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Vayu Aerospace Pvt. Ltd.
E-52, Sujan Singh Park,
New Delhi 110 003 India
Tel: +91 11 24617234
Fax: +91 11 24628615
e-mail: vayuaerospace@lycos.com
e-mail: vayu@vayuaerospace.in

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Admiral Arun Prakash says....

This Navy Day, let's focus on building a strong navy to meet India's global aspirations

The 30-month-long Sino-Indian military impasse in the Himalayas and China's strategic posturing in the South China Sea should be clear pointers for India's decision-makers that maritime power will have a critical role to play as an instrument of state policy in future outcomes. Navy Day, celebrated annually to commemorate a famous naval victory, and to remind us of our maritime heritage, also provides an opportunity for "maritime stocktaking".

Still smarting from the ignominy of its — government imposed — inaction in the 1965 Indo-Pak war, the navy's leadership had pre-determined that maritime power would play a pivotal role in the 1971 conflict. On the night of 4 December 1971, a force of small missile boats audaciously approached Karachi port to unleash missile salvoes that sank warships, set alight huge fuel reserves, bottled up the Pakistan Navy and blockaded merchant shipping. In the Bay of Bengal, while INS Vikrant's aircraft mounted sustained attacks on East Pakistan's airfields, ports and riverine traffic, its escorts cast a naval cordon that ensured that neither reinforcement nor evacuation was possible for the Pakistani army. The fact that maritime dominance had expedited Pakistan's surrender, however, failed to lift the pall of "sea-blindness" over Raisina Hill.

This is also an appropriate occasion to remind fellow citizens of some outstanding figures in our maritime past. The navy of 10th century South Indian Emperor Rajendra Chola vanquished the Sumatra-based Sri Vijaya thalassocracy to establish Chola power across present-day Malaysia and Indonesia. The resolute and visionary zamorins of Kozhikode waged a 90-year-long naval campaign led by the captains of the Kunjali Marakkar clan to eject the Portuguese from Malabar. The 17th century Maratha "sarkhel" or admiral Kanhoji Angre's Konkan fleet ceaselessly harried the British, Dutch and Portuguese, scoring many victories.

It is time also to recall two unsung shipbuilding pioneers. In 1736, Bombay's Lovji Nusserwanji Wadia started a tradition which saw seven generations of Wadia master shipbuilders constructing superb merchantmen and warships for the British.


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Two centuries later, in 1941, the visionary Seth Walchand Hirachand, resurrected Indian shipbuilding by founding Scindia Shipyard Ltd. in Visakhapatnam. The first modern, Indian-built merchant vessel, MV Jalusha, joined Seth Walchand's Scindia Steam Navigation Co in 1948.

Carrying forward this tradition, India's far-sighted naval leadership in the 1960s persuaded a reluctant government that the nation must also embark upon indigenous warships production. In the face of great scepticism, Mazagon Docks delivered the first, licence-built frigate, INS Nilgiri, in 1972. In the half-century since, Indian shipyards have launched over a hundred warships; ranging from patrol boats to destroyers and from hydrographic vessels to nuclear submarines.

The navy's bold vision saw its pinnacle in 2013 when Cochin Shipyard Ltd. launched India's largest indigenously designed and built warship — an aircraft carrier. Commissioned in September 2022 by the Prime Minister as (the reincarnated) INS Vikrant, the conception and successful completion of this complex project signified a major achievement for our naval staff, ship designers and builders.

Initiated by the Directorate of Naval Design in the late 1970s, the aircraft carrier project assumed urgency when it was realised that both the navy's carriers — Vikrant and Viraat — would face retirement by century-end. Even as the navy juggled ship-design options, aircraft choices and other imponderables, the government, in a recurrence of "sea-blindness", rejected the project in 1990. It took 12 years and the persuasive powers of successive chiefs to obtain approval for a 37,500-ton ship, capable of operating the "navalised" Russian MiG-29K fighter from a ski-jump.

While the awe-inspiring sight of this mammoth, Indian-built warship kindles justifiable pride, there should be a pause for reflection, especially amongst our defence R&D scientists when it is described as an "indigenous product". Many of the ship's major systems, including gas-turbine engines, guns, missiles and radars, are imported. Of equal concern is the foreign origin of aviation-related facilities such as workshops, aircraft lifts, arrester-wires and landing-aids, vital for flying operations. Only when all these have been delivered and installed and have passed flying trials will Vikrant be combat-ready.

The hiatus between ordering, launch and commissioning of Vikrant may be excessive by international standards but this prolonged gestation would have served a purpose if the invaluable experience gained and the priceless skills acquired, are ploughed back into a bigger/better follow-on carrier; with much greater involvement and contribution from our scientists. The case for IAC-2 remains in limbo, even as China awaits the third ship in its carrier-building programme and envisions a carrier-led Indian Ocean task force. Navy Day stocktaking shows that the Indian Navy has in the past decade realised many of its long-cherished objectives in all three dimensions of capability. New, indigenously designed, destroyers and frigates, stealthy in form, fielding long-range sensors and heavily armed with missiles, guns and anti-submarine weapons are being delivered at a slow but steady pace by domestic shipyards. Voids, however, remain in mine counter-measures, amphibious-lift and fleet-support capabilities.

