carried out the first test flight of the indigenously developed Hypersonic Technology Demonstrator Vehicle (HSTDV) from their Integrated Test Range off the Odisha coast. The HSTDV (seen in model form above) is an unmanned scramjet (allowing supersonic combustion) demonstration vehicle that can cruise up to a speed of Mach 6, reaching an altitude of 32 km. The mission was to "prove a number of critical technologies for futuristic missions".

DRDO Nag anti-tank missiles test fired

Three successful test firings of Nag anti-tank missiles were carried out at the Pokhran firing ranges, "the missiles test-fired during both day and night during the trials. All three tests were successful," according to DRDO officials. Earlier, the Defence Acquisition Council had approved procurement of production batches of the Nag at a cost of Rs. 524 crore.

DRDO's Cruise missile 'Nirbhay' test-fired



India's first indigenously designed and developed long-range sub-sonic cruise missile Nirbhay has been test-fired from the Integrated Test Range (ITR) at Chandipur in Odisha. Describing the trial as "successful", DRDO stated that the missile, which is capable of loitering and cruising at 0.7 Mach at altitude as low as 100 metres, covered the designated target range in 42 minutes and 23 seconds.

The Indian Navy's long reach

The Boeing P-8I in India

Back in January 2011 Boeing Defense, Space & Security received the Low-Rate Initial Production (LRIP)-I award from United States Navy (USN) for six P-8A Poseidon Multimission Maritime Aircraft (MMA). Overall, the USN plans to purchase 122 Boeing 737-based P-8A MMAs as replacement for its 196 P-3C Orion fleet.

The Indian Navy was the first international customer as on 1 January 2009 the Indian Government and Boeing signed a $2.1 billion contract for the delivery of eight P-8I MMAs, essentially Long Range Maritime Patrol/Anti-Submarine Warfare (LRMP/ASW) platforms with further options for more platforms. A further four P-8Is have subsequently been ordered pushing up the contract to $ 3.1 billion. More acquisitions for the IN will follow as the IN has an optimum requirement for thirty MMAs.

On 19 December 2012, the first P-8I was handed over to an Indian naval team at Boeing's Seattle facility, the Indian Navy inducting its first P-8I on 15 May 2013. The second and third P-8Is were received on 16 and 22

November 2013 respectively. The aircraft with INAS 312 are based at INS *Rajali*, in Tamil Nadu. The fourth, fifth and sixth aircraft were delivered in May, September and November 2014 respectively, the seventh and eight aircraft in February and November 2015 respectively.

The P-8 is based on Boeing's 737-800 commercial jet with the wings of the 737-900ER (Extended Range), with the design of the P-8 wingtips changed from the blended winglet to a backswept wingtip to improve performance for low-level flight.

Designed to operate in designated areas within the Network Centric Warfare (NCW) concept in addition to its formidable ASW suite, the P-8I is equipped with upgraded Raytheon APS-137D(V)5 maritime surveillance radar redesignated AN/APY-10 used to facilitate advanced reconnaissance missions over an area of 600-nautical miles. The radar offers Synthetic Aperture Radar (SAR) mode for imaging, detection, classification and identification of stationary ships and small vessels and for coastal and overland surveillance, Inverse Synthetic Aperture Radar (ISAR) mode for imaging, detection, classification and tracking of surfaced submarines and small, fast moving vessels that operate in coastal waters as also Moving Target Indicator (MTI) modes for long range surface search.

While two CFM56-7B27A high-bypass turbofan engines (each providing 120 kN of thrust) provide higher cruise speed (490 knots) and service ceiling to reach its area of operation rapidly, the P-8 is capable of operating 1,200 nautical miles from its base for an extended period of four hours besides arriving at station one hour earlier than any turboprop type. The aircraft have demonstrated a loitering speed of 180 knots over the sea at a low altitude of 60 metres. Various armament is carried on four wing pylons, two fuselage pylons and an aft weapon bay for a total of 5,700 kg payload.

For the ASW role, the P-8 is fitted with the same acoustic processor as adopted for the British Nimrod MRA Mk4. In IN service, another sensor is the CAE AN/ASQ-508A Advanced Integrated Magnetic Anomaly Detector (MAD) in a much shorter "sting" although their effectiveness can be nullified by submarine hulls made of titanium or non-magnetic steel. Still, CAE's AN/ASQ-508A MAD system represents one of the most advanced MAD systems in the market that will be integrated with the P-8I's mission system and will be used operationally during ASW missions.

