2019
AERO INDIA
SHOW DAILY
20 February 2019
VAYU
Day 1

Looking for Josh* at the Show!

Making sense of the Defence Budget

There was resonance in Parliament on 1 February 2019, with the catchy Bollywood slogan '*How is the Josh*', being bandied around as Finance Minister Goyal presented the national budget. Defence Minister Nirmala Sitharaman *(see photo)* had earlier chanted '*How is the Josh*' after watching the film *Uri : the Surgical Strike* at Bangalore.

(cont'd on page 3)

'Interim' FOC for LCA

With CEMILAC issuing 'interim' clearance for the FOC standard LCA on 31 December 2018, HAL Bangalore Complex have begun structural assembly of major modules for the front, centre and rear fuselage of the LCA series production aircraft SP-21. First flight of this aircraft is planned for October 2019 with the balance 15 aircraft to be delivered in the FY 2019-20. These will equip the IAF's No.18 Squadron, the second formation to receive the Tejas.

(cont'd on page 3)

* Passion

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saab.com/region/india/gripen

SAAB

(from page 1)

Making sense of the Defence Budget

In his 'Interim' National Budget presented to Parliament on 1 February 2019, Union Finance Minister Mr Piyush Goyal allocated Rs 3.18 lakh crore (US $ 45 billion) as the Defence Budget for 2019-20, which is about 6.87 present higher than the previous year's revised estimate of Rs 2.98 lakh crore. This includes a capital outlay of Rs 108,248 crore for buying new weapon systems but as the Minister suggested "if necessary, additional funds would be provided for securing our borders and to maintain preparedness of the highest order". However, as analysts have commented, India's Defence spending continues to slide downwards as measured against its gross domestic product (GDP), being a mere 1.51% this year, which is the lowest in decades.

(from page 1)

'Interim' FOC for LCA

Meanwhile HAL Bangalore Complex are completing production of LCAs SP-13, 14, 15 and 16, all being of the IOC standard, which will join the earlier 12 series production aircraft with No.45 squadron at AFS Sulur.

Air Chief on LCA induction and the future AMCA

In his recent statement at the CAPs Seminar in New Delhi, Air Chief Marshal BS Dhanoa, Chief of the Air Staff, IAF has stated that "to encourage HAL in manufacturing the LCA, we have maintained the requirements of the first 20 LCA at standards issued in 1985. Even though the (first) Squadron was formed in June 2016, it is so far equipped with only 10 aircraft." Further, the CAS said "our policy envisages a progressive improvement in scale of indigenisation. Forty LCA MK.1s have been ordered and *Request for Proposal* has been issued for 83 LCA Mk.IAs and we will be procuring 12 Squadrons of LCA Mark-2 and then finally the Advanced Medium Combat Aircraft."

First CH-47F (I) Chinooks for the IAF

Boeing has announced arrival of the first four CH-47F (I) Chinooks for the Indian Air Force, which was at the Mundra Port in Gujarat on 10 February 2019. The CH-47F (I) Chinooks advanced multi-mission helicopters were then ferried to Chandigarh, where they will be formally inducted in the Indian Air Force later this year. The Indian Air Force currently has 15 Chinook helicopters on order.

"The ahead-of-schedule arrival of the Chinooks validates Boeing's commitment to delivering on its promise of modernising India's defence forces. Through its current partnerships with Indian Air Force and Indian Navy, Boeing has ensured high rate of mission readiness and increased operational capabilities", stated Boeing officials.

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RFI for 114 new fighters: awaiting next steps


Saab Gripen


Lockheed Martin F-16

It is some 10 months since April 2018 when the IAF issued an RFI to procure 110 (actually 114) fighters of which 18 would be procured flyaway and the balance built in India by a strategic partner/Indian production agency (SP/IPA). Three quarters of these would be single-seaters and the rest twin-seat aircraft. International companies who have reportedly responded to the RFI are Boeing (F/A-18 Super Hornet), Lockheed Martin (F-16), Saab (Gripen), Dassault Aviation (Rafale), the European Consortium (Typhoon) and Mikoyan (MiG-35). It is learnt that the Su-35 has also entered the fray, being offered by Sukhoi from its Komsomolsk-on-Amur entity.


Dassault Rafale M

Air Headquarters have assuredly sought additional information before moving to the next step (issue of the RFP by the MoD) but two of the contenders have been recently quoted by the media. Ola Rignell, CMD Saab India has said that "except the first 18 aircraft, we intend to manufacture everything in India. Saab will look to build an ecosystem of defence manufacturing inside the country". Rignell highlighted the multi-role capability of the Gripen E which is "the most advanced multirole fighter designed to meet demanding operational requirements of Air Forces today".

Dr Vivek Lall, Vice President of Strategy and Business Development Lockheed Martin has stated that "We see current demand outside of India of more than 200 F-16s. The value of those initial acquisition programmes would likely exceed $20 billion".

Boeing's F/A-18 Super Hornet is being promoted as being the "most advanced aircraft of its kind in operation today with a robust roadmap laid out to ensure that the F/A-18 Super Hornet is capable of dealing with future threats". The Super Hornet is being offered not only for the Indian Air Force but is a contender to meet the Indian Navy's requirement for 57 carrier borne, multirole fighters. This is the case too with Dassault's Rafale, the Indian Air Force getting the F.3R Standard with the 'M' offered to the Indian Navy.


Boeing F/A-18 Super Hornet

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"Speeding up LCA deliveries"

VAYU Interview with R Madhavan, CMD HAL Part-I

VAYU : There are reports on HAL receiving 'Limited' clearance from CEMILAC for production of LCAs in FOC standard, you having been quoted on receiving the documents and drawings. What will be the schedule for their deliveries?

HAL : The Aeronautical Development Agency (ADA) handed over the Drawing Applicability List and Equipment Standard of Preparation (SOP) documents to HAL on 31 December 2018, duly cleared by the Centre of Military Airworthiness & Certification (CEMILAC) to go ahead with the production of FOC standard aircraft. HAL has established a manufacturing facility for production of eight aircraft per annum. Currently, HAL is producing LCA IOC standard aircraft for which IOC was received from ADA in December 2013. To date, HAL has produced 12 LCA Mk.I IOC–standard fighters. The balance four IOC–standard LCAs are under production and will progressively be delivered in the current financial year.

HAL has also made preparations for the production of LCA (FOC) standard aircraft after receiving the SOP and has planned to deliver all 16 FOC–standard LCAs progressively. For the eight trainer aircraft (four each in IOC and FOC standard), the SOP is yet to be released for their production.

So as to speed up production of LCAs, an investment of Rs 1381 crores has been sanctioned by the Government for establishment of facilities for ramping up production rate from 8 to 16 aircraft per year. Additionally, a parallel production line has also been established at Aircraft Division Bengaluru to support an increased rate of production. In addition, major assembly modules have been outsourced to private partners like DTL, Bengaluru (front fuselage), Alpha Tocol, Bengaluru (rear fuselage), VEM Technologies, Hyderabad (center fuselage) and L&T, Coimbatore (wings) to enhance the production rate *(see representative image below)*.

VAYU: The Light Combat Helicopter (LCH) programme is making rapid progress with armament and other on-going trials. What is status of the programme? When are deliveries to commence ? What is the order book position?

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HAL : After successful completion of flight testing of the LCH, basic performance, rocket firing trials and turret gun firing trials have been carried out. The helicopter participated in IAF's *'Iron Fist 2016'* exercise in March 2016 and displayed rocket firing capabilities in its weaponised configuration. The IOC for LCH was accorded on 26 August 2017 in presence of the Defence Minister and production activities have been launched, awaiting firm order.

The LCH has achieved another milestone, successfully carrying out air-to-air missile firing on a moving aerial target on 11 January 2019, the tests conducted at the integrated test range at Chandipur, Odisha. It was a flawless mission that achieved direct hit on the aerial target. With this, the LCH has successfully completed all weapon integration tests and is ready for operational induction.

HAL has submitted its quotation against the RFP for supply of 15 limited series production (LSP) helicopters which is presently under consideration.

VAYU : The Light Utility Helicopter (LUH) is also achieving several milestones like the GTV - endurance run, shake tests etc. Kindly indicate status of this project and future plans.

HAL : The LUH is a single-engine, three-ton weight class helicopter with Glass Cockpit and Multi-Function Displays. The LUH will be employed for the Reconnaissance and Surveillance role, the helicopter capable of flying at 220 kmph, with service ceiling of 6.5 km and a range of 350 km having 500 kg payload. The LUH has also recently achieved an important milestone, flying upto 6 km altitude in Bengaluru on 7 December, 2018, as part of envelope expansion tests. Maiden flight of third prototype (PT3) of the LUH took place on 14 December 2018.

As part of LUH development activities, HAL has built three prototypes, one Ground Test Vehicle (GTV) and one Break Away Fuselage (BAF). The three prototypes have cumulatively logged more than 170 flights, extensive flight testing being carried out to establish helicopter performance parameters. Sea level and hot weather trials have been completed as part of the development flight process. System level flight testing is under progress presently which will be followed by cold weather, hot weather, and high altitude trials.

Series manufacture is planned at the 'greenfield' Helicopter Manufacturing Facility coming up at Tumakuru for which the foundation stone was laid by the Prime Minister on 3 January 2016, with further activities in progression. HAL flew the LUH from the facility at Tumakuru on 29 December 2018 and also successfully met the timeline of 2018.

VAYU: HAL has been chosen as manufacturing partner by the Russians for execution of orders received by them on the Ka-226T programme. Kindly share some details on the way forward in this programme.

HAL : The IGA signed on 25 December 2015 between the Governments of India and Russian Federation envisages supply of 200 Kamov Ka-226T helicopters to the Indian defence services (Army & IAF) through a Joint Venture (JV) company in India. Accordingly, a joint venture company *Indo-Russian Helicopter Limited* (IRHL) was incorporated on 2 May 2017 with the following stakeholding : HAL 50.5 % ; Russian Helicopters 42 % ; Rosoboronexport 7.5 %. Following the RFI of 9 May 2017, the joint venture IRHL has submitted the techno-commercial proposal for the supply of 200 Kamov Ka-226T helicopters and allied equipment. The proposal is under evaluation by the Technical Evaluation Committee (TEC), with the JV committed to commence deliveries as per the delivery schedule in the RFP.

(cont'd in Show Daily Day 2, 21 Feb 2019)

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BOEING

"Gripen E is on Track"

Delivery of first series production aircraft in 2019

Part- I

VAYU Interview with Ola Rignell

Chairman and Managing Director, Saab India

VAYU: Saab is one of the global companies shortlisted to meet the Indian Air Force's requirement for future fighters, with the Gripen E as a strong contender. Kindly update our readers on status of this programme and as to when the first aircraft are being delivered to the Swedish Air Force.

Ola Rignell : Gripen E/F is part of the Gripen E-series and a new fighter aircraft system. The second Gripen E test aircraft, designated 39-9 has also made its maiden flight on 26 November 2018. Gripen E has successfully fired the IRIS-T air-to-air missile and completed the first tests to verify the ability to release external payloads by jettisoning one external fuel drop tank. The aircraft has also completed the first flight armed with the MBDA Meteor beyond visual range air-to-air missile (BVRAAM). Saab remains on track to deliver the first series production units of its Gripen E by the end of the current year.

VAYU: The Brazilian Air Force are to also receive their first Gripen Es in the near future even as preparations are ongoing for production of this aircraft type in Brazil. Meanwhile, what is the timeline for development of the two-seater Gripen F ?

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Ola Rignell : The development of the two-seat Gripen was closely connected with the Brazilian industry, with Embraer leading the development. A cumulative effort by Embraer, Saab and other companies that are benefitting from the technology transfer project, are developing the two-seat fighter with Sweden. The two-seat version of the Gripen NG is being developed at the Gripen Design and Development Network (GDDN), which was inaugurated in November 2016, in the state of São Paulo. In 2024 the last jet fighter will be delivered to the Brazilian Air Force, but the partnership between Saab and Brazil is expected to go on for a long time through a wide-ranging technology transfer that will enable Brazil to develop, produce and maintain supersonic jet fighters.

VAYU: As part of the 'Make in India' initiative, Saab has identified a number of Indian companies for collaboration in various areas including software development. Kindly enumerate on these.

Ola Rignell : Saab is looking at the Indian Industry as our potential partner in product development for the world market. We believe that the Indian Industry has the necessary capability and can absorb the state of the art technology for manufacturing world class products.

Our plans in India are based not just on selling products but on creating a defence eco-system which would involve hundreds of Tier 1, 2 and 3 partners, vendors and suppliers. Saab would incubate partnerships between its global supply chain and Indian suppliers. Saab would also foster R&D partnerships for next-generation platform, system and sub-system design and development across the industry.

Saab is also working with many suppliers in India, including CIM Tools, Tata Advanced Material Limited and Aequs (former QUEST Global Manufacturing).These companies play a very valuable role in helping Saab develop, industrialise and manufacture complex airframe assemblies for Airbus and Boeing. Our joint venture with Aequs manufactures and supplies assemblies for the global commercial aero structures market.

VAYU: Is Saab's Deployable Aircraft Maintenance (DAM) Facility designed specifically for the Gripen or can this be adopted for other combat aircraft as well?

Ola Rignell : Saab Deployable Aircraft Maintenance Facility combines a First Line Maintenance Hangar for storage, protection and maintenance of the aircraft, Maintenance Containers furnished as workshops and storage facilities and integrated Barracuda multispectral camouflage protection. It is rapidly deployed, enabling flexibility and mobility. The rigid design and compliance with NATO environmental standards facilitates operation in the toughest of climates. The Deployable Aircraft Maintenance (DAM) can be adopted by any combat aircraft.

(cont'd in Show Daily Day 2, 21 Feb 2019)

Boeing-Saab T-X selected by USAF

The US Air Force has awarded Boeing US$ 9.2 billion for the development of a new advanced pilot training system for future generations of fighter and bomber pilots. Boeing is the designated prime contractor for the *Advanced Pilot Training Programme* (T-X) with Saab as a risk-sharing partner in development of the aircraft. The initial US$ 813 million contract to Boeing covers the engineering and manufacturing development (EMD) of the first five aircraft and seven simulators.

The United States Air Force T-X programme was established in 2003 to select a successor for lead-in fighter training (LIFT) to the Northrop T-38 Talon, which was completing a half century of USAF service. Some 350 aircraft are to be ordered, but further purchases could push the overall purchase to over 1,000 numbers. The original in-service date for the T-X was slated as 2017, one of the driving requirements for the new trainer (T-X) being to prepare pilots for increased complexity in some areas, particularly information management, which are a part of fifth generation jet fighters like the F-22 Raptor and the F-35 Lightning II.

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Thales: Supporting India's big ambitions

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

As one of the fastest growing economies in the world, India provides extraordinary opportunities across sectors to build business partnerships. There has been resurgence in a push towards growth and self-reliance, very evident in India's growing defence sector. Being one of the world's largest defence spenders with an estimated spend of some two per cent share of its GDP, India is increasing efforts to boost indigenous research, development and manufacturing along with facilitating global defence players to invest in country, so as to enable India emerge as a global platform for the defence sector in the research, manufacturing and supply chain ecosystems.

The "Make in India" initiative is a step in the right direction for the defence industry, the policy expected to boost Indian industry across sectors including defence, thereby positioning India as a global manufacturing hub. This will not only help Indian industries become globally competitive but also allow companies like Thales to further support the country's modernisation needs. As an active contributor towards development of the Indian defence sector since 1953, Thales remains fully committed to the country.

Helping India master decisive moments

Since 1953, Thales has been assisting India achieve its big ambitions. As a long-standing partner, the organisation takes pride in having contributed towards nation building and solidifying its foundations by sharing its niche technologies and expertise in defence, transport, aerospace and digital security markets.

Thales has built up a reputation of being a trusted partner to all three branches of the Indian armed forces, providing them with flagship solutions ranging from combat aircraft, air defence systems, sensors (ground, ship-borne and airborne), tactical communication and military avionics, electronic warfare, among others.

Thales has enhanced the technical-operational capabilities of the IAF's Mirage 2000 fleet. In July 2011, Thales and Dassault Aviation signed a contract for the upgrade of this fleet. Another game-changer is selection of the Rafale by the IAF with Thales providing a number of state-of-the-art equipment and systems on-board this omnirole combat aircraft.

The company has also formed several other local partnerships from transfer of technology and supply chain perspectives. We have been working closely with Hindustan Aeronautics Limited (HAL) for over five decades. We also have a strong working relationship with Bharat Electronics Limited (BEL) with whom we have formed a joint venture (JV) BEL-Thales Systems Limited (BTSL) dedicated to civilian and select ground-based military radars. With BTSL, Thales is jointly developing the PHAROS fire control radar for gun and missile systems that will support both domestic Indian and international markets. BTSL will also be undertaking the production of the LBREC – Low Band Receiver of the self-protection suite of the Rafale. Thales also has JVs with Samtel, L&T Technology Services and Reliance Aerostructure.

By sharing its technological expertise with indigenous partners, Thales touches the lives of billions of Indians each day. The organisation's local partnerships and JVs reinforce the company's commitment to the country.

Focus on creating jobs

Our objective is to make in India as well as export from India, a strong workforce of over 1,500 people working both directly with as well as indirectly through the supply chain partnerships built with Indian companies. Our plan is to triple this number in the next two-three years as we are looking forward to developing capabilities for local engineering, procurement from India and strengthening our local partnerships.

As we are setting up a state-of-the-art Engineering Competence Centre in Bengaluru, we seek to hire over 2000 engineers in the next three-five years for this centre alone, a first-of-its kind engineering centre in India that will focus on software and hardware capabilities in the areas of civil as well as defence businesses, serving Thales' global needs.