The haemorrhaging of our diesel-submarine strength will be temporarily halted by the addition of six, modern, licence-produced French boats. But the government must urgently green-light Project 75 (I) so that serial production of submarines can commence. With PLA Navy units now frequently prowling the Indian Ocean, aerial surveillance and anti-submarine warfare assume strategic dimensions. Recent inductions of US-built, shipborne helicopters and maritime-reconnaissance aircraft are going to not only boost the Indian Navy's surveillance and anti-submarine capabilities but also enhance interoperability with partner navies.

In the half-century since the Bangladesh War, our navy has emerged as a compact but potent and professional force. Given the political leadership's regional/global aspirations, the service has a significant contribution to make — whether as a Quad member or as the regional "net security provider". The navy's role must be spelt out, and its force architecture defined as well as funded, accordingly. This can happen only if the national security elite conceives a comprehensive "maritime vision", and articulates it in a "National Strategy for Maritime Security".

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Admiral Arun Prakash says....

The laboured progress of India's defence reforms

India's newly anointed Chief of Defence Staff (CDS), even as he tackles thorny issues related to the management of two live borders, force modernisation, competing budgetary claims and personnel policies, will be under pressure, to expedite the creation of new joint command structures. While he receives unsolicited advice, from many quarters, the only counsel that the CDS should heed is; "to make haste slowly." This, because, contrary to popular impression, the appointment of a CDS, did not call for the immediate creation of theatre commands.

The 24 December 2019, PIB note, announcing Cabinet approval for creation of the post of CDS, drew a clear line between achieving "integration" and the "creation of theatre commands." In one para, the CDS is tasked, "As the Permanent Chairman of Chiefs of Staff Committee…to bring about jointness in operations, logistics, training … etc of the three Services, within three years". Separately, the Department of Military Affairs is mandated with "facilitation" of the "restructuring of Military Commands for optimal utilisation of resources, by bringing about jointness in operations, including through establishment of joint/theatre commands," (italics added), with no time stipulation.

Possibly due to a misinterpretation of the Cabinet's intent, the process of reform got off to a false start, in 2020, with coining of a new term, "theaterisation," which became its driver. The creation of theatres, should have been an end-state, or ultimate aim of a process for engendering jointness and integration. But once the "cart was put before the horse," the process, predictably, ran into inter-service conflict, resulting in a log-jam, which persists.

The nine-month delay, in the appointment of the second CDS may turn out to be a blessing in disguise, if it leads to introspection by our military and political leadership. Such introspection must take place against the background of the military confrontation with our powerful neighbour, China, and the ongoing conflict in Ukraine. Apart from this, note must be taken of three imperatives, in this process, that cannot be wished away.

Firstly, any conflict with China, will demand forces/resources from 4-6 of India's fourteen single service, and two tri-service commands (none of them co-located) as well the Space, and Cyber Agencies and the Special Forces Division. Facing them will be PLA's combined-arms forces, under the unitary Commander of its Western Theatre Command. One can imagine the command/control and logistic nightmare such a situation could create for India's operational commanders, and the fiascos that could ensue. The obvious imperative is to integrate these 14 commands into 4-5 geographic or threat-based theatres, and place necessary forces under a single commander charged with conduct of operations.

Secondly, the service Chiefs have to reconcile themselves, to the reality that once theatre commanders assume the "warfighter" role, they will be divested of operational responsibilities, and assume the "raise-train-sustain," functions, involving recruitment and training of personnel, as well as acquisition of combat wherewithal. The Theatre Commanders will have service "Component Commanders" of two/three-star rank, to render service-specific advice. It is through the Component Commanders that the Chiefs will retain a linkage with the theatres.

The last issue relates to air power, which has been the cause of fierce controversies over resources, roles and missions, ever since the first decade of the last century. Beneath the facade of inter-Service bonhomie hides this germ of discord, which no one wants to talk about. The idea that strategic bombing, alone, was the path to victory was propagated by air-power proponents, Billy Mitchell in America and Guilio Douhet in Italy. Command of the air, according to them, meant quick, cheap and decisive victory.

Notwithstanding the failure of the WW II Allied bomber offensive against Germany, a continued western belief in the decisiveness of air power, via "air dominance," has persisted during asymmetric conflicts in Iraq, Afghanistan, Kosovo, Lebanon, Libya and Syria. However, none of these conflicts resulted in a "decisive victory", for the west, nor did air power make a significant contribution.