Sayan Majumdar
[Images Courtesy Boeing]

Upgrade of the Su-30MKI

The IAF Sukhoi Su-30MKIs are to be upgraded to 'Super Sukhoi' standards, a total of 272 aircraft being received or on order for the Indian Air Force. This programme has long been discussed and involves major upgradation of the Type's avionics, self defence systems and weaponry. HAL Nasik Division will be primarily responsible for the upgrade programme and could well offer its expertise to foreign air forces flying the Sukhoi Su-30. "There is a market outside. We are already the only ones doing overhauls for this aircraft and once we conduct the upgrade, we can offer this for export to as well," stated HAL Chairman R Madhavan.

Irkut: Additional Su-30MKIs for IAF

Russia's Federal Service for Military-Technical Cooperation has confirmed, what was earlier speculated, that the Indian Government plans to acquire another 18 Su-30MKI multi-role fighters. These would add to the 272 aircraft already in service or under production at HAL in Nasik, and would be delivered in CKD condition for final assembly and delivery to the Indian Air Force.

GA-ASI Concludes Series of MQ-9 Demonstrations in Greece

General Atomics Aeronautical Systems, Inc. (GA-ASI) held a series of flight demonstrations using its MQ-9 Guardian Remotely Piloted Aircraft System (RPAS) in December 2019. The demonstrations showcased the maritime surveillance capabilities of the MQ-9, and the GA-ASI-developed Detect and Avoid (DAA) system for traffic-deconfliction in civil airspace. The flights were sponsored by the Hellenic Air Force (HAF) and the Hellenic Coast Guard (HCG) and staged out of Larissa Air Base in Greece. The flights were performed for an audience of European military and civilian representatives.

"We were honored to have the HAF's and the HCG's support for these flight demonstrations with our MQ-9," said Linden Blue, CEO, GA-ASI. "The MQ-9 RPAS is already a strategic asset for NATO countries, providing mission persistence and interoperability between allies. We showcased MQ-9s maritime surveillance and the civil airspace integration capabilities for our European customers."

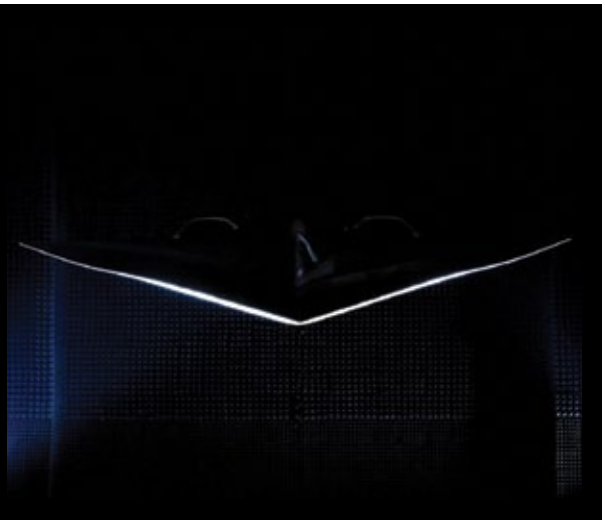
GA-ASI aircraft systems support the Italian Air Force, the UK Royal Air Force, the French Air Force, and the Spanish Air Force. The Ministry of Defence for the Netherlands has selected MQ-9 for the Royal Netherlands Air Force, and the Government of Belgium has approved Belgian Defense to negotiate the acquisition of GA-ASI's MQ-9B. In early December'19, the Australian Government announced selection of MQ-9B for the Australian Defence Force under Project Air 7003. GA-ASI RPAS are operated by the US Air Force, US Army, US Marine Corps, US Department of Homeland Security and NASA.

The DAA system consists of an air-to-air radar integrated with Traffic Alert and Collision Avoidance System (TCAS II), and Automatic Dependent Surveillance-Broadcast (ADS-B). The DAA system enables safe flight of an MQ-9 in civil airspace, and can even detect air traffic that is not actively transmitting its position.

The MQ-9 also demonstrated a multi-mode, maritime surface-search radar, and High-Definition/Full-Motion Video Optical and Infrared sensor. This sensor suite enables real-time detection and identification of large and small surface vessels in all-weather at long ranges, 360 degrees around the aircraft.

Airbus' stealth UAV 'LOUT'

Airbus' has recently its concept for a stealth unmanned combat aerial vehicle demonstrator for the German Government. Model of the Low Observable UAV Tested (LOUT) was displayed during a media briefing in November, but the project remains highly secretive and very limited details were provided. LOUT development work began in 2007 at Manching near Munich and Bremen in what the company calls "Skunk Works approach". LOUT was developed to demonstrate, "wideband signature reduction technologies and (be) a testbed for further VLO integration". The LOUT concept has a distinctive diamond-shaped planform with a configuration intended to support "radar, infrared, visual and acoustic stealth".