India is rich in engineering, human talents and certainly a source of competitiveness for our Group to grow. We further plan to invest in the country by partnering with customers, universities, commercial and technology partners, and to hire and train local talent to be as local as possible.

We look forward to participating in Aero India 2019.

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Rosoboronexport promotes

'Viking' air defence missile systems

JSC Rosoboronexport (part of the Rostec State Corporation) has begun promotion of its newest air defence missile system (ADMS) 'Viking' (a 'Buk-M3' type ADMS) to foreign operators.

"That's good news for us and our foreign partners. The 'Viking' complex preserves the best characteristics of the famous line of the 'Buk' air defence missile systems and represents an important milestone in the development of the medium-range ADMS. There are unique characteristics of the system which are in line with current requirements in the area of operation and for protection of infrastructure against strikes from contemporary and future air launched weapons in conditions of radio-electronic countermeasures and counter fire. "The 'Viking' has no equivalent today in the world weapons market," said Rosoboronexport's Deputy Director General Sergey Ladygin.

The 'Viking' multi-missile, highly mobile medium-range air defence system is the next step in development of the well known 'Kub' - 'Buk' ADMS line. However, in comparison with the 'Buk-M2E' ADMS, its effective range has increased by 1.5 times, up to 65 kilometres. Besides, the number of simultaneously fired targets has also multiplied by 1.5 times, becoming 6 by each self-propelled launching installation, while the number of ready-for-launch air defence guided missiles in one firing position, consisting of two combat units, has increased from 8 to 18.

The ADMS 'Viking' incorporates a number of unique features, not previously available in any air defence missile system. For instance, it has a capability of integrating launchers from the 'Antei-2500' ADMS, which provides for engagement of targets at a distance up to 130 kilometers to boost efficiency of the whole AD grouping in the defence against hostile air-launched weaponry.

The 'Viking' was developed and designed taking into account trends in the world market. Its technical characteristics allow the system to be adapted in the most versatile manner to meet priorities of Rosoboronexport's foreign customers. The combat control station of the 'Viking' has possibility of integration with the organic radar system as well as with other radars, including those produced outside Russia, but obviously possessing required characteristics. Besides, the ADMS has autonomous capability for use in firing sections or even separately from self-propelled firing installations, which enlarges the total defended area and increases the number of covered sites. This greatly helps to lower costs of an air defence site.

"Commissioned by the Russian Armed Forces, the 'Buk-M3' system and its export version 'Viking' have proved a very high level of combat efficiency during their daily operation and exercises. The 'Viking' has a very high kill probability in relation to enemy's aviation, attacking elements of precision-guided munitions, as well as tactical ballistic missiles, maritime and ground targets," added Sergey Ladygin.

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SECURING THE FUTURE

Enter Dassault's Rafale F4 standard

Eric Trappier, Chairman and CEO of Dassault Aviation, received the F4 standard development contract for the Rafale combat aircraft on 14 January 2019 during the visit to Dassault Aviation Mérignac plant by Florence Parly, French Minister of the Armed Forces.

The F4 standard is part of the process to continuously improve the Rafale in line with technological progress and operational experience. The F4 standard comes in the wake of standards F1 (specific to the first aircraft of the French Navy), F2 (air-to-ground and air-to-air capabilities), F3 and F3R (extended versatility).

Eric Trappier said that "In our role as industrial architect, we will be responsible for implementing innovative connectivity solutions to optimise the effectiveness of our aircraft in networked combat (new satellite and intra-patrol links, communication server, software defined radio). New functions will also be developed to improve the aircraft's capabilities (upgrades to the radar sensors and front sector optronics, helmet-mounted display capabilities), and new weapons will be integrated (Mica NG air-to-air missile and 1,000-kg AASM Air-to-Ground Modular Weapon). Lastly, with regard to availability, we are working under a through-life support contract which will become more *top-down* under the authority of the aircraft manufacturer."

Validation of the F4 standard is planned for 2024, with some functions becoming available in 2022.

An 'omnirole' aircraft, able to operate from land bases or an aircraft carrier, capable of carrying 1.5 times its weight in weapons and fuel, the Rafale has been designed to perform the full spectrum of combat aircraft missions: Interception and air-to-air combat using, Mica IR/EM missiles and Meteor missiles; close air support using a 30-mm gun, GBU laser-guided bombs and AASM GPS-guided bombs; deep strike using Scalp-Storm Shadow cruise missiles; maritime strike using the Exocet AM39 Block 2 missile and other air-to-surface weapons; real-time tactical and strategic reconnaissance using the Areos pod; buddy-buddy in-flight refueling and Nuclear deterrence using the ASMP-A missile.

Dassault Aviation renews agreement to support SMEs

Eric Trappier, Chairman and CEO of Dassault Aviation, and Florence Parly, French Minister of the Armed Forces, have also signed the renewed agreement between Dassault Aviation and the Ministry of Armed Forces for support to Defence SMEs. Dassault Aviation had first signed this agreement in January 2014 and in signing this renewal, "Dassault Aviation confirms its long-standing policy of supporting the hundreds of SMEs which partner it on military programmes."

The French industrial network of which Dassault Aviation is part has been growing for decades, gaining and sharing knowledge, ways of working, business rules and design and production tools that are invaluable and must absolutely be protected. "These competences, which stem from the production of various generations of aircraft since 1945, are synonymous with technological sovereignty, as few countries have them. They are also synonymous with growth: as an example, more than 150 French SMEs have been offered development opportunities in connection with the Rafale contract in India."

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IAI in follow-up agreements on MRSAM systems

Israel Aerospace Industries (IAI) has announced new agreements worth $93 million for provision of naval MRSAM (Medium Range Surface-to-Air Missile) systems. The contracts were entered with the Indian Navy and Cochin Shipyard Limited (CSL). Under the contracts, IAI will provide complementary systems for the air defence system (ADS). They involve follow up orders for a range of maintenance and other services for various sub-systems of IAI's advanced MSRAM ADS. Recently, the Indian Navy, in collaboration with IAI, carried out an interception test aboard the INS *Chennai*, which assessed for the first time potential collaboration between warship. The interception scenario, which was executed successfully, demonstrated how the operational force of the defence system can be multiplied.

Boaz Levi, Executive Vice President and General Manager of Systems, Missiles & Space Group stated, "The follow-up orders provide additional evidence of the satisfaction and trust of our Indian partners in respect to the MRSAM family. The test demonstrated the advanced technological capabilities of the air defence system as well as our collaboration between IAI, its partners in India's Navy, the local Indian industry and our colleagues at IAI's ELTA and Rafael. This is a badge of honor for the entire Israeli industry".

The MRSAM family is an operational air-defence system used by Israel's navy as well as by India's naval, air and ground forces. It has been uniquely developed by IAI in collaboration with Israel's Ministry of Defence, India's Defence Research and Development Organisation (DRDO), Rafael, IAI's Elta and additional industries in India and Israel. To date, MRSAM has achieved over $6 billion in sales. It provides broad as well as topical defence against a range of air assault, marine and ground threats. MRSAM comprises several key state-of-the-art systems, including a digital radar, command and control, launchers, and interceptors with advanced homing seekers.

IAI Ltd. is Israel's largest aerospace and defence company and a globally recognised technology and innovation leader, specialising in developing and manufacturing advanced, state-of-the-art systems for air, space, sea, land, cyber and homeland security. Since 1953, the company has provided advanced technology solutions to government and commercial customers worldwide including satellites, missiles, weapon systems and munitions, unmanned and robotic systems, radars, C4ISR and more. IAI also designs and manufactures business jets and aerostructures, performs overhaul and maintenance on commercial aircraft and converts passenger aircraft to refueling and cargo configurations.

MRSAM air defence system

VAYU Interview with Mr. Eli Alfassi, Executive VP Marketing, IAI

Heron TP (photo: IDF Spokesperson Unit)

VAYU : We last interacted on the eve of Defexpo 2018 when you stressed "True partnership paves the way for IAI in India". Can you tell us about the continuing progress of IAI in India?

EA : Successful teamwork is a critical aspect of a strategic endeavour and IAI has proved its partnership and support through decades of cooperation in India: in joint research, development, integration, testing to technology and work sharing.

IAI is engaged here with many local companies and works with various defence agencies, the Navy, Air Force, Army and the Coast Guard.

We expect to expand our collaborations with local leading companies in order to integrate strategic state-of-the-art systems for India's Ministry of Defence in various fields, and in accordance with the 'Make in India' policy.

VAYU : What are some of the current projects that IAI is involved with in India ?

EA : IAI has been working with India's defence industries and the armed forces for the past 25 years, as part of strategic collaboration in a variety of fields.

The company is engaged with many local companies and works with various defence services, including the Coast Guard, Navy, Air Force and Army. Our joint-development projects include the MRSAM air defence system, both maritime and land-based versions, various radar systems and UAVs. All collaboration agreements include transfer of technology for the benefit of local production as part of the Indian government's *Make in India* policy.

VAYU : Kindly elaborate on the MRSAM programme and co-operation with DRDO, BDL and BEL?

EA : MRSAM is an advanced air and missile defence system, a unique joint development by IAI and DRDO and various Indian companies including Bharat Electronics Limited (BEL), Larsen and Toubro, Bharat Dynamics (BDL) and several private Indian companies.

The MRSAM air and missile defence system is operational with the Indian Air Force, Indian Navy and Israel Defence Forces and in the near future with the Indian Army.

Recent contracts signed and to be executed with the Indian Navy, will be carried out with BEL Bharat Electronics Limited, which are the main contractor in these projects.

VAYU : Are IAI pushing for more advanced UAVs to the Indian Armed Forces? Currently India uses various IAI UAVs such as the Searcher, Heron and Harpy : any upgrades on the existing airframes?

EA : IAI is a global leader in the design, development, and manufacture of UAVs.

The Heron family, with over 40 years' of experience and more than 1,600,000 operational flight hours, perform intelligence gathering and targeting missions in support of key military operations around the world.

Our UAVs and loitering munitions systems are combat proven with more than 20 customers worldwide. IAI will continue to support existing customers worldwide, introducing additional state-of-the-art sensors and technologies.

VAYU : What is the main theme of IAI at Aero India 2019?

EA : A leading global defence company, IAI addresses the unique challenges of national defence and homeland security with technologically advanced and operationally proven solutions.

An Aero India 2019, IAI will present some of its latest and most advanced aerospace and defense solutions, featuring the latest technologies in military aviation, air defence and missiles systems, unmanned systems, special mission aircraft, radars and cyber technology.

Among the systems on display are the operationally proven air defence systems MRSAM, special mission aircraft, the Heron TP, the largest platform in IAI's family of advanced unmanned aerial systems (UAS). Satellites, radars, loitering munitions systems, EO surveillance systems, Strategic, HPR and tactical radars, advanced mission systems for helicopters. These are only some of the highlights of IAI's display at Aero India 2019.

The Meteor BVRAAM

The Indian Air Force and MBDA : "A lasting successful partnership"

MBDA has been delivering battle-winning capabilities to the Indian Air Force and collaborating with Indian industry for over 50 years. Throughout this history, there have been two guiding principles: to provide the very best technologies to the Indian Air Force, and to work in true partnership in support of the Indian Defence Industry. Fitting perfectly with our long-term strategy is the 'Make in India' programme, to which we are fully committed.

The Indian Air Force is receiving the ramjet powered and network-enabled Meteor beyond visual range air-to-air missile from MBDA. This next generation missile is widely recognised as a game changer for air combat, and will provide the Indian Air Force with an unrivalled air dominance capability. Key to this is Meteor's throttleable ramjet engine, active radar seeker and datalink that combine to provide unmatched end-game speed and manoeuvrability at greatly extended ranges, resulting in its all-important 'No-Escape Zone' being more than three times greater than any other existing or planned BVR weapons.

Other examples of technological edge equipping the Indian Air Force include the MICA and ASRAAM within visual range (or dogfighting) missiles. MICA is the only missile in the world featuring two interoperable seekers (active radar and imaging infrared) to cover the spectrum from close-in dogfight to long beyond visual range. Its ability to fly out to BVR in passive mode before the seeker locks on in the final stages of the end game has earned it the nickname "silent killer" as the target has little time to react or to deploy effective countermeasures. Possessing both infrared and radar-guided versions also makes MICA highly countermeasure resistant and therefore highly effective

ASRAAM is providing the IAF's Jaguar fleet with a step-change in air combat performance. 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 bombers, giving them unrivalled self-protection ability and enhanced ability to penetrate hostile airspace. These and other technologies make the Indian Armed Forces a proud equal to any modern force in the world.

Industrial partnership is of equal importance though, given the importance of sovereign industrial defence capability. MBDA has been assisting the development of sovereign Indian missile industry, both public and private, for over 50 years. Partnerships MBDA has formed with Indian industry have seen over 40,000 missiles of the MILAN family produced in India – a noteworthy and on-going success. Indian industry is now supplying key components for both MICA and ASRAAM missiles. MBDA continues to deepen its relationship with Indian industry, as seen by the recent formation of a joint venture with long-standing partner Larsen & Toubro to deliver a series of important missile programmes under the *Make in India* category.

The Mistral ATAM system has been successfully integrated on the Advanced Light Helicopter (ALH) and final integration is being done on the Light Combat Helicopter (LCH). Utilisation of the Mistral missile on India's helicopter platforms also provides a bridge to their use in a ground based VSHORAD role, where the missile is fully compliant with India's requirements and outperforms the capabilities of its rivals.

Loïc Piedevache, Country Head, India, MBDA Group

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VAYU Interview with

Air Chief Marshal BS Dhanoa,
Chief of the Air Staff, IAF

VAYU : The IAF has issued a new RFI for some 110 fighters and received responses by 6 July 2018, presumably from known OEMs. These are apparently being studied and selected companies would be asked to submit formal proposals for evaluation. Can you kindly indicate as to how long this next step could take?

CAS : The case for 114 fighters is through the Strategic Partnership route and the process as per Chapter VII of DPP-16 will be followed.

VAYU : The IAF is very short of 'force multipliers', such as AWACS and mid-air refuellers (MRA). Kindly give us a road map as to when this vital gap in the IAF's inventory is to be filled.

CAS : The Flight Refuelling Aircraft (FRA) is an important combat support platform and the RFI for six FRA has already been issued. Presently, a SoC is under formulation and the case will be progressed as per DPP. One AEW&C aircraft has been inducted in Initial Operational Clearance (IOC) configuration. The DRDO is carrying out the development trials on the second AEW&C aircraft towards the Final Operational Clearance (FOC). The procurement case of the two additional AWACS is under consideration. Further, DRDO is planning development of two AWACS India on the Airbus A330 platform.

VAYU : There are persistent rumours that HAL has suggested that the IAF order another batch of Sukhoi Su-30MKIs, as follow on to the 222 already contracted, the last of which are currently being manufactured at Nasik. Would these be considered as a "stop gap" to stem the erosion of fighter squadron numbers or earmarked for special operations, for instance as carriers of BrahMos supersonic missiles?

CAS : The IAF has already inducted a major portion of the contracted Su-30 MKI and delivery of the balance aircraft is ongoing. Procurement of 83 x LCA Mk 1A has been initiated to arrest the drawdown of fighter squadrons. Further, proposal to procure 114 fighter aircraft through the 'Strategic Partnership' model is being progressed and other suitable options are also being considered to ensure that the IAF attains the authorised strength of fighter squadrons.

VAYU : The IAF has projected a requirement for some 180 basic turbo prop trainers, but only 75 Pilatus PC-7s are presently in service. How is this shortfall being addressed and will the indigenous HAL HTT-40 be considered to fulfill the comprehensive needs ?Also, with HAL's Intermediate Jet Trainer (IJT) project stalled, could the Service consider a two-stage flying training pattern, with more hours on the BTA before transition to the Hawk AJT ?

CAS : The IAF is processing the procurement of additional Pilatus PC-7 Mk II under the 'Option Clause' to meet the training requirements. As far as the IJT is concerned, it had encountered design problems in the Stall and Spin testing. In view of this the IAF has, after due study, initiated 'Two Aircraft Type Flying Training' pattern. The HTT-40 is a Basic Trainer Aircraft which is still under development and the critical phase of flight test i.e Stall and Spin, is yet to begin.

VAYU : The air transport element of the IAF is seemingly well served by various types, ranging from the heavy-lift Boeing C-17 Globemaster III to HAL-Do228 LTA. However, the Avro replacement programme seems to have stalled: could you please let our readers know whether this will be revived in the near future? As a corollary, should not the selected type be required more as an An-32 replacement?

CAS : The Avro replacement programme is well under progress and is at the contract negotiations stage. As far as replacement of An-32 is concerned, the IAF will take a decision at an appropriate time.

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Ahead of Time

The S-400 gives formidable air defence for India

Armed with three types of missiles to create a layered defence, the S-400 Triumf (NATO reporting name: SA-21 *Growler*) is an air defence missile system developed by Almaz Central Design Bureau of Russia. Essentially an upgrade of the S-300 series of Surface-to-Air Missile (SAM) systems, this replaced the S-300P and S-200 air defence systems of the Russian Army from April 2007 onwards. Likely to enter service of in Indian Air Force, the proposed $ 5.5 billion deal has been cleared by Defence Acquisition Council (DAC). Capable of simultaneous engagement of 36 targets, the system can engage all types of aerial targets including aircraft, Unmanned Aerial Vehicles (UAV), and also ballistic and cruise missiles within the range of 400 km, and at an altitude of up to 30 km. The rapidly deployable system again is stand-alone and integrates a multifunction radar, autonomous detection and targeting systems, anti-aircraft missile systems, launchers, and the Command & Control (C&C) centre.