While the IAF was justified in taking umbrage at being described as a "support arm," by the previous CDS, it is undeniable that as far as armies and navies are concerned, air power plays a "support function," albeit, vital and indispensable. One of the lessons of 20th century conflicts was, that wars are won and lost, neither at sea, nor in the air, but on the ground by armies. Possibly, the same play-book is being re-enacted in Ukraine?

While "indivisibility of air power" may have been a good hypothetical construct, in the past, the need of the hour is to find modalities for sharing air power to enable future Theatre Commanders to smash the threat. While IAF reluctance to share assets, is understandable, it must take reassurance from the fact that the theatre air assets will be deployed on the advice of the Air Force Component Commanders.

An area, where the Services have been remiss, is in failing to initiate changes in professional military education, even before the reform sequence was initiated. The very first step should have been to re-cast the present Staff College as a "Joint Services Staff College" with changes in its curriculum to produce "joint staff officers," ready to serve in sister-service HQs; learning, in the process, to function as future Component Commanders and Theatre Commanders. Likewise for the three War Colleges.

Finally, those on Raisina Hill would be much wiser, were they to read about the thorny path of the US National Security Act of 1947, pushed through by President Truman, in the face of bitter opposition from the US Navy. Or about the "Revolt of the Admirals," over cancellation of the "super-carrier," which followed in 1949. Or how Secretary Defence, Forrestal resolved the air power "roles & missions" conundrum via the "Key West Agreement" of 1948.

And lastly, how it was two politicians, who persevered through four years of bitter debate, in the Pentagon, Congress and media to have the Goldwater-Nichols Act, passed in 1986.


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DAC AoN for 3 capital acquisition proposals

A meeting of Defence Acquisition Council (DAC), held on 10 January 2023 under the chairmanship of Raksha Mantri Rajnath Singh, accorded Acceptance of Necessity (AoN) for three capital acquisition proposals, amounting to Rs 4,276 crore. All the three proposals, two of the Indian Army and one of the Indian Navy, are under the Buy (Indian-IDDM) category.

The DAC accorded AoN for procurement of HELINA Anti-Tank Guided Missiles, launchers and associated support equipment which will be integrated to the Advanced Light Helicopter (ALH). The DAC also accorded AoN for procurement of VSHORAD (IR Homing) missile system under design and development by DRDO. Further, the DAC granted approval for procurement of Brahmos Launcher and Fire Control System (FCS) for the Shivalik class of ships and Next Generation Missile Vessels (NGMVs) for Indian Navy.

Training launch of IRBM Agni-3

India carried out a successful training launch of an Intermediate Range Ballistic Missile, Agni-3 from APJ Abdul Kalam Island, Odisha on 23 November 2022. The successful test was part of routine user training launches carried out under the aegis of the Strategic Forces Command. The launch was carried out for a predetermined range and validated all operational parameters of the system.

Training launch of SRBM Prithvi-II

A successful training launch of a Short-Range Ballistic Missile, Prithvi-II was carried out on 10 January 2023 from the Integrated Test Range, Chandipur off the coast of Odisha. A well-established system, Prithvi-II missile, has been an integral part of India's nuclear deterrence and the missile struck its target with high accuracy.

DRDO's Tapas UAV

On 7 December 2022, DRDO announced that the TAPAS UAV, designed/developed by Aeronautical Development Establishment (ADE) for tri-services successfully achieved a milestone flight test of 18 hours at Aeronautical Test Range, Chitradurga.

Honeywell MoU with NewSpace Research and Technologies

Honeywell has signed a memorandum of understanding (MoU) with NewSpace Research and Technologies, an emerging India-based developer of unmanned platforms, to collaborate on navigation systems for unmanned aerial systems. Honeywell will provide its Resilient Navigation System, which enables UAVs

to autonomously navigate in Global Navigation Satellite System (GNSS) denied environments.

"NewSpace Research and Technologies Private Limited is integrating some of the best resilient navigation technologies for robust operations in adverse and denied environments like the tactical battlefield area," stated Sameer Joshi, CEO, NewSpace Research and Technologies.

Collins Aerospace opens new centres in India

As part of a significant investment to expand its engineering, digital technology and manufacturing operations in India, Collins Aerospace, a unit of Raytheon Technologies Corp., has officially inaugurated its new Global Engineering and Technology Centre (GETC) and Collins India Operations Centre in Bengaluru. The new sites are part of a long-term growth strategy for Raytheon Technologies in India and globally to maximise collaboration and innovation providing cutting edge solutions for customers and provide additional STEM-based opportunities in the country.

MQ-9A leased to IN completes 10,000 FH

On 22 November 2022, a General Atomics Aeronautical Systems, Inc. (GA-ASI) MQ-9A Remotely Piloted Aircraft that is on lease from GA-ASI to the Indian Navy completed 10,000 flight hours in support of India national security missions. The 10,000-flight hour mark has been achieved by two MQ-9As being operated by the Indian Navy during a period of almost exactly two years, with the maiden flight of MQ-9A taking place on 21 November 2020. The MQ-9As are supplied to India by GA-ASI as part of a Company-Owned, Company-Operated (COCO) lease agreement.