Elettronica Group and its Naval EW suite

Elettronica group with its innovative Naval Electronic Warfare new generation suite, also proves the great integration work performed together with Leonardo and Fincantieri. Since 1960, Elettronica has supplied EW Systems to Navies of twenty-eight countries in five continents, and its systems are on board in major Italian Navy ships, the *Horizon* and FREMM frigates and *Cavour Carrier.* The PPA *Thaon di Revel* class is provided with an EW Naval Suite which can be considered as the most innovative proposal in the field of the Soft-Kill capability, conceived to fulfil the most stringent requirements for Naval Electronic Defence Electronic Support and Electronic Attack, matching the experience gained through the *Horizon* and FREMM programmes with continuous pursuit and use of advance solutions and technologies.

The new EW Suite of Elettronica is characterised by an innovative architecture that leverages the natural evolution of EW passive sensors (RESM/CESM) and actuators (RECM) to achieve a fully integrated, compact, optimised but still scalable solution. It also manages remote EW sensor on-board of ASW/ASuW Helo and/or UAV, enhancing the surveillance capability over-the-horizon.

The entire system is managed by a command and control unit, the EWMU (Electronic Warfare Management Unit) which fuses and synthesises all the information both in the radar and communication field. The technology is based on an enhanced intensive use of Digital Signal Processing, and solid state Active Electronically Steerable Array (AESA) technology. The Antenna Phased Array actuators are based on the latest design using GaN (Gallium Nitride) T/R modules, combining high performances with reduced dimension and weight.

LM's F-35A Lightning IIs with Hill AFB's 388th, 419th Fighter Wings

Just over four years after receiving their first F-35A Lightning II aircraft, the USAF's Hill Air Base has achieved full "warfighting capability". The term describes a set of focus areas within the 388th and 419th Fighter Wings: fully trained pilots and maintainers, a full complement of 78 aircraft and the mission and support equipment needed to operate.

The wing has been combat capable since the US Air Force declared initial operational capability in August 2016, and the F-35As have participated in several large combat exercises, deployed twice to Europe, once to the Pacific and supported two Middle East combat deployments, including one short-notice tasking.

When the first aircraft arrived in 2015, the goal was to fully equip each squadron with 24 primary assigned aircraft and six backups by the end of 2019, realized in December with the delivery of the 78th fighter. Over that four-year period, the wings received roughly two fighters every month. In the spring of 2016, the 34th FS deployed six F-35As to RAF Lakenheath in the United Kingdom.

Kalyani Group and Arsenal JSCo form Strategic Alliance

Kalyani Strategic Systems Ltd. (KSSL), the defence arm of Kalyani Group and Arsenal Joint Stock Company, Bulgaria signed a Memorandum of Understanding (MOU) to form a strategic alliance in India. KSSL and Arsenal will be developing a manufacturing capability in India for the 'AR' 7.62 x 39mm Assault Rifle and 'MG' 7.62 x 51mm machine gun series. The Strategic Alliance is also actively participating in projects for meeting the Army's requirement of certain types of ammunition over a ten-year programme. Arsenal have been in active operations in India for decades and have a proven record of performance.

Hristo Ibouchev Executive Director, Arsenal 2000 JSCo stated "Arsenal is proud to be the first defence OEM in Bulgaria to become an active participant in the 'Make in India' programme with Kalyani Group as its partner for assault rifles, machine guns and ammunition for India's Ministry of Defence."

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BEML at DefExpo 2020

BEML High Mobility Vehicle

BEML Limited is participating in big way by showcasing its products at the indoor and outdoor pavilions. In line with theme of 'Digital Transformation', BEML unveiled an AI based Mobile Healthcare Diagnosis System to address the medical needs of the Armed Forces and an 'Armoured Crew protected vehicle' like Medium Bullet Proof Vehicle (MBPV).

Further, BEML is also exhibiting its Mobile Standby Command Post Vehicle (MSCPV), Bulldozer with Hydrostatic Transmission drive technology (BD50HST) and 20T class heavy transportation vehicles in its outdoor stall.

Apart from this, BEML is manufacturing Truck Mounted Excavators, high capacity engines for DRDO, Autonomous Ground Vehicles (tracked & wheeled), Mounted Gun Systems in association with OFB and indigenously developed Infrared Signature Suppression systems for Indian Navy etc.

Armoured Repair & Recovery Vehicle

Night Fighting : What should the army aim for?