The S-400 air defence missile system uses four new missile types in addition to the missiles of the S-300PMU system, the first missile inducted for the system being the 48N6DM (48N6E3). It is an improved variant of the 48N6M with powerful propulsion system to destroy airborne targets within the range of 250 km. The Active-Radar Homing (ARH) 40N6 Anti-Ballistic Missile (ABM) of the S-400 has a claimed ranges of 400km and in addition specifically targets hostile airborne force multipliers at great distances like Airborne Early Warning & Control (AEW&C) aircraft, Joint-Surveillance Target Attack Radar (J-STARS), and support jammer platforms. To engage fast moving targets such as fighter aircraft with high hit probability, the S-400 Triumph also launches 9M96E and 120 km ranged 9M96E2 medium range SAM systems, which can engage targets flying as low as 10 metres.

The 91N6E Big Bird acquisition and battle management radar of the S-400 is based on the 8×8 trailer and is capable of detecting and tracking aircraft, rotorcraft, cruise missiles, guided missiles, drones and ballistic missiles within the distance of 600km. It can simultaneously track up to 300 targets and engage 72 of them.

Sayan Majumdar

Deployment of the S-400 during exercises in Russia

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BrahMos: India's ultimate force multiplier

India's military prowess has undergone steady transformation over the past few years and the country is now regarded as one of the major powers of Asia where the rapidly changing geostrategic situation has created new power equations.

Amongst the many modern, highly advanced military assets with India's armed forces today is the BrahMos supersonic cruise missile system, which has metamorphosed the Indian Armed Forces into becoming a most formidable force.

Induction of the BrahMos, the precision strike weapon with stealth, versatility and multi-role capability, has arguably revolutionised modern warfare to a great extent. This 'universal' missile has been designed to neutralise high-value ground or sea-based targets with its high speed, great accuracy and devastating warhead. Multiple target strike capabilities of the BrahMos have been validated with numerous successful test firings conducted from the ground, sea, sub-sea and now, air platforms.

While the land-attack BrahMos is now integral with the Indian Army and numerous Indian Navy warships are equipped with this 'prime strike' missile, the Indian Air Force has recently integrated the BrahMos on its Sukhoi Su-30MKI. Test firing trials of the BrahMos air-launched cruise missile (ALCM), launched from an IAF Sukhoi Su-30MKI against a sea target, first took place on 22 November, 2017. This 2.5-ton missile, an improved variant of the original anti-ship BrahMos, features a lighter propulsion system, improved nose cone and enhanced aerodynamic structure.

Advent of this advanced air-launched missile is a true "game changer" for the Indian Air Force, being a powerful tactical asset, especially as regional power plays are establishing strategic supremacy. BrahMos Aerospace, the India-Russia JV entity which designs develops and manufactures the BrahMos, has established its leadership position, carrying out a complex programme of integrating and flight testing of this unique, precision strike weapon from the air. The Su-30MKI, equipped with the BrahMos, will become India's ultimate 'trump card'.

"The BrahMos is a very heavy missile and such a class of weapon has never been deployed on a frontline air combat platform in the world. The BrahMos ALCM has enormously widened the Indian Air Force's stand-off air attack capability and given it distinct strategic edge over adversaries," says Dr Sudhir K Mishra, CEO & MD of BrahMos Aerospace. "As the heaviest – and deadliest – weapon launched from far standoff distances, the BrahMos-A would annihilate any kind of sea and ground-based targets".

India is the only country extant having in its inventory such a powerful supersonic cruise missile, launched from land, sea/sub-sea and air platforms. With the Indian Air Force now receiving the BrahMos-A in large numbers for integration with Sukhoi Su-30MKI, the Indian armed forces have acquired "unprecedented capability to engage critical enemy assets across the spectrum of warfare, thus decisively influencing the course of conflict in the future".

Dr. Sudhir K Mishra, CEO & MD of BrahMos Aerospace

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"Unmatched & Undefeated": The F/A-18 Super Hornet

Pilots swear by it, ground crews love working on it and commanders consider it one of the most capable assets at their disposal. Fitting multiple mission roles and embodying the true meaning of 'anywhere, anytime' capability; the F/A-18 Super Hornet has cemented a position for itself amongst the most legendary and game-changing fighters the world has ever seen.

The F/A-18 Super Hornet has lived up to its reputation. Faster, more capable and lethal than its predecessor, the Super Hornet has time and again proven its supremacy in pitched aerial battles and a myriad of other strike and support missions. Equally at ease on carrier decks and forward air bases, the Super Hornet has continued to enhance itself and prove itself adept at handling every mission assigned to it. In fact, the multi-role and fully capable Super Hornet has seamlessly taken on the mantle of aircraft such as the F-14 Tomcat, A-6 Intruder, Lockheed S-3 Viking, and KA-6D aircraft. An electronic warfare variant, the EA-18G Growler, replaces the EA-6B Prowler.

The first operational F/A-18 E/F Super Hornet squadron was formed in June 2001 and deployed into combat aboard the USS *Abraham Lincoln* (CVN 72) in July 2002. In April 2005, Boeing delivered the first Block II Super Hornet, complete with the world's first tactical multi-mode AESA radar, and it became fully operational by 2007.

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-18 Super Hornets.

Constant Evolution for Continued Relevance

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.

The Super Hornet is the most advanced aircraft of its kind in operation today, with designed-in stealth, an AESA radar and many other advanced technologies. The Super Hornet not only has a low acquisition cost, but it costs less per flight hour to operate than any other tactical aircraft in US forces inventory. Part of its affordability is because the Super Hornet is designed to need far less maintenance, which translates into the high mission availability it is known for.

Boeing and its industry partners have built more than 700 Super Hornets and Growlers, all on cost and on schedule. Boeing is confident that it will see F/A-18 production well into the mid 2020's, based on the US Navy's need for more aircraft and near-term international opportunities.

'Perfect Fit' for the Indian Armed Forces

The Super Hornet brings the latest generation of technologies to the warfighter. The AESA radar in particular, is an exponential leap in technology that will be needed for current and future missions. The Advanced Targeting Forward Looking Infrared system, Joint Helmet Mounted Cueing System, Multifunctional Information Distribution System,

(cont'd on page 50)

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Nammo: Innovative 40 mm programmable ammunition

"In combat situations, the enemy avoids direct fire by hiding behind obstacles, which provides a tactical challenge for own troops. Innovatively, Nammo developed the programmable ammunition concept to give forces a reliable advantage, providing a flexible and effective solution to a common war situation. Technological advances have made the battlefield more dynamic than ever, which means weapon systems must quickly adapt to counter threats."

Before Nammo developed its programmable ammunition technology, conventional 40 mm ammunition rounds had not changed for over 40 years. In 2002, Nammo initiated a technology programme to explore programmable ammunition to introduce more capability for each round. With introduction of the 40 mm x 53 MK285 Programmable Pre-fragmented High Explosive (PPHE), Nammo became the first company to qualify programmable ammunition for 40 mm Automatic Grenade Launchers (AGL).

Nammo's innovative 40 mm programmable ammunition technology allows the burst distance against enemy troops to be programmed accurately directly into the round. This achieves more precise targeting in defilade (for example, trenches, rooftops or inside buildings) and enables friendly troops to neutralise enemy forces that are avoiding direct fire.

Nammo: A propellant reload programme for expired AIM-9L Rocket Motors

The Sidewinder family of missiles has been in operational service with many air forces worldwide since the 1950's, and even older versions are still commonly used by several nations. Nammo started its Sidewinder Rocket Motor production in the 1960s with the AIM-9B version and substantial quantities were manufactured up to the late 1970s. A new and modern composite propellant Rocket Motor plant was then established for mass production of the AIM-9L version, and this production line is still fully operational with high capacity. The Sidewinder is the most widely used air-to-air missile in the West, with more than 110,000 missiles produced for the US and 27 other nations. Several upgrades and improvements of the various Sidewinder versions have been offered to increase operational capabilities as well as service life. A propellant reload programme is currently ongoing for expired AIM-9L Rocket Motors.

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Adani-Elbit UAV unit inaugurated

On 14 December 2018, Adani Defence and Aerospace (ADA) inaugurated its Unmanned Aerial Vehicles (UAV) facility in Hyderabad, set up in partnership with Israel's Elbit Systems. "The UAV complex, which has a staff count of 110, will roll out four complete carbon areo-structures for Hermes 900 in 2019 and 18 aero-structures in 2020. The first of the aero-structures is expected to roll out in March 2019... The structures would then be sent to Israel for final assembly for the global market," stated ADA head Ashish Rajvansi. Should the company receive orders for 150 UAVs expected from the Indian MoD, the Hermes 900 Medium Altitude Long Endurance UAV would be built entirely in India and the complex upgraded. "Other than the UAV complex, the 20 acre Aerospace Park will also house a helicopter unit and a training and R&D facility. Of which, the helicopter gear complex – a joint venture with Rave Gears – is expected to come up by September next year."

Japan moots 2+2 dialogue 'as early as possible'

According to a Japanese spokesperson, Japan is focused on boosting defence and security ties with India and would like the first 2+2 dialogue between the defence and foreign ministers of the two sides to be held "as early as possible". Bilateral economic cooperation has been the driving force for the past decade and defence and security cooperation was catching up, said Natsuko Sakata, a spokesperson of Japan's foreign ministry. The two sides had agreed on holding a 2+2 dialogue during Prime Minister Narendra Modi's visit to Japan last October and Tokyo would like the inaugural round to be held "as early as possible".

Japan is also keen on beginning negotiations for the proposed Acquisition and Cross-Servicing Agreement (ACSA), which is aimed at logistics and cross-servicing arrangements between the Indian Armed Forces and Japan's Self Defense Force. It was also acknowledged that the progress has been slow on the forward movement on plans for the Indian Navy to receive the Japanese ShinMaywa US2i amphibian aircraft to India, although this remains very much on the agenda.

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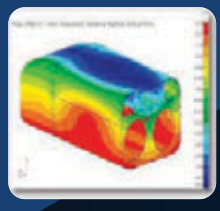


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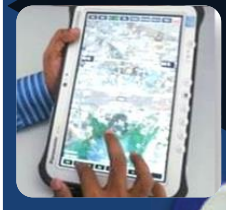

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IAI's Heron TP Medium Altitude Long Endurance (MALE) Unmanned Aircraft System (UAS)

The Heron TP became fully operational in 2010 and is currently operated by the Israeli Air Force. It has recently been selected by Germany for their SAATEG MALE UAV requirement, and other countries are showing significant interest in acquiring the Heron TP as well.

Lessons learned from the Heron TP's operational use in Afghanistan indicate that future RPAS must be a weapons capable platform, wherein that capability is for expeditionary operations. According to various sources, the Heron TP is very adept and battle proven in this capability. In addition to serving the Armed Forces, the Heron TP UAS could also support various government departments by providing wide area surveillance and 'target of interest' tracking that will significantly enhance existing capabilities provided by manned aircraft and satellite systems.

IAI has a very long heritage for UAS development and is world renowned for developing aircraft based on operational experience and real-world combat operations in which the State of Israel is constantly engaged. The company has imbibed lessons from their Heron UAS to develop the larger, more capable Heron TP which delivers greatly enhanced performance, endurance and payload capability. The Heron TP has been flying under the Israeli Air Force Flight Authority for the past 12 years and is fully compliant with NATO STANAG 4671 regulation. With recent announcement of long term lease of Heron TPs to Germany, IAIs partner, Airbus (under contract to the German Government) will conduct a complete and independent airworthiness type certification for the Heron TP on behalf of the German Military Airworthiness Authority. Ron Keret, Deputy General Manager of IAI's MALAT Division, said that the Heron TP UAS is designed to the standard of manned aircraft with redundant control surfaces and flight controls. As he explained, "The same engineers that design civilian aircraft, designed the Heron TP to manned standards. Triple redundancy of the platform was built into the aircraft to facilitate flight safety and for certification to operate in non-segregated airspace.

The Heron described

With a length of 14 metres, wingspan of 26 metres and maximum takeoff weight of 5,670 kg, the Heron TP is the largest unmanned aerial system operating with the Israeli Air Force. The aircraft has a distinctive twin-tail boom which provides control surface redundancy and extra surface area to facilitate the mounting of numerous antennae across both booms. This configuration reduces signal interference and allows for multiple simultaneous uses, while leaving the fuselage and wings clear for mission payloads. The multi-mission Heron TP has the capacity for 2,700 kg of internal and external stowage for payloads and fuel and has 12 hardpoints spread across the centre fuselage and nacelles. These hardpoints can be fitted with a standard BRU rack, which can accommodate numerous payloads and special kits like the Survival Kit, Air Droppable (SKAD) pod. All mission and sensor data will be transmitted to the GCS (Ground Control Station) and other authorised secure users in real time via dual-redundant SATCOM or Line-Of-Sight data links.

The Heron TP has an endurance of over 30 hours in mission configuration and over 35 hours in ferry configuration. It can operate at altitudes up to 45,000 ft. at speeds up to 220 *ktas*. The system comes with a state-of-the-art Ground Control Station where operators can perform all mission functions which includes programming flight path of the UAV and controlling the various sensor operations.

The Heron TP is powered by a 1200 shaft horsepower Pratt & Whitney Canada PT6-67A turboprop engine, and is capable of speeds, climb rates, and altitudes which are unique in the MALE UAV category, thus making it ideal for long operations and for high/hot/ heavy conditions.

Control of the Heron TP is via GCS which transmits signals using satellite or line-of-sight link. Within the GCS are bays (operator stations) that control the UAV. Two bays are adequate to control a UAV, its systems/payloads, and provide redundancy. The GCS can also be scaled up with more bays as is necessary. One of the benefits of having nearly 50 years of lessons-learned experience with UAVs is the level of automation that IAI has developed. For example, taxi, takeoff and landing of the Heron TP is fully automated, carried out from the GCS which feeds GPS coordinates along with knowledge of airfields. Most UAV operations require a forward located Launch and Recovery Element (LRE) to operate the platform away from home base. The Heron TP UAS, however, does not need an LRE as it can use its satellite data-link command and control capability to land and re-launch from remote operating strips without the requirement of on-site specialised equipment.

The Heron TP is capable of Automatic Taxi, Take Off, and Landing (ATTOL), thus there is no requirement to preposition personnel at remote landing sites.

Strategic Partners for NUH programme

In order to meet the Indian Navy's urgent and long pending requirement for Naval Utility Helicopters (NUH), as replacement for the obsolescent HAL-built Chetaks (*image above*), it is learnt that the Ministry of Defence is to invite private sector companies to participate in the project for 111 helicopters under the strategic partnership (SP) policy of the 'Make in India' initiative. An expression of interest (EoI) will first be issued to identified companies who would thereafter team up with the concerned OEM.

The Navy's specification for the NUH is that it should be twin-engined, under 5-tonnes AUW have flotation gear, wheeled landing gear with folding blades and able to carry a torpedo. Helicopter types being considered include the AS565 MBe Panther, Bell 429, Super Lynx 300, S-76D and the Ka-226 while the SPs reportedly include the Tatas, M&M and L&T, although HAL could also participate.

Expanding force of HAL-Dornier 228s

Increasing the inventory of and number of units operating the HAL-Dornier 228 maritime patrol aircraft, the Government of India have recently sanctioned setting up of three new Naval Air Squadrons in Gujarat and Tamil Nadu. Besides this, the Central Government has also sanctioned manpower towards manning additional aircraft in existing Dornier Surveillance Squadrons in Kerala and the Andaman Islands. This contract for procurement of 12 additional Dornier 228 aircraft was signed on 29 December 2016 with delivery commencing in January 2019.

The new Dornier 228 aircraft being delivered under this contract are fitted with improved 'state-of-the-art' sensors and equipment which include glass cockpit, advanced surveillance radar, ELINT, optical sensors and networking features. The aircraft would enhance Maritime Domain Awareness of the Indian Navy through round the clock sensor based surveillance and provide targeting data in areas of operation to monitor and neutralise various threats and other hostile activity in the seas around the Indian peninsula and the long coastline of over 7000 kilometres.

An interview with

General Alexander Kharchevsky: Synonymous with the Su-30SM

Major General Alexander Kharchevsky (in photo above) is arguably one of the most famous military pilots of Russia extant and his name is synonymous with that of the Sukhoi Su-30SM. General Kharcheevsky became a household name in Russia in 2000 when he piloted a Su-27UB twin-seater, with Vladmir Putin, then acting President of Russia as its second crew member.

The General was for about 20 years commander of the Russian Air Force's Centre for Combat Employment and Retraining of Personnel VVS which is a research, training and instructional centre. He also formed, trained and then led the famous aerobatic team *Russian Falcons*, first equipped with Su-27 and later with Su-30SMs, which he describes a "gift of his fate", being the latest avatar of the family of Su-30MKI super-maneuverable multi-role fighter which has out performed western fighter types in simulated combat at various air exercises.

Manufactured by IRKUT, the Su-30SM fighter was developed to meet requirements of the Russian Air Force, the prototype making its maiden flight in September 2012. The multirole Su-30SM can be deployed in counter-air strikes, counter-land and counter-sea missions, can conduct electronic counter-countermeasures and early warning tasks. The aircraft also acts as a command-and-control platform within a formation of combat aircraft in joint missions.

In 2015, General Kharchevsky formally retired from service at the age of 65 with his flying career spanning more than 45 years.

Vayu's Interview with the General

VAYU: Sir, you were involved in development of the Su-30SM before this type aircraft became operational with the Russian Aerospace Forces. What is your perception of this combat aircraft?

AK: Some time back, I used to fly a Su-30MKI fighter, which became the precursor of an entire family of combat aircraft, including the Su-30SM. The aircraft made an exceptional impression on me, having all the performances that are necessary for a modern fighter. Ever since I started flying, I have dreamt of flying an aircraft that exactly fulfills one's desires : Success in air battle completely depends on this. The Su-30MKI become such an aircraft whose pilot does not need to think on how to enter combat, increase speed and altitude. The super maneuverability of the aircraft and its computerised systems permit the employment of weapons at any angle of attack, speed and altitude.