Tata Technologies enters Europe's aviation hub

Tata Technologies, a global product engineering and digital services company, inaugurated its innovation centre in Toulouse, France, to cater for the new-age product engineering and digital requirements of the global aerospace and defence sector. As a strategic supplier for Airbus, Tata Technologies brings 3-decades long engineering expertise, having worked with global aerospace customers on a wide range of strategic projects across product engineering, manufacturing engineering and customer services engineering areas. This new centre in Toulouse celebrates the larger Tata Group's commitment to the aerospace and defence sector.

Keel laying ceremony for 2 PCVs

In a landmark event, the keel laying ceremony of the two pollution control vessels (PCV) being constructed by GSL for Indian Coast Guard was held at Goa Shipyard Ltd on 21 November 2022. The primary role of the Pollution Control Vessel is to carry out dedicated oil spill response operations in the vast EEZ of our country and also around the various neighboring islands and operation of one integral twin engine helicopter. Responding to marine pollution is a highly technical task requiring specialised and dedicated equipment, these vessels are fitted with state of the art pollution control and response facilities.

8th ASW craft steel cutting at CSL

Steel Cutting for 8th Anti-Submarine Warfare Shallow Water Craft being built by Cochin Shipyard Ltd for Indian Navy was carried out on 17 December 2022 by Commodore A K Chakrabarti, Warship Production Superintendent. Top officials of CSL and Indian Navy attended the event.

Launch of 'Ikshak'

'Ikshak', the third of the four Survey Vessels (Large) (SVL) Project, being built by GRSE/L&T for Indian Navy was launched on 26 Nov 22 at Kattupalli, Chennai. Contract for building four SVL ships was signed between MoD and Garden Reach Shipbuilders & Engineers (GRSE), Kolkata on 30 October 2018 for a total cost of Rs 2435 Cr. As per build strategy adopted by GRSE, first ship is being built at GRSE, Kolkata and construction of balance three ships (upto outfitting stage) has been sub-contracted to L&T Shipbuilding, Kattupalli.

Launch Of 'Arnala'

'Arnala', the first of 8 x ASW SWC Project, being built by GRSE for Indian Navy was launched on 20 December 2022 at L&T, Kattupalli, Chennai. Contract for building eight ASW SWC

ships was signed between MoD and Garden Reach Shipbuilders & Engineers (GRSE), Kolkata on 29 April 2019. Arnala class of ships will replace the Abhay class ASW Ships of Indian Navy and are designed to undertake anti-submarine operations in coastal waters and Low Intensity Maritime Operations (LIMO) including subsurface surveillance in littoral waters.

ASW SWC Project at GRSE

Keel laying of the two warships (Yard 3033 and Yard 3036) of Anti-submarine Warfare Shallow Craft (ASW SWC) project under construction by GRSE, Kolkata was undertaken on 31 December 2022. The ASW SWC ships will have over 80% indigenous content, ensuring that large scale defence production is executed by Indian manufacturing units thereby generating employment and capability build up within the country.

Commissioning of ICGS Kamla Devi

Indian Coast Guard Ship Kamla Devi, the fifth in series of five Fast Patrol Vessel was commissioned at Kolkata on 12 January 2023. ICGS Kamla Devi is 48.9 meters long and 7.5 meters wide with a displacement of 308 tons. The ship is capable of achieving maximum speed of 34 knots, powered with MTU 4000 Series Engines and propelled by three 71S type III Kamewa waterjet of Rolls Royce. The ship is built indigenously by Garden Reach Shipbuilders & Engineers (GRSE) Ltd, Kolkata. The ship is fitted

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with state-of-the-art technology, navigation and communication equipment, sensors and machinery. The ship is also equipped with 30 mm 2A42 Medak gun and 12.7 mm SRCG (Stabilised Remote Controlled Gun) for enhancing the fighting efficiency of the ship.

Pratt & Whitney opens new India Engineering Centre

Pratt & Whitney, a Raytheon Technologies business, on 19 January 2023, officially opened the doors to its new India Engineering Centre (IEC) in Bengaluru. The facility is co-located with Pratt & Whitney's India Capabilities Centre (ICC), which opened in 2022 to provide integrated global supply chain support, and the recently inaugurated Collins Aerospace engineering and global operations centres. The IEC, which was designed to meet the LEED Platinum certification, further enhances Raytheon Technologies' combined presence in India of over 5,000 employees and facilitates collaboration across the company's businesses.

More than 50 employees are now based in the state-of-the-art facility, with an additional 450 jobs to be filled over the next four years. Work performed at the IEC will encompass elements such as aero and mechanical and control systems for various products in Pratt & Whitney's broad portfolio of large and small commercial engines. It will also extend across the entire product lifecycle from development to field support and sustainment.