The operational environment of irregular warfare in and around India necessitates changes in the way armed forces need to prepare for, and conduct operations. In this kind of conflict, 'survivability' across the full spectrum of conflict at the tactical level of warfare, is often the battle winning factor.

NETRO NC-3000

MKU, a leading Indian private sector enterprise, is actively engaged in developing indigenous solutions for night fighting capability, unveiling its latest range of night vision and thermal devices at DefExpo 2020. Well known globally for its state-of-the-art protection and survivability gear for soldiers and platforms. MKU's Netro range of Electro-optic devices on display during the DefExpo include Thermal and Image Intensified weapon sights, monocular and binoculars, which are of latest global standards, and more importantly, the 'Made in India' legacy.

Mr Vaibhav Gupta, Director, MKU stated, 'It is the deep understanding of conflict scenarios faced by the soldiers in the field today which enables MKU to develop solutions which go beyond the ordinary'.

In keeping with successive Indian Army Chiefs' resolve of 'Winning Indian Wars with Indian Solutions', MKU has designed and developed its thermal and image intensifier devices in compliance with the Indian Army's qualitative requirements. "We are fully compliant to meet with Indian Army's QRs, and are ready to compete at the international level as well" says Prachi Gupta, Vice President, MKU who has been the moving force behind the innovation team at MKU.

NETRO TM-4100

Explaining further, Mr Neeraj Gupta, MD MKU stated "One single solution like 'Thermal Imaging' or 'Image Intensifier' technology cannot suffice and cater to all conditions and parameters. A clever blend of technologies to suit multiple operational requirements is the right answer for night vision solutions". Power requirements and costs involved are other contributory factors while deciding upon an optimal solution.

MKU is arranging for an elaborate display and demonstration of the capabilities of the latest generation Night Vision and Thermal devices at their 'Experience Zone' created within their booth at the Expo. Visitors are invited to gain a first-hand experience of this capability.

Visit MKU at Hall # 1, Booth # R16

Airbus signs aircraft services MoU with Adani Defence and Aerospace

Airbus India and Adani Defence & Aerospace signed a Memorandum of Understanding (MoU) at DefExpo 2020 "to leverage synergies in aerospace and civil aviation sector". The MoU was signed by Anand Stanley, President and MD, Airbus India & South Asia and Ashish Rajvanshi, Head of Adani Defence & Aerospace.

Airbus and Adani will explore opportunities for collaboration in the area of aircraft services for the Indian and South Asian market. Airbus' Global Services forecast envisages the Indian aircraft services market to grow to US $6.3bn by 2025.

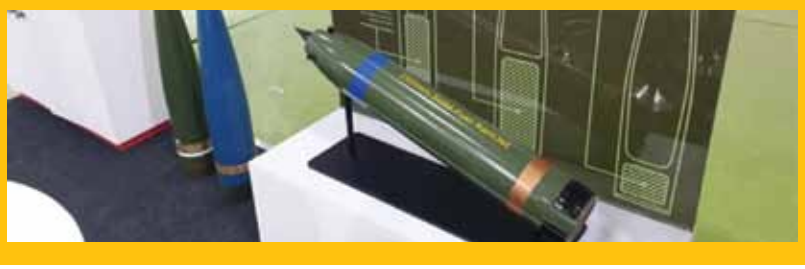
"Airbus is not only the world's leading civil aviation company but is also a major innovator and provider of aircraft services. This MoU demonstrates our commitment to support the development of India as a world-class services hub for aerospace products," said Anand Stanley.

Adani Defence & Aerospace has established a comprehensive aerospace and defence ecosystem in India. With Adani's recent foray into airports, this potential collaboration will leverage the synergies between the product and services excellence of Airbus and infrastructure, engineering and mega project execution capabilities of Adani.

"India is at the cusp of transformational growth in aircraft services market. Our collaboration with Airbus is aligned to our vision of nation building and to indigenise critical technologies and services thus creating a vibrant ecosystem in aerospace capabilities in India," said Ashish Rajvanshi.

Nammo: "Designed for urban combat"

Nammo's M72 ultra light shoulder launched munition for urban combat. Weighing only 3.5 Kg, the M72 is the much needed upgrade to meet demands of the modern combat soldier. In the photo are Christer Gordon, Programme Director standing next to Karanjit Singh



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Ladies at DefExpo 2020

Gayathri Sharma of Rolls-Royce India

Ina Bansal from Lockheed Martin India

With the Gripen as background is Richa Gupta of Saab

Adding colour at the Thales stand are these ladies including Pawandeep Kaur (centre)

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