VAYU: What was your position and experience at that time ?

AK: I was in charge of the Centre for Combat Employment and Retraining of Personnel. My experience as a fighter pilot exceeded 30 years, had flown all the fighters that were in service in Russia, so could compare. It must be noted, that I and many other pilots at this Centre had experience in air combat exercising against the best foreign fighters including American ones. We knew the strengths and weaknesses of our fighters and of their rivals.

VAYU: How did Russian fighters perform against their competitors?

AK: During the 1990s, in terms of flight characteristics and accordingly, in close combat, our 4th generation fighters out performed their foreign counterparts, but their avionics at that time lagged behind the western ones. With launching of the Su-30MKI/SM family of fighters, this situation changed radically. Because of the airborne phased-array radar and armament control system, we were able to hit targets well beyond visual range. With new avionics and weapons, the aircraft became multifunctional.

VAYU: Did you follow development of the Su-30MKI in India?

AK: Of course, we were particularly pleased on receiving information about the excellent performance of Indian pilots (flying Su-30MKIs) during international exercises. We in Russia were proud of the Su-30MKI's performance and have great respect for skills of IAF pilots, many of whom we knew personally. We understand how difficult it is to operate in foreign skies, over unknown terrain, in an unfamiliar environment after long, intercontinental flights, especially when one's opponent is resident, and familiar with his environment.

VAYU: As a commander who has trained hundreds of military pilots, how would you feel about Su-30SM fighters performance in combat environment?

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AK: Both the military leadership of Russia and the pilots themselves, very well appreciate effectiveness of the Su-30SM. These aircrafts were employed for fighter escort, carrying out attacks against surface targets as also continuously maintaining surveillance against airborne aerial threats including unmanned aerial vehicles. Su-30SMs were also used for special tasks and also escorted for aircraft to Russian President Vladimir Putin during his visit to combat zones. Mr. Yuri Borisov, deputy prime minister of Russia, has particularly pointed out the effectiveness of Su-30SMs during counter-terrorist operations, exceeding the operational criteria by three to four times. It must be noted that this performance was carried out while aircraft were operating in isolation, far from their basis bases and in adverse climatic conditions.


Su-30SM : "gift of my fate", says the General

VAYU: In summary, and as such an experienced pilot, how would you improve the Su-30SM?

AK: For me, the Su-30SM was a gift of my fate. However, even the most advanced contemporary system would be improved. Earlier, one would look at means to improve the fighter's performance, working on increasing the engine thrust, inducting a range of high-precision weapons and EW systems. Today, I must say with satisfaction, that much activity in these areas is underway in Russia and we see positive results already.

Rostec systems testing SSJ-100 and MC-21

In December 2018, Technodinamika holding company (part of Rostec State Corporation) completed the qualification testing of the fire protection system and oxygen system accessories that will be used in SSJ-100 and MS-21 aircraft. Fire protection system accessories will be sent to Sukhoi Civil Aircraft for further certification testing within SSJ 100 aircraft in the spring of 2019. Technodinamika will also supply these accessories for the new Russian aircraft MC-21. "We are targeting both domestic and international market. With this in mind, the accessories were tested for compliance with Russian (25 AP) and international standards (TSO). In future, this should facilitate getting EASA certification both for individual accessories and the whole aircraft," commented Industrial Director of Aviation Cluster of Rostec Anatoly Serdyukov.

Tests showed that in some parameters the products exceed similar products made by foreign suppliers by 8-12%. This applies both to the mass properties

and lifetime of the accessories. In September 2018 Technodinamika won the tender for the supply of fire protection system accessories for the new Russian airliner MC-21. The contract terms and delivery dates have now been negotiated with Irkut Corporation.

Controp at Aero India 2019

At Aero India 2019 CONTROP is presenting its SIGHT-HD, a specialised targeting EO/IR payload for Remote Weapons Stations (RWSs) and Armoured Fighting Vehicles(AFVs). The SIGHT-HD is a gyro-stabilised payload that was developed especially to withstand extreme environmental conditions, facilitating mid-to-long range target acquisition, day and night, for mobile and stationary applications. When installed on AFVs, it is ideal for a wide range of applications, such as border surveillance, perimeter protection of sensitive installations, force protection, route clearance and more. At just 13kg, the low-weight payload is easily installed on any type of vehicle or weapon station.

Controp's new Sight-HD payload

The SIGHT-HD includes a high-performance Thermal Imaging (TI) camera using a 3-5µ Cooled IR detector with a continuous zoom lens; High Definition (HD) Color Day camera with a continuous zoom lens; and an Eyesafe Laser Range Finder (ELRF), all integrated into an all-in-one Line Replacement Unit (LRU). The advanced image processing features include local AGC on the TI and Day cameras; Video Enhancement; Automatic Video Tracker and Picture-in-Picture (PIP). A Laser Pointer, Control Unit (CU) and Digital Video Recorder (DVR) are also available as optional add-ons.

Another product is the iSky-50HD which was uniquely developed for the challenging and often turbulent aerial environment to provide solutions for most medium and long-range aerial surveillance platforms. Features include a continuous optical zoom lens in the day (or high definition-HD) and thermal imaging (SD/HD) cameras, gyro-stabilised gimbals and multi sensor options including Eyesafe Laser Range Finder (ELRF) and/or Laser Pointer, all of which provide outstanding capabilities. The iSky systems can be installed on helicopters, fixed wing aircraft and unmanned aerial systems (UAS), and may be integrated with the platforms' systems. The payload system includes three (3) channels: a continuous zoom HD day channel, a continuous zoom HD thermal channel, and a SWIR spotter. Additional optional features include an Eyesafe Laser Range Finder (ELRF) and/or Laser Pointer. The systems include superb gyro-stabilisation, real-time image enhancement features, built-in INS, and automatic video tracker. All of the CONTROP iSky day/night camera payloads have an easy interface to radar and other mission systems for slewing the EO/IR camera to the detected target.

Ideal for manned or unmanned airborne platforms, all of the iSky systems include real-time Image Enhancement Features, built in INS, automatic target tracking and are successfully operated, fully integrated and deployed by Search and Rescue (SAR), Border Surveillance, Law Enforcement, Special Operations, Maritime Patrol and Force Protection Units, around the world.

Controp iSky-50HD

Then there is the famous SPEED-ER Land-Based Ultra-Long-Range Observation System, including SWIR camera, Day zoom camera and spotter, Thermal Imaging Cameras, and Land-Based EO/IR gyro-stabilised gimbal. The SPEED-ER is a first-of-its-kind gyro-stabilised, land-based, ultra-long-range observation system. Its 3 channels – Visible,

Controp iSky payload on naval helicopters

Controp Spider for coastline protection

Controp SPEED-ER for extended long range protection

Thermal and SWIR (Short-Wave Infrared) – ensure sharp, clear and stabilised pictures. The SWIR provides outstanding images, even in conditions of haze, dust, rain or high humidity, and at any hour of the day or night. This capability makes SPEED-ER unique in the industry, and ideal for diverse and challenging applications and missions including coastal and border surveillance. The SPEED-ER can be used for land borders surveillance, coastlines surveillance, vessel traffic services (VTS) and long range air defence.

First Cockpit assembly of Falcon 2000 by DRAL for Dassault Aviation

The first cockpit front section of the Falcon 2000 series, produced by Dassault Reliance Aerospace Limited (DRAL) at its manufacturing facility at MIHAN, Nagpur, is shortly to be handed-over to Dassault Aviation. Matching with the highest quality standards, this first front section is to be delivered to Dassault Aviation's Falcon final assembly line in France. In parallel, larger infrastructures are being developed and will soon be completed allowing the ramp-up of DRAL capabilities toward the taking-off of an entire Falcon 2000 fully manufactured and assembled in India.

"This is a new step in Dassault Aviation's plans up in India, confirming its decision to invest in India for the future and in its commitment to the *Make in India* initiative." It demonstrates the company's determination to establish in India state-of-the-art manufacturing facilities with cutting edge technologies as well as best-in-class international aeronautical standards in terms of efficiency in production and competitiveness. Further to the creation of the joint venture Dassault Reliance Aerospace Limited in February 2017 and the laying of the foundation stone of its manufacturing facility at MIHAN in Nagpur end of October 2017, this visible achievement illustrates Dassault Aviation's determination to build up an Indian aerospace manufacturing eco-system, matching the highest standards in this field and positioning India as an international reference in the global aerospace market", stated company officials.

This first Falcon 2000 cockpit from the DRAL facility at MIHAN, Nagpur is being displayed on Dassault Aviation's booth at Aero India 2019.

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UAC: Improved Il-78 tanker flight tested

An improved United Aircraft (UAC) Ilyushin Il-78M-90A tanker commenced flight testing with its maiden flight conducted from the Aviastar SP production site in Ulyanovsk. Key changes on the updated model include a new wing with increased fuel capacity and Perm PS-90A-76 engines, in common with the -90A version of the Il-76 heavy transport.

Besides its enhanced tanker performance, the new model can also be used as a transport aircraft by removing its additional on-board fuel tanks. The -90A also has new navigation systems that will enable it to be operated in international airspace in accordance with civilian requirements.

Testing of Su-57 Avionics 'Complex' completed

The communications, navigation and surveillance systems of the Su-57 are described as an integrated avionics 'complex', featuring network centric architecture with a unique approach to embedded computer processing and data transmission. The Su-57 will eventually replace Russia's multi-purpose fourth generation Su-27 fighter fleet.

"From the perspective of electronics engineers, modern fighters have already reached a level where sharp growth of their capabilities is no longer possible. However, we know that modernisation of their airframes, and engines could lead to a 20–30 percent advantage in over their predecessors. At the same time, design of new 'brains' or avionics could result in an increase of their efficiency and combat capabilities by several times," stated the Deputy Director General for Research and Development of Radioelectronic Technologies Concern. The new "complex" is based on Russian multi-core chips and an operating system, which works within a real-time mode in close communications with other fighters jets, military transport aircraft and ground forces.

Prior to each Su-57 test flight, a specific flight programme is loaded onto the flight management computer. This comprises intelligence data, information on weapon systems of the target, coordinates and other vital data, all of which can also be adjusted during a combat mission, at any time. Sukhoi Design Bureau engineers describe the Su-57 avionics as "featuring a central computer which controls all aircraft systems, including weapons and is information for the pilot. The computer is simultaneously "an electronic pilot, an electronic navigator and an electronic flight engineer" automatically recognising and determining priorities and targets.

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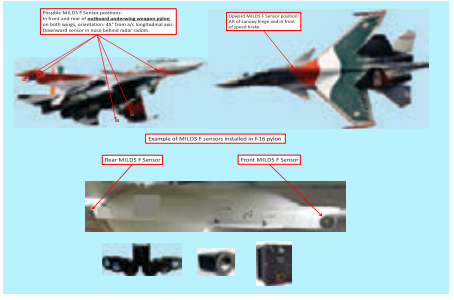

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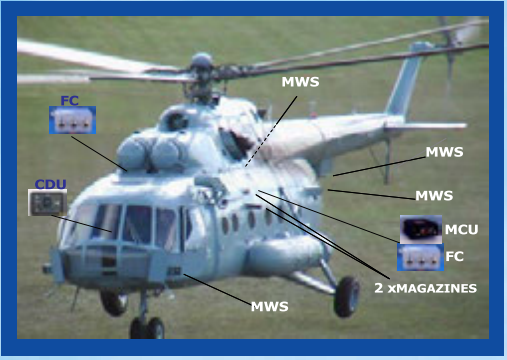

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Rolls-Royce: "Speeding up indigenisation, Partnering for progress"

2019 has begun to a splendid landscape in showcasing India's burgeoning aerospace and defence capabilities: the 12th edition of Aero India show. The tagline for Aero India 2019 "The Runway to a Billion Opportunities", is apt in conveying India's growing value proposition to global investors and domestic manufacturers.

India is at the cusp of metamorphosing from an important regional player to one with global presence As India's geo-political and economic ambitions grow, it needs to develop robust indigenous manufacturing capabilities and an ecosystem to achieve self-reliance in the aerospace and defence industry.

Currently, the country is one of the largest importers of conventional defence equipment and spends almost one-third of its total defence budget on capital acquisitions. About 60 percent of its defence requirements are met through imports.

Owing to its dynamic security environment, India's defence requirements are likely to increase in the foreseeable future, making indigenous development of modern defence hardware and technology as top priority for the government.

Sea of opportunity

With the government pledging $250 billion to modernise the country's military equipment — from fighters to guns and submarines — India is uniquely positioned to create a vibrant defence manufacturing ecosystem that can help achieve self-reliance. It offers tremendous opportunities in engineering, services, supply chain sourcing and associated maintenance, repair and overhaul-related activities. Although the government is taking numerous measures to bolster defence manufacturing, the pace of modernisation must be balanced with both short and long-term initiatives.

Hastening indigenisation

At Rolls-Royce, we believe that co-development and co-manufacturing is the way forward to achieve the vision of turning India into a global high-value manufacturing destination, not just for the home market but also for export.

Foreign original equipment manufacturers (OEMs) have already begun leveraging these benefits and are encouraging Indian industry to adopt best practices for global quality standards in their manufacturing processes so as to nurture a world-class supply chain and defence manufacturing ecosystem in India.

The government is already investing in this area, but the pace of development needs to pick up considerably to not miss opportunities, and public-private participation can go a long way in hastening this process.

Additionally, a strong supply chain is critical for a defence manufacturer. Steadily a handful of Indian small–and medium-sized enterprises (SMEs) are playing a key role in the global supply chain of OEMs. With the government's offset policies, procurement policies and regulatory incentives spurring the growth of a domestic defence industry, the SMEs need to play a more active role.

Importantly, to be ready for opportunities of the future, industry needs to develop and retain talent through specific training to address growing needs of the market. In addition, academia and industry, backed by government policies, need to forge partnerships to encourage research and technological advancements and create a talent pool that is industry-ready.

With defence being within the government's high-priority focus area, India should emerge as a preferred partner for co-development and co-creation of an indigenous and self-sufficient defence manufacturing ecosystem.

Kishore Jayaraman,
President, Rolls-Royce, India & South Asia

Rolls Royce at Aero India 2019

Aero India is a key event for the aerospace sector, offering an excellent opportunity to meet with many customers and partners. At this year's show, Rolls-Royce is showcasing its technological prowess along with its local partners at the show in Bengaluru.

The Elettronica Group

Advanced electronic and cyber warfare solutions

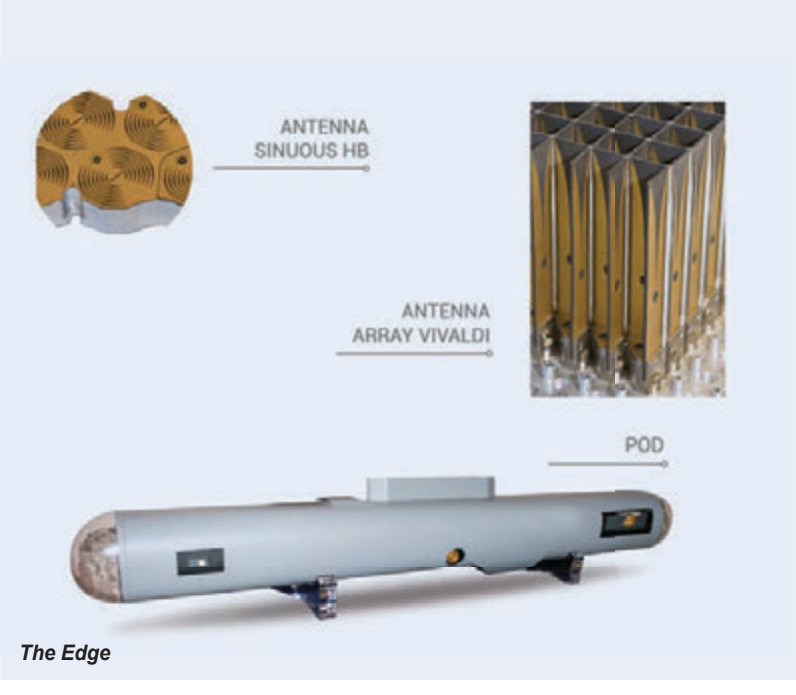
Elettronica Group have been at the cutting edge of electronic warfare for more than 60 years, supplying armed forces and governments of 30 countries with more than 3000 high technology systems. Privately controlled by Benigni's family, with Leonardo and Thales in the shareholders structure, the Group is composed of three industrial assets: 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 all the key modern military platforms such as the Italian PPA, the fighter Eurofighter Typhoon, the NFH-90 helicopter, the Italian and French warships *Horizon* and FREMM, and a wide range of projects in the Gulf, Middle East and Asia.

In a recent collaboration, Elattronica has tied up with Indra of Spain for the first next-generation, fully European self-protection infra-red solution, to defend any type of airborne platforms, from helicopters to transport/tankers to jets fighters, from heat-guided missiles (MANPAD). The solution, named EuroDIRQM (Direct InfraRed Countermeasure) reflects its European roots and the use of a new technology -the Quantum Cascade Laser (QCL), is the latest development in laser technology that represents a step forward from conventional semiconductor lasers. The EuroDIRQM solution will bring together about 30 years of combined experience in the DIRCM field by the two companies. MANPADS are today the main cause for military aircraft losses in conflict scenarios representing an international threat and a global concern due to their proliferation and their use by terrorist groups.

In addition to MANPADS, new military and security challenges are arising globally in the form of new and lethal threats, and one of them is the massive growth in the use of drones. ADRIAN (Anti-Drone Interception Acquisition and Neutralisation) is an advanced anti-drone system dedicated to the protection of critical infrastructures and public areas during open events and civil airspace from hostile mini and micro drone threats. The company is already working with the Italian Air and Land Forces for the supply of this anti-drone system and with a country in the Middle East.