DRDO's Fuel Cell-based AIP system progresses

The Fuel Cell-based Air Independent Propulsion (AIP) system of DRDO's Naval Materials Research Laboratory (NMRL)

will soon be fitted onboard INS Kalvari. An agreement was signed between senior officials of NMRL and Naval Group France in Mumbai on 23 January 2023 to extend cooperation to enter into the detailed design phase for integration of indigenous AIP in the Kalvari class submarines. As part of the agreement, Naval Group France will certify the AIP design for integration in the submarines.

The AIP has a force multiplier effect on lethality of a diesel electric submarine as it enhances the submerged endurance by several folds. It has merits in performance compared to other technologies and is unique as the hydrogen is generated onboard. This technology has been successfully developed by NMRL with the support of Indian industry partners. The technology has now reached the stage of maturity for industrialisation.

It is worth mentioning that the land-based prototype of the NMRL's AIP has been tested successfully. This new endeavour will be a significant step towards the detailed design certification of the energy module, which will be performed by NMRL along with Indian industry and design of the platforms impacted by the integration of the indigenous AIP inside the Indian submarine by Naval Group. These actions will seamlessly lead the way to start of localisation and industrialisation of AIP including the hull fabrication by the Indian industry for future fitment on-board the submarines.

GA-ASI and Bharat Forge in strategic partnership to manufacture aerostructures

In a major move to boost manufacturing in India, General Atomics Aeronautical Systems, Inc. (GA-ASI) and Bharat Forge Limited, India have announced a partnership to manufacture main landing gear components, subassemblies, and assemblies of remotely piloted aircraft. Part of the Kalyani Group, Bharat Forge is the largest repository of metallurgical know-how, design and engineering expertise, and manufacturing prowess in India.

"GA-ASI is eagerly looking forward to working with Bharat

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Forge in the critical field of aerostructure manufacturing," stated Dr. Vivek Lall, Chief Executive, General Atomics Global Corporation. "Bharat Forge's expertise in the field of forging is known globally, and their outstanding contributions in the aerospace sector has inspired us to work together for building the next generation of the world's most advanced unmanned aerial vehicles."

Mr. Baba Kalyani, Chairman and Managing Director, Bharat Forge Limited, states, "Aerospace is a high 'Technology Intensive' domain, which relies on Product Integrity, Reliability, and Zero Defect. This is a culture by itself and demands a strong focus on people and processes. As part of our aerospace growth strategy, our collaboration with GA-ASI is a strong testimony of our culture in Bharat Forge Aerospace to assimilate and demonstrate the same, as partners to General Atomics, in making India Atmanirbhar."

ICG contract for 10 VTOL drones

The Indian Coast Guard has concluded maiden contract for 10 multicopter (VTOL) drones in consonance with Government of India's policy of embracing drone technology. These drones are capable of being launched from both ships whilst underway, as well as shore stations and will play a significant role in the reach if ICG unit during surveillance and security operations, in addition to assisting in Search and Rescue (SAR), both by day as well as night. The ICG plans to induct 100 additional drones by 2025.

Western Air Command Commanders' Conference

The Western Air Command Commanders' Conference was held on 10 and 11 November 2022 at New Delhi. Air Chief Marshal VR Chaudhari, Chief of the Air Staff (CAS) was the chief guest during the conference. On his arrival at Command HQ, the CAS was received by Air Marshal Sreekumar Prabhakaran, Air Officer Commanding-in-Chief, Western Air Command and was accorded a ceremonial Guard of Honour.

Brahmos-ER ALCM tested

Indian Air Force on 29 December 2022 successfully fired the Extended Range version of Brahmos Air Launched missile against a ship target from a Su-30MKI aircraft. The missile achieved the desired mission objectives in the Bay of Bengal region. With this, IAF has achieved a significant capability boost to carry out precision strikes from Su-30MKI aircraft against land/sea targets over very long ranges. The extended range capability of the missile coupled with the high performance of the Su-30MKI will give the IAF "a strategic reach and allow it to dominate the future battle fields". The dedicated and synergetic efforts of IAF, Indian Navy, DRDO, BAPL and HAL have been instrumental in achieving this feat.