The company also offers the EDGE, the new Escort Jamming solution for airborne applications based on a high level of electronic and mechanical innovation. An autonomous pod configuration designed to increase the survivability and success of attacking airborne forces with unique performances and installation capabilities. EDGE's functions are designed to create a safe corridor for multiple mission aircraft. It's embedded ELINT features and networking capabilities enhance situational awareness, intelligence collection and advanced jamming countermeasure against new 3-D radars. Elettronica is the co-design authority of the Praetorian self-protection system in wing-tip-pod configuration on board of the Eurofighter Typhoon platform, that allows the aircraft to dominate the electromagnetic scenario by automatically responding to air-to-air and surface-to-air threats.



The Edge

Rafael celebrates over 20 years of activity in India

Spyder in Indian Air Force service

Rafael Advanced Defense Systems Ltd. is participating here at Aero India 2019. The company has a rich history of collaboration with India's defence industries, resulting in multiple Joint Ventures, subsidiaries, as well as fruitful information sharing. These partnerships have led Rafael to make significant investments in infrastructure, production facilities and R&D in the country through its 'Make in India' initiative. With a legacy of 70 years, Rafael Advanced Defense Systems Ltd. designs, develops, manufactures and supplies a wide range of state-of-the-art defence systems for air, land, sea and space and cyber defence for the Israeli Defence Forces and its defence establishments, as well as for international customers.

Solutions being exhibited at Aero India 2019 include:

SPYDER - a quick reaction, low-level surface-to-air missile system designed to counter aerial threats. The system provides effective protection for valuable assets, as well as excellent defence of forces located in the combat zones. SPYDER incorporates Rafael's most advanced, operationally-proven performance air-to-air missiles: the Derby MK3 active radar (RF) missile and Python-5, a dual waveband Imaging Infra-Red (IIR) missile.

C-DOME – an operational naval area defence system designed to effectively protect combat vessels against a large set of modern threats, using the combat-proven Iron Dome interceptor.

PYTHON-5 - a fifth-generation air-to-air missile that provides full-sphere launch capability for pilots engaging enemy aircraft. The missile can be launched from very short to Beyond-Visual Ranges, with high kill probability, excellent resistance to countermeasures, including against evasive targets**.**

Derby Mk III - an active radar air-to-air missile that provides fighter aircraft with outstanding and effective performance in both short ranges and Beyond Visual Range (BVR) intercepts. The missile enables operational flexibility with multi-shot capability. The Derby Mk III incorporates an innovative RF seeker combined with a dramatic increase of kinematic performance.

SPICE Family - Rafael's family of stand-off air-to-surface gliding bombs, based on the electro-optical scene-matching technology for precise hits at ranges up to 100 km.

SPIKE Family – Rafael's family of advanced electro-optical guided missile systems. The SPIKE Family consists of: SPIKE SR (Short Range), light shoulder-launched fire-and-forget up to 1.5 km; SPIKE MR (Medium Range), fire-and-forget up to 2.5 km; fifth generation SPIKE LR2, with fire-and-observe and updated capabilities up to 5.5 km; SPIKE ER2 (surface-to-surface) with standoff ranges of 10 km and rotary-launch standoff up to 16 km; and SPIKE NLOS, a precision guided missile with excellent standoff range of up to 30 km.

IMILITE - Multi-Source, Multi-Task Imagery Exploitation System that receives, processes, and exploits multiple standalone imagery video and other intelligence data in a centralised and a unified manner.

RECCELITE – real-time airborne reconnaissance system for low and medium altitudes. The system consists of an airborne pod, a wide-band digital data link, and a ground exploitation station. The pod is a self-contained, self-cooled multi-sensor modular system.

LITENING 5 is a new generation navigation and targeting pod, featuring advanced high-resolution sensors for effective stand-off identification and targeting.

DRONE DOME - Drone Dome is designed to detect, track, and neutralise drones either by jamming their communications or destroying them using a laser beam. Drone Dome has 360-degree coverage, very fast response-time, causes minimal collateral interruptions to the surrounding urban environment, and offers maximum safety to friendly aircraft.

BNET is a Broadband MANET IP Software-Defined radio for ground and air applications.

Global Link – a power data link solution, based on over 15 years of deploying state-of-the-art communication systems to major air forces. It supports simultaneous, robust data, as well as voice and video services with multiple auto relays. The Global Link system supports ease of use with high automation based on advanced MANET algorithms, reducing soldiers' workload, and avoiding the need for cumbersome and restrictive network planning.

BSAT - specifically characterised, developed, and tested to provide a Satcom response to the operational needs of tactical forces.

Spyder system on display at New Delhi recently

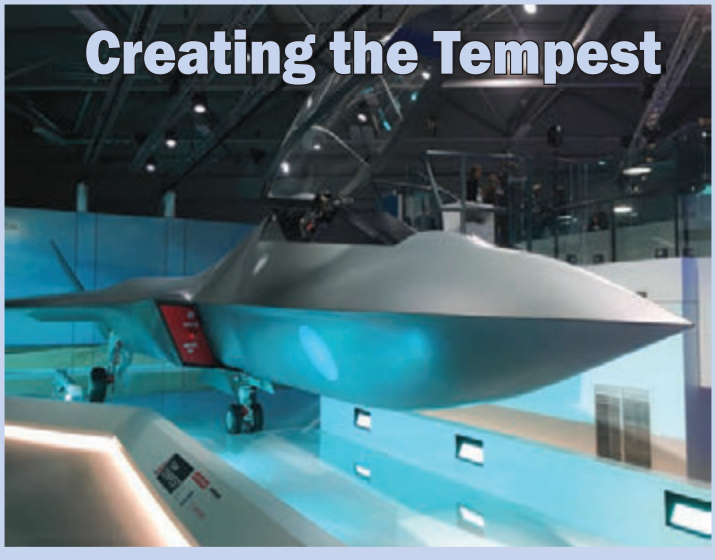
MBDA's Meteor BVRAAM

Every pristine combat aircraft must perforce have modern weaponry for execution of missions. It is prudent to deduce that selection of Dassault Rafale multi-role strike aircraft for the Indian Air Force (IAF) was at least partially influenced by the platforms MBDA Meteor Active-Radar Homing (ARH) Beyond Visual Range Air-to-Air Missile (BVRAAM) with its 80+ nautical miles range to provide an ultra-long range interception capability against fighter-sized targets, critical in attaining "first look-first shoot-first kill" capability. Besides fulfilling the interceptor role for "outer-air battles", the IAF is faced with a proliferation of BVRAAMs in its 'neighbourhood' including Raytheon AIM-120C-5 variant of AMRAAM in Pakistan Air Force (PAF) service.

A 3.65-metre long, stealthy, low drag, lightweight (185-kg) BVRAAM design from MBDA's stable, the 80+ nautical miles ranged Meteor with a more linear velocity profile is designed as a complete unit, requiring no assembly and maintenance immediately before loading. It is designed to be compatible with AIM-120 type rail and eject launcher systems. Born out of the multi-national Project S225X examining the future BVRAAM technologies and designed for a network-centric warfare (NCW) environment, the Meteor has a data-link capability to be guided not only by the launching aircraft but also by another fighter or even by Airborne Early Warning & Control (AEW&C) platforms. The extended range/enhanced kinematics is ensured by Meteor's solid Boron fuelled Variable-Flow Ducted Ram-rocket (VFDR) propulsion system, also referred to as Throttle-able Ducted Rocket (TDR), supplied by Bayern-Chemie, along with a speed of more than Mach 4 and high terminal velocity.

The Meteor is capable of autonomously engaging wide range of airborne targets, including cruise missiles with less than 1-metre square RCS. For mid-course navigation guidance, Meteor utilises Inertial Navigation System (INS) combined with update commands provided by the launch, or any friendly aircraft via the two way secure microwave data-link, to adequately offset Identification Friend or Foe (IFF) complexities or challenges at long ranges. The two way data-link, additionally allows the launch platform to provide updates on targets or re-targeting when the missile is in flight.

Sayan Majumdar



Creating the Tempest

On 16 July 2018, opening day of the Farnborough International Air Show 2018, in presence of British Prime Minister Theresa May, the UK 'future fighter' concept was unveiled, seen as a major milestone in its approach to develop a 6th generation fighter through international cooperation. As an integral part of the UK's 'Combat Air Strategy' paper, the core 'Tempest Team' will comprise BAE Systems, Rolls Royce, Leonardo and MBDA along with the UK's defence equipment and support agency and the RAF rapid capability office to develop a twin-engine, delta-winged, low-observable fighter. To be known as the *Tempest,* the future fighter will eventually supplant the present Typhoon and operate alongside F-35 Lightning IIs.

There are reports that BAE Systems may offer India involvement in the Tempest programme.

advanced high capacity computer system, and state-of-the-art cockpit provides the warfighter with intuitive situational awareness and capability now and far into the future.

The fighter is highly capable across the full mission spectrum and is a true multi-role 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 defenses, 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 missions.

Boeing has also completed extensive analysis and testing on 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.

One Fighter, Many Benefits

Boeing has had a presence in India for more than seven decades and is committed to expanding its partnership by producing Super Hornets in India and thereby further developing India'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 the best aircraft to launch 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 learned 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 for its armed forces, and pursuing the joint development of future technologies.

Boeing's partnership with HAL and Mahindra will enable it to optimise the full potential of India's public and private sector to deliver next-generation F/A-18 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 defense 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

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The Aeronautics Orbiter 4 STUAS/NSUAS

"Most advanced UAV of its kind"

Having an endurance of more than 24 hours with a maritime version, Aeronautics newest UAS is the Orbiter 4 STUAS/NSUAS, an advanced multi-mission platform with ability to simultaneously carry and operate two different payloads. Orbiter 4 continues evolution of the Orbiter family and the Small Tactical UAS, and delivers "top mission performance with the lightest, most versatile, and is the most advanced covert platform available today ideal for both land and maritime operations".

Based on the aerodynamic structure and properties of the Orbiter 3 STUAS, performance of the Orbiter 4 gives maximum endurance of more than 24 hours, with maximum takeoff weight of 50 kg, maximum flight attitude of 18,000 feet and the ability to operate two different payloads simultaneously.

With its Advanced Image Processing Capabilities, automatic takeoff and recovery system and ability to navigate with, and without GPS and datalink, the Orbiter 4 delivers similar capabilities as other tactical platforms operational today, but with better endurance, serviceability, operational flexibility and cost-effectiveness. Operated by 3 personnel, the Orbiter 4 is easy to use and maintain, and carries a low logistical footprint.

According to Amos Mathan, CEO Aeronautics, "the Aeronautics Group provides comprehensive aerial solutions consisting of several integrated platforms. These 'system of systems' solutions are ideal for the most advanced Defense Para-military and HLS missions. With our latest development, the Orbiter 4 STUAS, Aeronautics group is – as always - one step ahead".

Aeronautics Ltd is an Israel-based defence solution provider and a world leading developer and manufacturer of Unmanned Aerial Systems focusses on the Mini, Tactical, and MALE UAS categories. Since its establishment in 1997, the Company's products have been delivered and successfully deployed by over 50 defence, military and homeland security forces on five continents.

Aeronautics Ltd, are a leader in the development, manufacture, and marketing of state-of-the-art unmanned systems for land, sea and air, integrating surveillance equipment with network information. As a specialist in the field of unmanned Intelligence, Surveillance, and Target Acquisition and Reconnaissance (ISTAR), Aeronautics in-house vertical integration capabilities facilitate rapid delivery of tailored turnkey solutions to its customers.

With its subsidiaries, Commtact, Zanzottera, Controp, RT, PoziDrone and CP Tech, the Aeronautics Group offers a 'one-stop shop' for cost-effective solutions for defence and HLS missions.

Courtesy: Aeronautics

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Flight tests of the MC-21-300 airliner

The MC-21-300 test aircraft has carried out maiden night landing while undergoing flight tests at the Flight Test Institute named after MM *Gromov*. The functioning of navigation and landing, as well as external lighting equipment was checked during flight. For instrument testing of its systems, the aircraft carried out several passes over the runway from two directions at various altitudes. "The flight mission was accomplished successfully and all systems operated properly."

Currently, two MC-21-300 test aircraft are undergoing flight tests, while a third aircraft is on static tests at TzAGI. Three more MC-21-300 test aircraft are under construction at Irkutsk Aviation Plant, a branch of Irkut Corporation (part of UAC), two of which will join the flight tests programme while the third aircraft will be subjected to endurance tests at TzAGI.

EASA flight test team participates

Two test pilots and a flight test engineer of the European Aviation Safety Agency (EASA) completed training procedures and obtained Russian permission to fly as part of certification campaign of the MC-21-300. In first stage of training, the EASA specialists studied the MC-21-300 design and Flight Crew Operation Manual. Procedures performed on the simulators and test benches included take-off, approach and landing using both landing systems and visual approaches; handling qualities and controllability characteristics of MC-21-300 aircraft in various control modes within the entire range of admissible operating altitudes, speeds, weights and centres of gravity; actions in case of emergency and approaching high angles of attack, when the stall warning activates.

On completion of theoretical and simulator training, EASA specialists performed familiarisation flights to gain familiarity with the basic characteristics of the stability and controllability of the aircraft, landing approach and go around procedures, including simulation of one engine failure.

The new Russian short-medium range, narrow-body MC-21 commercial aircraft is being certified in accordance with both Russian and foreign standards. The application for type certificate of MC-21-300 aircraft was submitted to EASA in August 2016. MC-21 validation is currently underway in 18 panels, established jointly with EASA.

HAL's LUH in High-altitude Cold Weather Trials

The Light Utility Helicopter (LUH) achieved an important milestone of flying at 6 km altitude in Bengaluru recently. The helicopter was flown by Chief Test Pilot Wg. Cdr. (Retd) Unni K Pillai and Test Pilot, Wing Cdr (Retd) Anil Bhambhani. The flight was carried out under the envelope expansion tests and flying at 6 km altitude is a critical requirement towards the certification of LUH. The helicopter exhibited satisfactory performance and handling qualities. With the completion of this milestone, LUH can now undertake high altitude cold weather trials planned in early 2019.

The LUH is a 3-ton class new generation helicopter designed and developed by Rotary Wing Research and Design Center (RWR&DC) of HAL to replace the ageing Cheetah and Chetak helicopters used by Indian Armed Forces. First flight of LUH PT-1 was carried on 6 September 2016 and the second prototype flew on 22 May 2017. HAL has in principal order for 187 LUH that includes 126 for Indian Army and 61 for IAF.

The LUH is being indigenously developed by HAL to meet the requirements of both military and civil operators. The helicopter with glass cockpit can be deployed for reconnaissance, surveillance roles and as a light transport helicopter. The helicopter will be capable of flying at 220 kmph, with a service ceiling of 6.5 km and a range of 350 km with 400 kg payload. The LUH is powered by TM/HAL Ardiden 1U/Shakti 1U single turbo shaft engine with sufficient power margins to cater to demanding high altitude missions.

Light Utility Helicopter PT3 joins programme

Soon after flying at 6 kms altitude recently, the Light Utility Helicopter (LUH) project gathered momentum as the third prototype (PT3) made its maiden flight on 14 December 2018. The LUH was flown by Test Pilots, Wg Cdr (Retd) Anil Bhambhani and Gp. Capt (Retd) M R Anand V M. The flight was flawless and this prototype would augment development flight testing in conjunction with other two prototypes towards Certification. Based on the feedback from flight testing of PT1 and PT2, PT3 is built to the standard of deliverable configuration.

Mr. R Madhavan, CMD-HAL stated, "with this achievement, LUH is now close to production clearance and HAL is confident of meeting requirements of the Armed Forces". The successful completion of first flight of third prototype of LUH is a quantum leap and will soon replace the ageing fleet of Cheetah/Chetak, stated Arup Chatterjee, Director (Engg., R&D) HAL.

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Lockheed Martin meets 2018 F-35 Production Targets

Lockheed Martin delivered its 91st F-35 aircraft in 2018, meeting the joint government and industry delivery target for the year and "demonstrating the F-35 enterprise's ability to ramp to full rate production." The 91 deliveries in 2018 represent nearly a 40 percent increase from 2017 and about a 100 percent production increase compared to 2016.

In 2019, Lockheed Martin is set to deliver more than 130 F-35s, representing yet another 40 percent increase in production. The 91st aircraft is a US Marine Corps F-35B, delivered to Marine Corps Air Station Beaufort, South Carolina. In 2018, deliveries included 54 F-35s for the United States, 21 for international partner nations and 16 for Foreign Military Sales customers. By end 2018, more than 355 F-35s had been delivered and are now operating from 16 bases worldwide. More than 730 pilots and over 6,700 technicians were trained and the F-35 fleet has surpassed more than 175,000 cumulative flight hours. Ten nations are flying the F-35, seven countries have F-35s operating from a base on their home soil, four services have declared Initial Operating Capability, and two services have confirmed that their F-35s have been employed in combat operations.

UK to double its F-35 inventory....

.... and add to the economy

The UK is set to double the number of F-35 stealth fighters after ordering 17 more aircraft. Defence Secretary Gavin Williamson announced that 17 new F-35B aircraft will be delivered between 2020 and 2022 and will complement the 16 British aircraft currently based at RAF Marham and in the US, as well as two additional aircraft which are already on order. Overall, the UK has committed to procure 138 F-35s over life of the programme. The 17 new aircraft being ordered are part of a $6 billion contract for 255 aircraft being built for the global F-35 enterprise.

The announcement also impacts on the economy, with British companies building approximately 15% by value of all 3,000-plus F-35s planned for production. It is projected that around £35 billion will be contributed to the UK economy through the F-35 programme, with around 25,000 British jobs also involved.

The MQ-9B SkyGuardian & SeaGuardian

Building on a Legacy of Persistent Maritime, and Overland ISR

General Atomics Aeronautical Systems, Inc. (GA-ASI) is the leading designer and manufacturer of proven, reliable Remotely Piloted Aircraft (RPA) systems, radars, and electro-optic and related mission systems. Over its more than 25 year history, GA-ASI has built 23 different variants of unmanned aerial vehicles (UAVs) that have flown over five million flight hours, with 90 percent of those being combat flight hours. GA-ASI's most recent and most advanced RPA variant is the MQ-9B SkyGuardian/ SeaGuardian.

MQ-9B builds on the legacy of all previous aircraft produced by GA-ASI and is truly remarkable in many ways. Incorporating a GA-ASI developed Detect and Avoid (DAA) system, it is the world's only fully-airspace integrated RPA/UAV that can be certified to fly in controlled and international airspace. This is the result of a five-year, company funded, development programme to deliver an RPA/UAV that can meet the stringent airworthiness type-certification requirements of various military and civil authorities. The MQ-9B's DAA system consists of a Due Regard Radar (air-to-air radar), coupled with a Traffic alert and Collision Avoidance System (TCAS) and Automatic Dependent Surveillance-Broadcast (ADS-B),

In 2017, the MQ-9B development aircraft set an endurance record for GA-ASI aircraft when it flew for more than 48 consecutive hours. This unprecedented level of endurance enables the MQ-9B to provide persistent Intelligence, Surveillance, and Reconnaissance (ISR) at a significantly lower cost than manned aircraft. In addition, the MQ-9B has a range of over 6,000 nm and is equipped with nine hard-points for sensor or weapons carriage with over 4,000 lbs. of available payload.

To commemorate the Royal Air Force's (RAF) centenary celebration (RAF100), GA-ASI's MQ-9B completed the first-ever trans-Atlantic flight of a Medium-altitude, Long-endurance (MALE) RPA. The MQ-9B flew from Grand Forks, North Dakota to RAF Fairford in Gloucestershire, UK, covering 3,760 nautical miles in 24 hours, and landing with 40 percent fuel reserves. In 2017, GA-ASI and the RAF marked the 10-year anniversary of RAF MQ-9 operations that coincided with the RAF completing 100,000 flight hours with its Reaper force. The RAF is acquiring MQ-9B SkyGuardian as part of its Protector RG Mk1 programme.

To date, GA-ASI has delivered over 850 aircraft, more than 300 GCS, and its aircraft operate worldwide. Every second of every day, there are 69 GA-ASI-delivered RPA airborne worldwide.

Developed to fly in civil airspace, MQ-9B provides persistent situational awareness across vast maritime domains. It does this without putting aircrew at risk and at a significant cost effectiveness over manned aircraft alternatives. Interoperable with NATO, its multi-mission capability makes it a valued asset in a variety of scenarios – from environmental protection, to Humanitarian Assistance/ Disaster Relief (HA/DR), to Maritime Domain Awareness (MDA), to Search and Rescue (SAR) overland and overwater Intelligence Surveillance and Reconnaissance. (ISR).

Courtesy: GA–ASI

Saab IDAS self-protection systems to counter complex threats

Saab have been delivering the IDAS self-protection suite to Hindustan Aeronautics Limited (HAL) for the Indian Army´s Dhruv ALH fleet. Electronic warfare (EW) self-protection systems for airborne environments are faced with a wider variety of threats. The latest Compact Integrated Defensive Aids Suite (CIDAS) developed by Saab in South Africa protects aircraft against a broad variety of airborne threats, including man-portable air defence systems (MANPADS) and laser-based threats, many of which are encountered in the current prevailing peace keeping environment.

IDAS-3 is the high-end system that can be configured with laser and missile approach warning, as well as the full multi-spectral detection capability for radar, including a DRx digital receiver as an option. This comprehensive EW data management system offers exceptional performance cost-effectively. Modular flexible architecture allows tailoring of the system to user requirements with any of the sensor types. Multiple interfaces (Ethernedt, MIL-STD 1553B, ARINC 429, RS 422 and RS 485) and low box count allow for easy installation in helicopters, transport aircraft and fighters.

The IDAS system protects crew by enhancing platform survivability in sophisticated, diverse and dense threat environments, providing timely warning against radar, laser and infrared guided threats and automatically deploys the appropriate countermeasures. The system is fully integrated with BOP-L, Saab's new advanced lightweight countermeasures dispensing system. The BOP-L family of advanced countermeasures dispensers offer superior system integration and levels of protection for helicopters and fixed-wing transport aircraft.

Flexible configuration and low weight, in conjunction with high performance, makes BOP-L the preferred choice in new and retrofit installations. Its dispensers are controlled via a fully integrated Chaff and Flare Dispenser Controller printed circuit board housed in an Electronic Warfare Controller (EWC), which allows for automatic dispensing under the control of the EWC upon threat identification, as well as semi-automatic and manual firing capability. User-defined dispensing techniques can be selected by the EWC per identified threat, and the dispensing techniques can be defined in the threat library for the EWC and uploaded to the system on the flight-line.

IDAS has achieved outstanding operational success with a growing list of customers in Europe, Asia, Africa and the Middle East. The product is in operational use in many countries on helicopters, commercial transport aircraft as well as fighter jets. In 2017, Saab received an order from Airbus Helicopters for integrated EW self-protection systems for H225M Caracal multi-role utility helicopters. Production of the IDAS self-protection system began in the same year at Saab's manufacturing facility in Centurion, South Africa, with deliveries scheduled for 2020.

In 2018, Saab received a follow-on order from Hindustan Aeronautics Limited (HAL) for the IDAS self-protection suite for the Indian Army's Dhruv helicopter. The order includes the IDAS and the production will take place at the Centurion facility with delivery to be made during the course of 2019. The system has a long and successful history with proven capability on many airborne platforms such as the Saab 2000, Agusta-Westland A109, Super Lynx 300, Boeing CH-47 Chinook, Denel Rooivalk and Oryx, Eurocopter Cougar, Puma and Super Puma, NH Industries NH90, C-130 and L100 Hercules, Sukhoi Su-30MKM.

Deliveries are ongoing for the HAL Dhruv Advanced Light Helicopter.

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The EJ200: Why would you want anything less?

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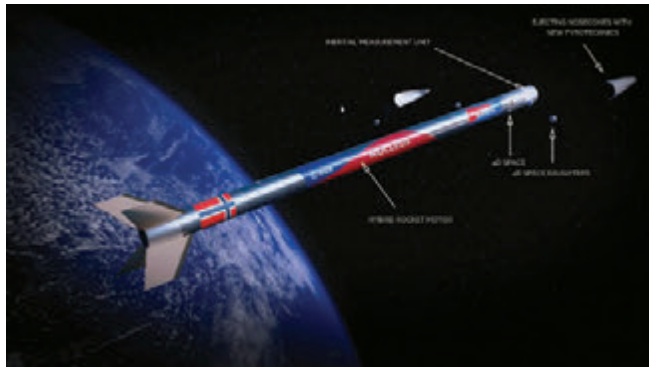
NAMMO's 'Nucleus' in first launch

On 27 September 2018, Nammo successfully carried out the first launch of *Nucleus*, a sounding rocket powered by its new hybrid rocket motor. *Nucleus* was launched from the Andøya Space Centre in Northern Norway, and reached an altitude of 107.4 km. That made it not only the first rocket powered by a Norwegian motor design to cross the Karman line, the commonly recognised border to space, but also the first European hybrid rocket motor to do so in more than 50 years.



The Hybrid Rocket Motor powering the *Nucleus* has been developed by Nammo at Raufoss in Norway, and could potentially power a whole new generation of smaller European launch vehicles.

Nucleus is a sounding rocket, designed to lift scientific instruments into the upper layers of the atmosphere. The hybrid rocket motor propelling it, however, can be scaled up to lift a wide range of payloads, including small satellites into low earth orbit. "For this specific flight, *Nucleus* carried 3 technical experiments aloft. The most important one was the ASC/UiO 4D-SPACE module loaded with its 6 'daughter' payloads. During flight, the 'daughters' were released 2 at a time when the rocket passed 60 km altitude. They measured small-scale plasma structures and transmitted data back to the main 4D-Space module. In addition, we also tested a newly ASC developed pyrotechnical system and an inertial unit (IMU) from Sensonor AS", said Kolbjørn Blix, Director of Space Systems at Andøya Space Centre.

Nammo is hoping that the new propulsion technology demonstrated with *Nucleus* will be able to power future launch vehicles for small satellites. "Over the next few years, there are plans to launch thousands of small satellites." The benefit of our new hybrid rocket motor is they can lift them into orbit with the accuracy of a liquid fueled engine, but without the associated complexity and costs, making it ideal for smaller European launch sites," stated Onno Verberne, Nammo's VP of Business Development for space.

Presently, just a select few nations – Russia, India, China, USA, France and Japan – have the capacity to build launch vehicles for satellites and send them into space from home bases. If the technology demonstrated in the *Nucleus* is successful, Norway has the potential to join them.

The *Nucleus* rocket is 9 metres long with a total weight of around 800 kg. The motor gives a thrust of 30 KN (3 tons) but planned future version of the engine would give 75-100 KN of thrust.

Norwegian Prime Minister in India

Prime Minister of Norway Erna Solberg was in New Delhi on a three day state visit to India in early January 2019. Talks were held with Prime Minister Narendra Modi on a host of issues so as to expand the multi-faceted bilateral partnership. The Norwegian Prime Minister also delivered the inaugural address at the Raisina Dialogue and addressed India-Norway Business Summit during her stay at New Delhi.

MBDA capabilities demonstrated

The 5th Generation MMP

Some 15 foreign delegations, as well as representatives of the European Defence Agency (EDA) and the NATO Support and Procurement Agency (NSPA) recently witnessed the

full range of capabilities of MBDA's 5th generation MMP *(Missile Moyenne Portée)* ground combat missile during live firing demonstrations. This demonstration took place in two phases: a dynamic phase, in which international representatives watched three firings conducted by the French Army Technical Section (STAT) and a static phase, based on presentations and workshops making use of standard operational equipment for simulations, training and support.

Marte ER missile success

MBDA's Marte ER anti-ship missile has completed its first firing, successfully passing a major phase in its development. The firing trial was carried out at an Italian test range where the Marte ER missile flew for more than 100 km on a planned trajectory that included several waypoints and the sea skimming flight, successfully testing all flying phases. Pasquale Di Bartolomeo, Executive Group Director Sales & Business Development and Managing Director MBDA Italia, commented: "This test is further confirmation of the robustness of the ER version of the Marte family of multi-platform anti-ship missiles that can be launched by ships, helicopters, coastal batteries and fast jets. The Marte family has a strong and successful history both at domestic and international levels, most recently with Marte ER being ordered earlier in 2018 by the Qatar Emiri Air Force (QEAF) for their new NH90 helicopters."

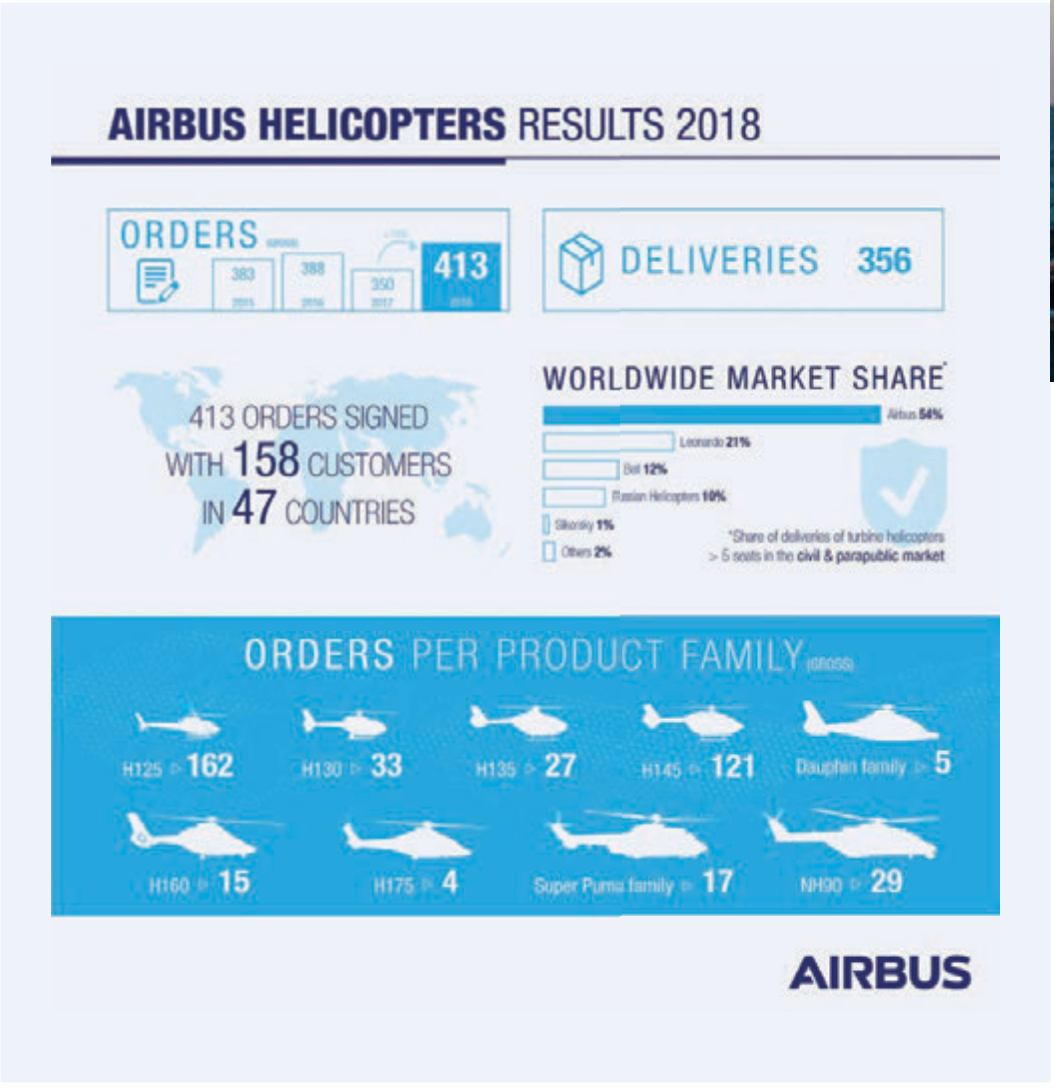
Sea Venom-ANL missile trials

MBDA's Sea Venom-ANL anti-ship missile has successfully conducted further firing trials, passing a significant new milestone for the Anglo-French co-operation programme. This latest trial demonstrated the Sea Venom-ANL's lock on before launch (LOBL) capabilities, with images from the missile's infrared seeker being used by the operator to designate the target prior to launch. The Sea Venom-ANL is capable of being launched from a wide range of platforms, and will be used on the UK Royal Navy's AW159 Wildcat and French Navy future HIL *(Hélicoptère Interarmées Léger)* helicopters.

Maintaining the lead Airbus Helicopters sales in 2018

Airbus Helicopters delivered 356 rotorcraft and recorded gross orders for 413 helicopters (net: 381) in 2018 (up from 350 gross orders in 2017), maintaining their lead in the civil and parapublic market while reinforcing its position in the military market, having notched key successes in international campaigns. The company also booked 148 orders for light twin-engine helicopters of the H135/H145 family and secured 15 orders for the next-generation H160. At the end of 2018, the overall delivery backlog increased to 717 helicopters.

"Our commercial performance in 2018 demonstrates the resilience we have developed as a company to help us navigate what remains a challenging environment," said Bruno Even, CEO Airbus Helicopters. "Even though the civil and parapublic market remains at a low level worldwide, we have maintained our global leadership, thanks to our wide and modern portfolio of products and services and our international footprint. Meanwhile, we have increased our market share in the military sector by securing major contracts with leading armed forces worldwide, with best-in-class solutions. These positive trends give us the means to prepare the future and continue our transformation, with innovation at our core and customer loyalty at heart."



In 2018, Airbus Helicopters delivered the first of 100 H135s for China at Qingdao, where a dedicated final assembly line will serve the growing demand of the Chinese market for civil and parapublic helicopters. Meanwhile, the Hong Kong Government Flying Service took delivery of the first H175s in public services configuration.

The year 2018 also saw successes for the Super Puma family which demonstrated its versatility by being selected in key military campaigns, while attracting new civil and parapublic customers with re-configured H225s previously operated on the oil and gas market. Likewise, 2018 proved to be a very positive year for the NH90, which attracted orders for 28 units in Qatar while being selected by Spain for a follow-on order for 23 units.

Various programme milestones were achieved in 2018, including the power-on and ground testing of the CityAirbus electric vertical take-off and landing (eVTOL) technology demonstrator, with its maiden flight expected in early 2019. The first H160 in serial configuration entered flight trials in 2018, while the VSR700 unmanned aerial system demonstrator carried out its first unmanned flights at the end of the year.

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‘Ship-based’ Ka-226T helicopter presented at Aero India 2019

Russian Helicopters are presenting the ‘ship-based’ Ka-226T helicopter at Aero India 2019 . Indian authorities are already familiar with the ‘land-based’ version of this helicopter and as part of the ‘Make in India’ programme, the Ka-226T helicopter will be manufactured by the Indo-Russian joint venture to serve requirements of the Indian Air Force and the Indian Army.

The light utility helicopter Ka-226T has a coaxial twin-rotor system, its maximum takeoff weight is 3.6 t, and it is able to transport up to 1 t of payload. The modular design is a distinctive feature of the rotorcraft. A transport cabin that can carry up to 6 people (or modules with special equipment) can be easily installed on the Ka-226T helicopter. “Improved performance characteristics of the Ka-226T helicopter, its environmental-friendliness, cost effectiveness, advanced avionics and additional flight safety solutions make this machine one of the best models in its class”.