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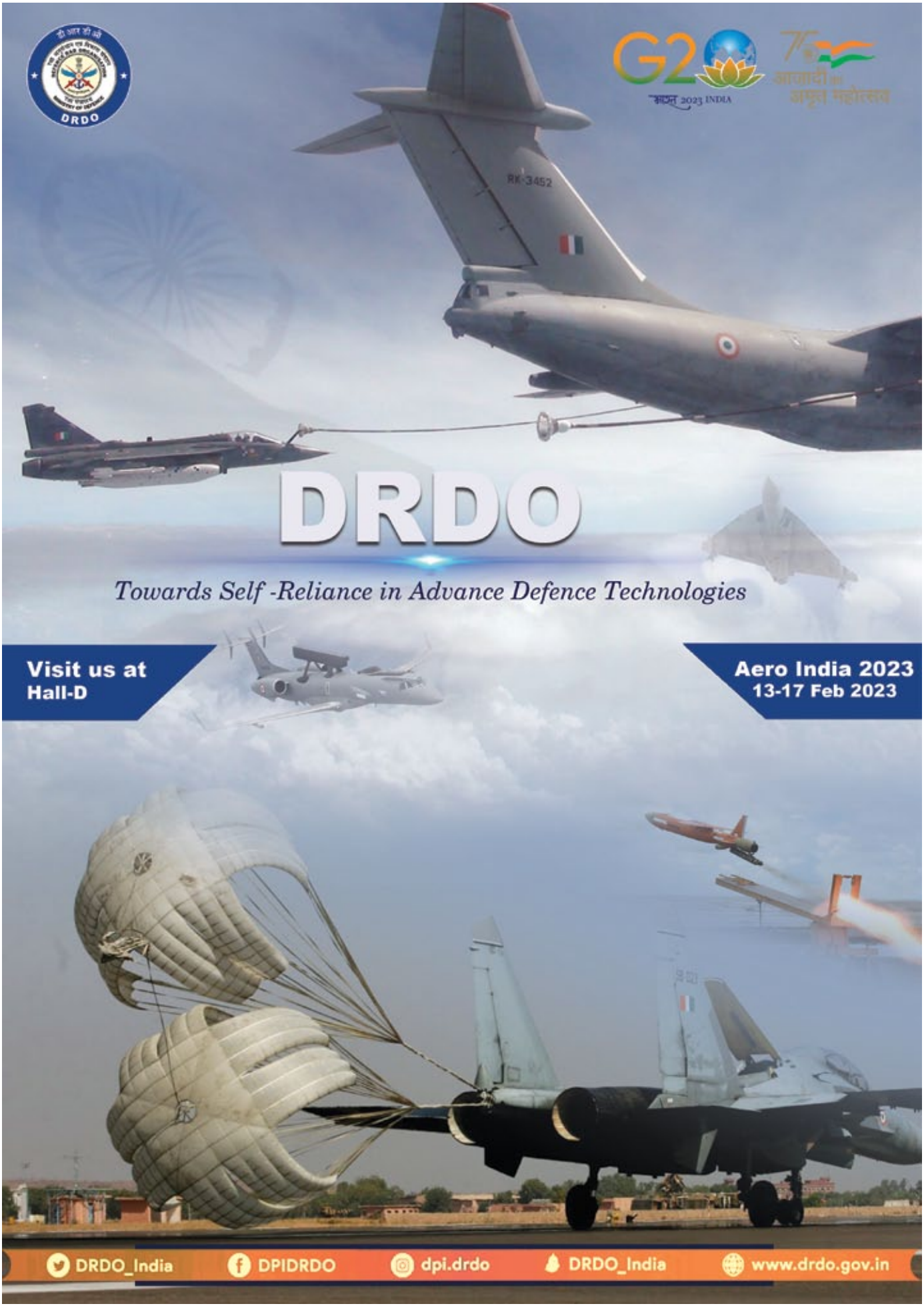
Combined Graduation Parade at AFA Dundigal

Air Chief Marshal Shaikh Abdul Hannan, Chief of the Air Staff, Bangladesh Air Force reviewing the Combined Graduation Parade held at Air Force Academy Dundigal, Hyderabad on 17 December 2022. A variety of IAF aircraft performed and held flypasts.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IAF's Heritage Centre

Indian Air Force (IAF) Heritage Centre being set up at Sector 18, Chandigarh has received a Vintage Prototype Aircraft "Kanpur-1". This rare single engined machine had been designed and built by late Air Vice Marshal Harjinder Singh in 1958 and was in the proud possession of Punjab Engineering College (PEC) Chandigarh.

ISRO's PSLV-C54/EOS-06 mission

The third generation Indian satellite for monitoring the oceans, formally named as Earth Observation Satellite-6 (EOS-6) was launched on 26 November 2022 by the Indian Space Research Organisation (ISRO) in partnership with Ministry of Earth Sciences (MoES) among others, from its First Launch Pad (FLP) at Satish Dhawan Space Centre (SDSC), Sriharikota. This is the 56th flight of Polar Satellite Launch Vehicle (PSLV) and 24th flight of PSLV-XL version with 6 PSOM-XLs.

IN-SPACe signs MoU with QNu Labs

The Indian National Space Promotion and Authorisation Centre (IN-SPACe) has signed a memorandum of understanding (MoU) with Bangalore-based deep tech startup QNu Labs to develop indigenous Satellite QKD (quantum key distribution) products. With this MoU, QNu Labs, with the support of ISRO and IN-SPACe, aims to demonstrate unlimited distance Satellite QKD based quantum secure communication. The outcome of this collaboration shall ensure that India leads the future of global quantum communication networks that will involve a combination of the quantum-satellite constellation, providing intercontinental connectivity.

AZAD Engineering's NAS parts for Boeing

Azad Engineering, a leading manufacturer of highly engineered complex precision parts for Aerospace, Clean Energy, Defense, Oil and Gas and SPS OEMs has delivered the first consignment of National Aerospace Standard (NAS) parts to global aircraft manufacturer Boeing. The consignment is a part of the contract secured by AZAD in the September 2021.

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Dassault Systèmes' 3DEXPERIENCE Platform for IN

Dassault Systèmes has announced that Director General Naval Projects, Vishakhapatnam (DGNP(V)) is using its 3DEXPERIENCE platform to help boost performance and innovation for key naval infrastructure projects in India. This includes facilitating industrial facade design, building information management, integrated project management and budget optimisation. With this collaboration, DGNP(V), which is actively involved in establishing marine infrastructure for the Indian Navy on the Eastern Seaboard, has achieved significant improvements in operations management and facility productivity, as well as improved cost and time efficiency of projects over time and reduced errors in calculations.

Airbus to supply Tactilon Agnet solutions

Airbus is to supply additional Tactilon Agnet licenses to BSNL network operator in India. Over a 3-year period, 20 000 additional public safety users and industry stakeholders around India such as police forces, fire fighters, ports and airports will be able to benefit from Airbus' multimedia critical communication and collaboration platform. Airbus' Tactilon Agnet is a future-proof modern, easy-to-use, flexible and scalable platform for business and mission-critical users alike. Tactilon Agnet can transmit data, video, and voice communications to all relevant bodies at once. It allows radio-device, smartphone, tablet, and laptop users to communicate individually, or in a group.

Passing Out Parade Indian Naval Academy

In a Passing out Parade (POP) held at Indian Naval Academy, Ezhimala, on 26 November 22, 252 trainees comprising Midshipmen of 103 Indian Naval Academy Course, cadets of 36 Naval Orientation Course (Regular), 36 Naval Orientation Course (Coast Guard), 36 Naval Orientation Course (Foreign), 32, 33 and 34 Naval Orientation Course (Extended) passed out with flying colours, marking the culmination of their ab-initio training. The passing out trainees comprises of 16 foreign cadets from 7 countries and 35 women trainees.

Skye Air and Vegrow collaborate for drone delivery

Skye Air Mobility, has joined hands with Vegrow in Himachal Pradesh to conduct its 3-days long drone delivery trials to carry over 100 kgs of apples from farmland to Vegrow Hub solving a wider transportation problem existing today.

IndiGo touches 300 aircraft strong fleet

IndiGo, on 6 January 2023, announced that its fleet now consists of 300 aircraft. Currently, IndiGo operates the Airbus A320 ceo and neo, the A321 neo and the ATR 72-600 aircraft. The seating capacity on the A320 ceo fleet is 180, A-320 neo fleet is 180/186, the A321 fleet is 222/232 and ATR fleet is 78. "The 300 aircraft strong fleet will help in catering to the growing passenger volume, as Indian aviation marks recovery and growth in 2023", stated the airline.

Alliance Air and ATR in maintenance partnership

Alliance Air and ATR have announced the extension of their Global Maintenance Agreement (GMA) for another five years. This year marks 20 years of partnership since the airline signed its

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first ATR pay-by-hour maintenance contract in December 2002. Through this package, the airline will continue to benefit from the repair, overhaul and pooling services of Line Replaceable Units, along with the availability and maintenance of propellers and landing gears for its fleet of two ATR 42-600 and 18 ATR 72-600.

Beluga and "Profit Hunter" at Mumbai

Mumbai International Airport/CSMIA on 22 November 2022 welcomed the Airbus Beluga and Embraer E195-E2 'Profit Hunter', the largest jet in the E2 family, as both made their maiden grand entry in Mumbai.

CDB Aviation leases 6 A320neos to Air India

CDB Aviation, a wholly owned Irish subsidiary of China Development Bank Financial Leasing Co, Limited, announced the signing of lease agreements for a fleet of six Airbus A320neo aircraft with Air India.

APPOINTMENTS

Air Marshal PM Sinha assumes command of WAC

Air Marshal Pankaj Mohan Sinha assumed command of the Indian Air Force's Western Air Command on 1 January 2023. The Air Marshal is a graduate of National Defence Academy, Pune and was commissioned into the IAF as a fighter pilot in June 1985. He is an alumnus of the prestigious Defence Services Staff College, Wellington. An experienced fighter pilot, Category 'A' Qualified Flying Instructor, Fighter Striker Leader, Instrument Rating Instructor & Examiner, Air Marshal Sinha has more than 4500 hours of flying experience.

Rear Admiral Vineet McCarty is Cdr Of The Sword Arm

The 'Sword Arm' of Indian Navy, the Western Fleet, underwent a change of guard on 15 November 22. A ceremonial naval parade was held at Naval Dockyard, Mumbai, and the baton of the Flag Officer Commanding Western Fleet was handed over by Rear Admiral Sameer Saxena to the new Fleet Commander, Rear Admiral Vineet McCarty. Rear Admiral McCarty was commissioned into the Indian Navy on 1 July 1989. He is an alumnus of the prestigious Defence Services Staff College, Wellington, and National Defence College, New Delhi.