Two powerful engines provide for a high safety level of the helicopter, very important when the helicopter is operated at sea. The ship-based version of the helicopter has a rotor blade folding system. Besides, the helicopter is equipped with a state-of-the-art avionics suite, and all its parts and systems are designed for operation in the harsh marine environment. Due to its small size, the helicopter can be positioned on ships and small displacement vessels. The ship-based Ka-226T helicopter can be used for search-and-rescue and transport missions day and night both in favorable and adverse weather conditions.

In the spring of 2018, the ship-based Ka-226T helicopter was demonstrated to the members of an Indian delegation during their visit to the Kamov Design Bureau. The helicopter was demonstrated as part of the tender for the supply of 111 light multi-purpose helicopters for the Indian Navy announced by the Indian government. It is expected that these helicopters will be used for search-and-rescue, humanitarian, observation and counter-terrorism operations, and will serve as guidance for naval weapon systems.

Safran and the Indian Defence Sector

Safran maintains a very long association with the Indian Army, 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 Shakti designation, 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 in 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, and 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

Safran to Power the Bell Nexus

The first application of the Safran Hybrid-Electric Propulsion System (HEPS) on the Bell Nexus, has been officially unveiled at the Consumer Electronics Show (CES) in Las Vegas. The propulsion solution of this multi-rotor vertical take-off and landing (VTOL) aircraft is capable of producing more than 600 kWe power. HEPS works by distributing thermal and/or electrical energy, depending on the phase of flight, to multiple rotors. It comprises three sub-systems: electric generation that relies on a turbo-generator and batteries, electric power management and the electric motors that generate lift and propulsion.

Aequs and India's potential

Ramping up machining capacity for the aerospace industry

Machining Facility at Aequs

The global machining industry has witnessed remarkable growth over the years with several dynamic forces like technological advancements, escalating global demand and automation, supporting such progress. As a key sector which contributes to the mammoth manufacturing industry, there is significant potential for continual growth, taking into account the steep increase in demand for machined parts globally across sectors, based on a recent report by Deloitte.

The Indian machining sector has primarily been supporting the automotive industry so far. Considering the massive need by aircraft and parts OEMs for machined parts owing to the burgeoning demand for military and commercial aircraft globally, especially in the Asia-Pacific, Middle East and Latin America, there is immense opportunity for suppliers who have the capacity to absorb large orders and capability to deliver them flawlessly. However, this opportunity is not without its challenges.

In the aerospace industry, accountability, traceability, documentation and quality of parts are of critical importance. Suppliers catering to the sector need highest industry accreditations to meet stringent quality and safety regulations of aerospace manufacturing owing to the profound effect each part has on safety. This may lead to entry barriers for new entrants as the entire process can be both time-consuming and capital intensive. Fortunately,

Aravind Melligeri, Chairman & CEO, Aequs Group

in India, with the backing of the government in terms of regulatory support and infrastructure development, the country is on a 'hyper drive' to turn into an aerospace manufacturing hub for global players.

The "India opportunity"

India has the potential to become one of the largest commercial and defense aircraft markets. While mature markets are shifting their focus away from civil and defense spending, India is showing multi-fold increase in demand with rising air passenger traffic and increasing military procurement. India's liberalisation of civil aviation policies, offset requirements, cost advantages and a liberal Special Economic Zone law – providing attractive fiscal benefits for developers and manufacturers – are making the country an attractive destination for aerospace OEMs.

The country also has a strong framework to contribute to the resources in this sector such as research & development, the ability to leverage IT competitiveness in engineering services and manufacturing expertise. With a well-educated talent pool, India is ready to contribute to the global A&D sector. A competitive market ensures innovation and creative growth, encouraging more players to invest and optimise the manufacturing process. Based on a report by PwC, "the total offset opportunity for the aerospace sector is valued to be at least US $ 10-15 billion." As India keeps honing its capabilities, with time a large share of this opportunity can be exploited by Indian suppliers. With the inclusion of both public and private players in the sector, India is fast becoming a diverse and creative environment for growth of the A&D sector.

With the inclusion of more aerospace players in this sector, the demand for machined parts shall continue to rise with time. This is good news for India which is in the cusp of building its indigenous supply chain base.

Machined to perfection

Although India has a strong domestic manufacturing base and has always had sufficient capacity to produce low cost components due to labour arbitrage and abundance of resources, catering to the aerospace industry requires ramping up in both capacity and capability. Presently, while the government policies are favourable for aviation and defense sectors, private manufacturers, building their precision machining capacity to leverage the demand for machined parts by aerospace OEMs, are under pressure to absorb the long gestation periods and acquire the necessary accreditations to be eligible for order fulfillment.

Fortunately, owing to the present interest of leading international OEMs shifting towards India, Indian companies are able to get access to the latest technologies and capabilities that are turning out to be a major game-changer in the A&D machining sector.

With lowering trade barriers and upskilling of the present talent pool, the drive towards globalisation of the aerospace supply chain has been amplified. With its adoption to newer technologies such as robotics and automation, strategic partnerships with leading aerospace players and government's push in the sector, India has the potential to ramp up its machining capabilities and become a major contributor in the aerospace machining sector.

DRDO: Successful Flight Test of SFDR

Defence Research and Development Organisation (DRDO) of India successfully flight tested the second indigenously developed 'Solid Fuel Ducted Ramjet (SFDR)' propulsion based missile system from ITR, Chandipur, Odisha on 8 February 2019. Ground booster, separation of ground booster and Nozzle-less-booster performance were found satisfactory. Missile was guided to high altitude to simulate aircraft release conditions and subsequently nozzle-less-booster was ignited. SFDR based missile accelerated to achieve ramjet Mach number successfully. The trajectory was tracked by telemetry and radar stations till touchdown. All the mission objectives have been met. The success of SFDR propulsion technology is a significant milestone and will pave the way for development of long range air-to-air missiles in the country.

Boosting Mission Readiness

Boeing and the Indian 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 soon to be inducted AH-64 Apaches and CH-47 Chinooks, Boeing platforms and services are actively aiding the Indian armed forces missions to protect the country's sovereign borders.

Boeing's commitment to deliver capable platforms that meet the Indian armed forces modernisation and mission requirements spans across the present. Our 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 help the Indian Navy and the Indian Air Force modernise their fleets with a fighter that offers true multi-role capability and a distinct combat advantage.

As India expands its air force and increases its defensive capabilities, the KC-46 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. Pegasus is the best choice for today and the decades to come. The brand new KC-46 is designed from the ground-up to be a combat-ready tanker. This means that unlike other tankers, it can operate closer to the fight, covertly and with the ability to protect itself. In India's crowded neighbourhood, it means it can be closer to action to fuel the fight.

Boeing has the right platforms and capabilities to match the evolving mission requirements of the Indian armed forces. Ranging across the entire gamut of strategic airlift, combat operations and Intelligence, Surveillance and Reconnaissance (ISR) roles, Boeing platforms provide warfighters with the capability to dominate combat areas.

A Partnership for the Future: The F/A-18 Super Hornet

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 jet with a defined flight plan to outpace threats into the 2040s. It is highly capable across the full mission spectrum and is a true multi-role 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 defenses, maritime strike, reconnaissance, forward air control and tanker missions.

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 expediential leap in technology needed 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 warfighter with intuitive situational awareness and capability now and far into the future.

(cont'd in Show Daily Day 2, 21 Feb 2019)

Updates from General Atomics

Testing of ATTS at RIMPAC

General Atomics Electromagnetic Systems (GA-EMS) participated in the *Rim of the Pacific Exercise* (RIMPAC) to conduct demonstrations and testing of the Missile Defense Agency's (MDA) Airborne Tracking and Targeting System (ATTS). The ATTS is integrated with an MQ-9B remotely piloted aircraft to generate precision tracks and imagery of targets of interest. The system was employed throughout the RIMPAC exercises conducted near the Hawaiian Islands.

Auto-Land of MQ-9 Block 5 RPA

The USAF has completed the first-ever automated landing of an MQ-9 Block 5 Remotely Piloted Aircraft (RPA), followed by the first auto-takeoff. The new Automatic Takeoff and Landing Capability (ATLC) was developed by General Atomics Aeronautical Systems, Inc. (GA-ASI) to enhance mission capability. By automating the takeoff and landing of the RPA, ATLC increases the safety and efficiency of air crews.

French MQ-9 Reapers over Paris

The French Air Force operated two of its MQ-9 Reapers simultaneously in support of France's Bastille Day events, one over Paris and the second over Cognac. The French Reaper Remotely Piloted Aircraft (RPA) assisted French authorities by providing airborne surveillance during the national celebration, benefitting from permanent corridor

systems connecting all military-dedicated airspace, which enabled the RPA to access restricted areas created over Paris for the Bastille Day celebrations. This MQ-9 Reaper flew over a populated area of seven million people, alongside numerous other military aircraft participating in the flypast.

Testing of MQ-25s HDD

General Atomics have concluded performance testing of the arresting hook Hold Down Damper (HDD) for its proposed MQ-25 unmanned aerial refueling aircraft for the US Navy. GA-ASI worked in collaboration with a team from GKN Aerospace's Fokker business unit in Helmond, Netherlands, who supply arresting hooks for the GA-ASI. The test simulated dynamic conditions providing performance characteristics of the HDD, such as damping, spring rate and pressure control functionality.

Second MQ-9B SkyGuardian flight

General Atomics has carried out flight of its second MQ-9B SkyGuardian Remotely Piloted Aircraft, conducted at Laguna Army Airfield in Yuma Proving Grounds. The second MQ-9B SkyGuardian gives the GA-ASI programme team another aircraft to perform important development testing and demonstrations. New capabilities that were not available when the first prototype was completed in 2016, such as lightning protection, an upgraded avionics and software suite and a de-icing system, have been included as part of MQ-9B's roadmap to become the first RPA certified to fly in civil airspace.

Quarter Century of Air Shows at Yelahanka

Vayu as the official Show publication, 1993-2019

In fact, the very first Air Show in India was *AVIA India,* which took place during 15-18 December 1993 at AFS Yelahanka, north of Bangalore which has now become synonymous with the event. *Vayu Aerospace Review* was official publication partner for this India's first airshow and has remained so, with Special Issues and Show Dailies marking the events over the next quarter century, Aero India 2019 included.

At this very first effort, which was organised by a private company but involved several senior retired IAF officers including the former CAS, some 21 nations and 138 exhibitors participated, including those from the USA, UK, France, Germany, CIS, Israel, Italy, Singapore and Japan. On static display were 30 aircraft, including the first MiG-21-93 (precursor to the MiG-21bison) with the legendry General Designer Academician Rostislav A Belyakov personally present. There were several mockups including that the light combat aircraft, (though still eight years from first flight of the prototype), of the *Akash* SAM, HTT-35, precursor to HALs present HTT-40 basic turboprop trainer and NAL's *Saras.* Interestingly every days flying display was heralded by the Indian Navy's Sea Harriers carrying out their awesome VTOL performance but in contrast, the Indian Air Force chose to remain on ground, a fact rued by many senior (retired) Air Marshals.

Aero India 1996

Obviously, after witnessing such positive response, the Ministry of Defence got enthused into organising an air show by themselves, but by the time all glitches were ironed out, three years were to elapse and the first Aero India show was held in December 1996, also at Yelahanka. Then Prime Minister HD Devegowda inaugurated the event where some 22 countries took part and 62 aircraft were displayed. However owing to lack of infrastructure, including road access to Yelahanka, there were many snarls while crowd control overwhelmed the hapless organisers at the site.

Aero India 1998

Two years on, during 8-12 December 1998, there were 25 aircraft on static display and then Defence Minister George Fernandes with Minister for Civil Aviation Ananth Kumar jointly inaugurating the event. However, most leading companies from America did not participate following the sanctions imposed by the US Government on India following the nuclear tests in May 1998 at Pokharan.

Aero India 2001

With excessive rains during Aero India 1996 and 1998, which played spoilsport, and following advice of the Indian Air Force, third edition of Aero India was shifted to the month of February, since weather would be more conducive for the aerial display, with clear skies expected over Bangalore.

Defence Minister George Fernandes inaugurated the five-day event on 7 February, 2001 with over 150 international companies from 17 countries participating at the Show. The LCA made its long awaited public appearance, flying on third day of the Show, escorted by a Mirage 2000 of the IAF.

Aero India 2003

This took place during 5-9 February and was again inaugurated by Defence Minister George Fernandes, with 176 international companies from 22 countries showcasing their products and services, as also 75 Indian companies. Of the 62 aircraft on display 46 were from Indian Air Force. The Sukhoi Su-30MKI performed its first public aerobatic display and the Show also featured the first formation flying display by the HAL ALH *Dhruv.*

Aero India 2005

This event was inaugurated by then Defence Minister Pranab Mukherjee on 9 February, with 136 Indian and 236 international companies participating. Spotlight was on the four ALH formation display team *Sarang* of the IAF. The NAL Saras made its maiden public display at the event.

There was a feast of flying displays including by the Russian MiG-29K, Su-30MKI and Il-78 tanker; the American F-15E, C-130J Super Hercules and P-3C Orion aircraft; the French Mirage 2000 and Falcon 2000; the British Hawk 100, Jaguar and Sea Harrier and the Swedish Saab JAS 39 Gripen apart from HAL's Dhruv ALH and HJT-36 Intermediate Jet Trainer (IJT).

Aero India 2007

Held on 7-11 February, this edition had some 70 aircraft on static display with 30 carrying out flight demonstrations. This Show also marked Platinum Jubilee of the Indian Air Force, with a specially painted Su-30MKI highlighting the occasion. Sweden's Saab sent three Gripens to participate at Aero India 2007, two twin-seater JAS-39Ds and a single seater JAS-39C. Other attractions were the Lockheed-Martin F-16 and the Boeing F/A-18E/F Super Hornet, all contenders to meet the Indian Air Force's 126 aircraft MMRCA requirement.

Aero India 2009

AERO INDIA 2009
"Asia's Premier Air Show"

This Show over the days 11-15 February, provided a platform for 289 Indian and 303 international companies from 25 countries to display their products. There were 70 aircraft on static display while 30 aircraft took part in the flight display, the Eurofighter Typhoon making its flying debut in India. Aero India 2009 also witnessed the biggest US participation till date, the contingent including the F-16 Fighting Falcon the F/A-18 Hornet, the C-17 Globemaster III, the C-130J Hercules and the KC-135 Stratotanker.

Aero India 2011

This Show, which was from 9 to 13 February, witnessed perhaps the largest number of aircraft participating, including virtually all the contenders for the IAF's gigantic MMRCA tender. These included the Boeing F/A-18E/F Super Hornet, Dassault Rafale, Eurofighter Typhoon, Lockheed Martin F-16 Falcon, Mikoyan MiG-35 and Saab JAS 39 Gripen, all together at Yelahanka, perhaps for the last time. The Show also bid adieu to the *Surya Kiran* formation aerobatic team (SKAT) as their mounts, HAL Kiran Mk.IIs, were urgently required for the Phase II flying training role.

Aero India 2013


(photo: Angad Singh)

This Show from 6 to 10 February provided an extended platform for 352 international and 255 national companies to showcase their products and services. During the event, an armed ALH Mk.IV 'Rudra' was handed over by HAL to the Indian Army. The Russian aerobatic team, *Russian Knights*, flying Su-27s, performed for the first time in India.

Aero India 2015

This 10th edition which took place 18 to 22 February was inaugurated by Prime Minister Narendra Modi, with the 'Make in India' initiative as theme. There was participation of some 33 countries with 623 companies (295 Indian and 328 International, with 72 aircraft and an increased space of 27,678 sqm. The Prime Minister stressed that it would now be easier for public, private and foreign investors to manufacture defence equipment in India after ongoing reform of the defence procurement policies and procedures. The Indian Prime Minister had met his Japanese counterpart some months earlier the ShinMaywa US-2i amphibian aircraft featured in their discussions.

With the French aircraft having been declared as the MMRCA 'of choice', Rafale International, the consortium consisting of Dassault, Thales and Snecma (a Safran subsidiary), showcased three Rafale fighters. Including

a single-seat Rafale C and two twin-seater Rafale Bs, the latter performing displays everyday. The IAF displayed its first Sukhoi-30MKI fitted with the indigenous BrahMos supersonic missile while also in the flying display programme were the Tejas, LCA, with the Sarang display team being joined by air enthusiast teams from Sweden and the UK.

Aero India 2017

The flypast at start of this Show, on 14 February was heralded by the *Might Formation* of five indigenously-built aircraft: Tejas LCA, HAL-Dornier 228, HTT-40 HAL-Hawk-i, and Su-30MKI. This could well have been billed as the 'Hawk Show', with three variants of this advanced jet trainer on display at Yelahanka : this was the BAE Advanced Hawk, HAL's indigenous HaH Hawk-i and the standard Hawk Mk.132 which is now mount for the *Surya Kirans.* There were 270 Indian and 279 international companies participating and during the Show, DRDO handed over the first of three indigenously designed airborne early warning on control (AEW&C) platforms to the Indian Air Force.

And so to Aero India 2019 ..... watch this space !

2019 AERO INDIA

Going ahead with India's regional airliner programme

As announced by Civil Aviation Minister Mr Suresh Prabhu at the recent 'Global Aviation Summit 2019 in Mumbai', the Government is working to constitute a 'Special Purpose Vehicle' (SPV) involving HAL, NAL, ADA and possibly 'a private company' to design & develop a 70-90 seater regional transport aircraft in India. According to the Minister, India needs "2,300 new airliners to meet future air travel demand" and that "we will soon roll out a road map for the manufacturing of (such) aircraft in India".

Earlier, on a Webinar broadcast, Director of National Aerospace Laboratories, Mr Jitendra J Jadhav, outlined the approach on the RTA programme which will be followed by a special seminar at Bangalore on 21 February. On sidelines of Aero India 2019, the *Indian National Academy of Engineering* (INAE) in association with the Department of Production and Ministry of Civil Aviation, have organised an international seminar on 'Civil Aviation-Regional Air Connectivity'. An approach paper on the proposed IRTA gives the broad parameters of this next generation turboprop regional airliner as being of high wing design with winglets, powered by a futuristic turboprop engine, with extensive use of composites in its structure.

'Protecting our Protectors'

DCM Shriram venture into Defence

Making their debut at the DefExpo 18 in April 2018, where the Group announced their new venture into Defence equipment manufacturing, DCM SHRIRAM had Admiral Sunil Lanba, Chief of the Naval Staff and Chairman and Chief of Staff Committee formally inaugurating the ZEBU light bullet proof vehicle, in presence of Mr Alok Shriram Vice Chairman of the Company.

For DCM Shriram Industries Limited (DSIL), this new venture was inspired by the Defence Procurement Procedure (DPP 2016). With the DCM brand being "a ceaseless part of India's growth for decades," they took a conscious decision to bring that skill and experience to a new field. The beginning was made with the design and testing and production of the ZEBU light bullet proof vehicle for the Indian Defence and Para-Military Forces and its futuristic export.

As Mr Tilak Dhar, Chairman and Managing Director said, "Our group, under the guidance of our founder Lala Shriram and later Lala Bansi Dhar, has consistently been a part of nation building endeavours for over 125 years. We have been manufacturing original, India-made products since 1890 and have consistently worked towards aiding growth and development. We firmly believe that this project will create jobs not only within our company but in numerous automotive ancillary units and allied services, bringing further prosperity to the nation and greatly enhancing our Armed Forces' access to critical resources and thus their capabilities."

The ZEBU is a world class armoured bullet-proof vehicle which meets all the requirements and various service conditions that India's armed personnel face and function in, including various types of terrain and climatic conditions, be it the heat of the desert, the glacial conditions in the high Himalayas or the rainy jungles of India's North East.

Mr Alok B Shriram, Vice Chairman and Deputy Managing Director added, "In addition to manufacturing and providing vehicles within India, our aim is to eventually export them to other nations and peace-keeping forces. Featuring excellent all-terrain and off-road capabilities, a 360° rotating turret and several other features, this new LBPV is a promising new entrant to the indigenous defence sector in India, the team firmly believe that the ZEBU is the first step towards achieving their target as well as fulfilling the desired goals of Indian Government and the Indian Armed Forces going forward.

Over the year, the Group have also gone 'airborne', diversifying to include the 'Flyeye' Mini UAV which is hand launched after achieving readiness in less than 10 minutes. The system has the surveillance payload with two cameras (Daylight & IR) under the fuselage which ensures better range of observation and quickly switching of the video imaging.

VAYU Interview with Col HS Shankar, Founder and Chairman/Managing Director of Alpha Design Technologies

VAYU : We begin with your trailblazing navigation satellite project with ISRO : how have you broken the 'space barrier' for the Medium scale private industry? What's next in line with satellite launches and integrated space services?

HSS: ADTL has again received additional major projects from the ISRO for making 9+6 Satellites (Medium & Large sized) over the next 3+2 years. In addition, ADTL is planning to establish its own AIT facilities for medium & small-sized satellites. Another major development is establishment of more than 1000 ground Satellite Receiving Terminals at nine North Eastern States, SAARC Countries, Andaman & Nicobar Islands and others.

VAYU : Please give an overview of Alpha's growth from a defence and avionics equipment and systems manufacturer to becoming leader of a consortium of MSMEs, spawning a huge private sector space industry in the country and strategic partner with some defence and aerospace majors in the world. What are the new international programmes ?

HSS: It is our view that if all MSMEs work on a Consortium basis, sharing each other's capabilities and costs involved in developing the equipment company with trials, evaluations, etc., it is possible to meet expectations of the Defence Forces in terms of lower costs, shorter delivery times and, of course, stringent specifications/quality of the products. On the international scenario, ADTL has, through its JVC with ELBIT of Israel, received export orders worth Rs. 105 crore (US $15.0 million). Also, initiatives have been taken for export of Thermal Imager based Fire Control Systems (TIFCS) for tanks to several SE Asian countries.

VAYU : Colonel, please share with us some insights from your personal saga : winning the Vishista Seva Medal from President of India for developing night-firing capabilities of Tigercat Missiles during 1971 Army Operations and later, as director for Research and Development with Bharat Electronics Limited inspiring your vision in founding new manufacturing units, R&D centres.

HSS: My journey from the time of joining the Army as a 21 year old young engineer during 1964 and after commissioning, taking part in the 1965 and 1971 Operations has been a most interesting and professionally satisfying experience, also recognised by award of the VSM. After 22 years in Army, I joined BEL and became Director R&D for 7 years, during which period, I was fortunate to be associated with production of first lot of 75,000 EVMs at BEL. On retirement from BEL, we started *Alpha Design Technologies* and which has grown from 3 to 1,116 personnel. Biggest achievement at ADTL has been to launch our own Satellite with guidance from ISRO to outer space (IRNSS 1i which joined the constellation of 7 Satellites to provide Indian GPS and Navigation data). Thus, as far as I am concerned, having been associated with EVMs and Satellites, my cup of joy is, indeed, full!!

VAYU : What are new developments in your joint venture with Israel's Elbit Security Systems for manufacturing UAVs and opto-electronics equipment? What are the major critical technologies being developed at the R&D Centre of Excellence in association with Elbit?

HSS: Two major UAV versions : Sky Lark (Mini UAV) are now taking part in high altitude trials in Ladakh and Sky Striker which is a UAV having target destruction capability are two important projects in the JVC. In addition, newer version of Commander's Panoromic Sight (COAPS), new Gunner's TI Sight, etc., which are of international standard, are being manufactured and exported.

VAYU : As more and more OEMs and multinational organisation opt for manufacturing bases and supply chains in India, how does this reflect on indigenisation and the Make in India initiative, especially from your perspective ?

HSS: This indicates the positivity and effectiveness of *Make in India* initiative of the Government. Success achieved by us, and some more Companies in MSME sector, are resulting in exports from India, which is very encouraging indeed.

(cont'd in Show Daily Day 2, 21 Feb 2019)

BIRD Aerosystems unveils SPREOS DIRCM solutions through partner DEFSYS

BIRD Aerosystems, the leading developer of Special Mission Aircraft Solutions (ASIO) and Airborne Missile Protection Systems (AMPS), is presenting its SPREOS Directional Infra-Red Counter Measure (DIRCM) solution in its production configuration for the first time, at Aero India 2019. Alongside the SPREOS, BIRD Aerosystems are also presenting its Missile Approach Confirmation Sensor (MACS). BIRD's MACS and SPREOS provides counter measure capabilities significantly enhancing the protection of airborne platforms which are an ideal solution for a range of airborne platforms, including military helicopters and transport aircraft, as they ensure optimal protection against different MANPADS threat types. MACS and SPREOS will be manufactured in cooperation with DEFSYS Solutions Pvt. Ltd under the *Make in India* paradigm.

SPREOS DIRCM

The MACS (Missile Approach Confirmation Sensor) performs a confirmation of suspected incoming missile threats detected by the helicopter missile warning sensors (MWS), and virtually eliminates any false alarms. MACS can work alongside with any legacy MWS and is "the ideal solution for enhancing the Indian Armed Forces helicopters protection, ensuring practically zero false alarm rate and most effective countermeasure."

SPREOS DIRCM integrates into a single Line Replaceable Unit (LRU) multiple functions, including threat confirmation, tracking and jamming of advanced IR guided missiles. SPREOS slews to the direction of the threat, activates its multi-band radar functionality, confirms and tracks while analysing its unique information to enable the most effective jamming response. Following the confirmation and tracking, SPREOS deploys the dual-band countermeasure laser, causing the missile to miss the aircraft. The SPREOS can work with any legacy MWS and is the most advanced, compact and lightweight DIRCM in the market.

Location: Hall B/3.6, DEFSYS' Booth

MACS on an Mi-17 helicopter

AvioHeliTronics in defence manufacturing

"The Next Big Thing"

With the increasing participation of OEMs across the globe and manufacturing complexes lately opening up under the 'Make In India' initiative as well as 'Manufacture in India', AvioHeliTronics are prepared for rapid growth in its manufacturing vertical.

With experience of over a decade, with meticulously designed infrastructure having highly skilled experts, AvioHeliTronics are carrying out focused research and translating that into successful development of advanced capabilities which include design-to-manufacture of aero structures. AvioHeliTronics offers these services in capacity of an IOP (*Indian Offset Partner*) to several aerospace majors, extending to the domain of civil aviation, and as service provider to several OEMs plus Tier-1s in the Design & Development of Embedded-Software (Avionics/ Railways), AeroStructures-Design/Analysis/Prototyping and Technical-Documentation.

Manufacturing has been AvioHeliTronics strong forte, with its modern facilities spread over a 25,000 square-feet area, equipped to work around-the-clock. AvioHeliTronics current manufacturing unit has an array of high-technology equipment, operated by very skilled experts. AvioHeliTronics is in a promising position with an added advantage of Certifications including AS9100 D, CMMI Level 3(Svc. & Dev.), ISO 27001:15, CEMILAC, R&D Unit, recognised by DSIR and Defence Industrial Licenses (D-IL).

With AvioHeliTronics focussing on R&D, this has resulted in mature designs, further checked for inconsistencies and errors by well-placed pre-manufacture checks. Manufacturing processes are continuously optimised at AvioHeliTronics, with insightful inputs from R&D teams working in the domain. In fact, such work on optimisation of design and manufacturing in seamless manner ensures optimisation in multi-dimensions. Equipped with in-house capabilities to deal with manufacturing from the ab-initio stage, AvioHeliTronics have the advantage of giving highly efficient solutions, optimising the manufacturing life-cycle in many innovative ways.

Over the years, AvioHeliTronics have demonstrated their ability to meet the exacting demands of various aerospace companies, both national and international. Their national customers include aerospace majors, particularly Hindustan Aeronautics Limited (HAL), Indian Space Research Organisation (ISRO), Brahmos Aerospace.

"The growing needs and demand for manufacturing in global and domestic markets have urged us to expand in multiple dimensions in the field of aerospace manufacturing. Senior executives of AIS have been following long-term growth strategies which are not just focused on scale, but on growth in technology, quality and expertise. These strategies have shaped our upcoming venture, the state-of-the-art manufacturing facility at the Aerospace SEZ Park in Devanahalli, Bengaluru," stated Deepika Ramesh, COO & Sr. VP.

This facility will be equipped with new and advanced manufacturing machinery that include 5-axis CNC Machines, Milling Centres and CNC Turning Centres amongst others. Additionally, inspection facilities such as Coordinate Measurement Machines (CMM), Profile Projectors, Video Measuring System (VMS) are being installed to ensure precision requirements associated with defence projects and aerospace.

Apart from its expertise in manufacturing, AvioHeliTronics has an established customer base for various domains of business:

Embedded Electronics & Software (Avionics)

- Design, Development, Coding(C / C++ / Ada, QT, Open GL ES, Lab windows) as per DO 178B/254
- IV&V (DO 178B – Level: A, B,C& D)
- Solutions: RADAR control Software; Mission Payload Software; DMM /IHH; Navigation System Software; Railway system control Software

Structural Engineering

- Digitisation of drawings; 3D Modelling
- Reverse Engineering and Prototyping
- Design Dossier Checks (Airbus and Bombardier Standards)
- Jigs and fixture Design & Aero structure analysis (CFT, Stress, F&DT, CAE)

Technical Documentation

- Illustration and Authoring Activities
- Interactive Electronic Technical Manuals (IETM)
- Engine Manuals, CMM, IPC,Technical Translations

Visit AvioHeliTronics at HALL C, STALL C2.12

"A Mighty Punch !"

Lockheed Martin's Miniature Hit-to-Kill Interceptor

Lockheed Martin is developing an exciting new air defence interceptor called *Miniature Hit-to-Kill* (MHTK), which essentially takes components from core technology the company developed for the combat-proven Patriot Advanced Capability-3 (PAC-3) and Terminal High Altitude Area Defence (THAAD) weapon systems and miniaturised this to address the Counter-Rocket, Artillery and Mortar (C-RAM) threats.

Message from Lockheed Martin at Aero India 2019

LOCKHEED MARTIN

Lockheed Martin looks forward to meaningful engagement with our customers, partners, and peers in India and the global defence industry at Bengaluru during Aero India 2019.

The programmes we shall be presenting include the peerless C-130J Hercules (of which India operates 11, one of which made headlines around the world for landing at the highest landing strip in the world Daulat Beg Oldi in the high Himalayas in 2013), the F-16 fighter jet, an equally impressive and proven platform for which we previously announced future potential production of wings in India in partnership with Tata Advanced Systems; our helicopters the S-92, MH-60R, CH-53K and S-76; Javelin the world's most versatile precision weapon system, as well as the INDAGO unmanned aerial system (UAS) which presents payload options and advanced ground control software that helps users accomplish a diverse set of missions.

We shall be involved with the upcoming *Start-Up Showcase*, and the *Women in Aviation* event and *Women's Day* activities and occasions that sync with our social responsibility efforts in India. We believe there are critical to progress and capability development at grassroots level, and through our involvement in the *India Innovation Growth Programme*, participating in a number of Innovation-related activity including the *Drone Olympics* and the 2019 Aero India Start-up Workshop and Showcase.

We are excited to be at Aero India 2019, and look forward to the Show and to engage with various arms of the Indian armed services as well as our industry partners, peers and the public.

MHTK provides unmatched levels of accuracy, lethality and assured defeat for C-RAM threats. To shrink the technology behind the missile, Lockheed Martin looked to the defence industry for inspiration, then applied the

core principles of hit-to-kill capability, seeker accuracy and missile agility to focused problems.

Lockheed Martin has achieved miniaturisation on MHTK using photonics, medical imaging technologies and mobile phone industry techniques, combined with state-of-the-art electronic packaging. The company also borrowed technologies from other Lockheed Martin programmes, such as ejection seat capabilities of the F-35 Lightning II and durability best practices from the automobile industry.

The MHTK interceptor is 2.5 feet (72 cm) in length and weighs about 2.2 kg at launch. Though small, MHTK is designed to retain the range and lethality desired in a C-RAM solution, its small size enabling the defeat of a saturation attack. The MHTK uses hit-to-kill technology, which destroys threats through very accurate application of kinetic energy in body-to-body contact. In fact, MHTK does not contain a warhead, which reduces the risk of collateral damage as seen with traditional blast-fragmentation interceptors. This unique technology leverages existing combat-proven systems and provides a mobile, organic self-protection capability to Army maneuver elements and critical infrastructure.

The MHTK interceptor has been successfully flight tested to demonstrate the interceptor›s impressive agility, and to validate the performance of its airframe and electronics, with more flight testing is planned for 2019.

Over 200 Su-30MKIs delivered to IAF

With 272 Sukhoi Su-30MKIs on order by the Indian Air Force, this aircraft type already equips some 40% of the IAF's frontline fighter squadrons, with 222 of these being delivered by HAL's Nasik Division. By early January 2019, HAL had delivered 202 Su-30MKIs and the last of those on order would be completed during FY 2020-21, equipping some dozen squadrons.

According to reliable sources, ordering of additional Su-30MKIs for the IAF has been considered, both to augment the reducing combat aircraft numbers as also maintain industrial activity at one of HAL's largest manufacturing Divisions, even as a major upgrade programme (the 'Super' Sukhoi) is planned. The additional orders vary from 8 (to make up attrition) to 18 (for one additional squadron) to 40 aircraft for two more squadrons.

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Bengaluru: India's Aerospace Capital and its 'Silicon Valley'

Bangalore – or Bengaluru as recently renamed – conjures up many images to many people, depending on their interests and vocation. With its salubrious climate, the British chose to site a cantonment here and much of the central and original city continues that tradition, with several Army training establishments located in and around the metropolis which has grown into becoming India's third largest city with a population of over 12 million people.

Before Bangalore got its appellation of being the 'IT capital of India', it rightly was (and is) regarded as India's aviation (aerospace) capital, with HAL being the jewel in the crown. Established as Hindustan Aircraft Ltd in December 1940, and today globally known by its alphabets HAL, Hindustan Aeronautics Ltd has its Corporate Head Office in Bangalore Cantonment, not far from the Karnataka State secretariat and scores Government offices.

Some kilometres away, in the former suburb of Domlur, is located HAL's Bangalore Complex which consists of its Aircraft Division, Aero Engine Division, Industrial and Marine Gas Turbine Division, Overhaul Division, Foundry and Forge Division, Aerospace Division, and lately the LCA Division, plus Helicopter Complex. These abut HAL's Aircraft Research & Design Centre, the Rotary Wing R&D Centre and the Aeronautical Development Agency, the latter engaged with Design & Development of the Tejas light combat aircraft (LCA) and futuristic Advanced Medium Combat Aircraft (AMCA).

The Defence R&D Organisation (DRDO) boast of several establishments in the Vimanapura area: Aeronautical Development Establishment (ADE), Defence Avionics Research Establishment (DARE), Electronics & Radar Development Establishment (LRDE), Gas Turbine Research Establishment (GTRE), Centre for Airborne Systems (CABS) and Centre for Military Airworthiness Certification (CEMILAC).

National Aerospace Laboratories (NAL), Indian Space Research Organisation (ISRO) and the Indian Institute of Science (IIS) rightfully claim their exalted place in Bangalore's sun, even if the city's natural and scientific attraction have meant that its population has burgeoned and continues to rise.

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