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Indian Army approves five Make II Projects

To give a further boost to ongoing projects, Indian Army has now approved Project Sanction Orders (PSOs) of five Make II projects. Make II projects are essentially Industry funded projects involving design, development and innovative solutions by Indian vendors for development of prototypes. An assurance of order is given after successful prototype development.

Following are the projects whose PSOs have been approved:

High Frequency Man Packed Software Defined Radio (HFSDR): Project Sanction Order (PSO) for development of prototype of Frequency Man Packed Software Defined Radio (HFSDR) under Make II scheme has been issued to 14 Developing Agencies (DAs). 300 HFSDRs are planned to be procured by the Indian Army, on successful development of the prototype. State of the art, light weight HFSDR will provide long distance radio communication through enhanced data capability and band width coupled with enhanced security. It will facilitate blue force tracking with map based navigation using GIS, thereby increasing real time situational awareness. These radio sets will replace the existing HF radio sets in the inventory, which have limited data handling capability and obsolete technology.

Drone Kill System: RPAS have greatly impacted the modern battlefield even though drone related technologies are constantly evolving. The indigenous industry has adequate expertise to develop world class products in this field. As part of efforts to further encourage the indigenous anti-drone ecosystem, the Indian Army has approved Project Sanction Order (PSO) to 18 Developing Agencies (DAs) for procurement of 35 sets of Drone Kill Systems under the Make II scheme, post successful development of prototype. The project is reserved for MSMEs/Start-ups. Drone Kill System is a hard kill anti drone system against low Radio Cross Section (RCS) Drone/ unmanned Aerial System (UAS), being developed to function in all types of terrains, both during day and night.

Infantry Training Weapon Simulator (IWTS): Project Sanction Order (PSO) has been issued to four Developing Agencies (DAs) to develop the prototype for subsequent procurement of 125 sets of IWTS under the Make II procedure. The IWTS is the first tri service Make II project with the Indian Army as the lead service. The project is reserved for MSMEs/ Start ups. IWTS will be utilised to augment marksmanship skills of young soldiers on variety of weapons used by the, providing user friendly graphics to simulate battle scenarios. IWTS is a modern training aid, which will reduce recurrent expenditures on live ammunition, besides obviating the challenges of availability of firing ranges and inclement weather. Each IWTS will facilitate training of 10 personnel at any one point of time.

155mm Terminally Guided Munitions (TGM): Project Sanction Order has been issued to six Developing Agencies (DAs) for development of 155 mm Terminally Guided Munition (TGM) under Make II scheme. Variants of ammunition were held in the inventory of the IA, sans, the precision strike capability. The IA therefore plans to procure approximately 2000 rounds of 155mm TGM against high value targets with assured precision and lethality for mission accomplishment and minimum collateral damage.

Medium Range Precision Kill System (MRPKS): Project Sanction Order has been issued to 15 Developing Agencies (DAs) for developing a prototype of MRPKS under the Make-II category of DAP 2020. Post successful development of this prototype, the IA will procure 10 Sets of MRPKS. The Medium Range Precision Kill System (MRPKS), once launched can 'Loiter' in the air for upto two hours and can acquire, designate and engage real time high value targets upto 40 km. In times to come we see our country transforming as "AtmaNirbhaar" in Loitering Munition Technology.

The Indian Army is already progressing 43 ongoing projects under the Make II procedure of Capital Acquisition. 17 out of 43 projects have been initiated through suo-moto proposals received from the industry, which has generated enthusiasm and confidence in the Indian defence industry for participation in the "Make procedure".

Make II procurement scheme has given an impetus to increase the design and development in the defence industry to achieve indigenisation of high end technology systems in various types of weapon systems, ammunition and modern training systems, which are currently not available in the country. Multiple measures to expedite the ongoing Make II projects have resulted in tangible outcomes. 22 out of 43 Make II projects are now in prototype development stage, which is 66 % of projects by cost (Rs 18,000 Crores out of 27,000 Crores).

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Ammo India 2022

Posted On: 27 JUL 2022 12:50PM by PIB Delhi

Raksha Mantri Rajnath Singh has called for innovations in the field of ammunition for the creation of a strong and self-reliant base that keeps the Armed Forces fully prepared to deal with future challenges. He was addressing the inaugural session of the second conference on Military Ammunition (Ammo India) on the theme 'Make in India Opportunities and Challenges' in New Delhi on 27 July 2022. The Raksha Mantri described advanced ammunition as the reality of the new age warfare, which is a must for India, given its regional and global imperatives and security challenges.

"Scientific and technological as well as the economic development of a nation is reflected in the capacity of its weapons and ammunition. The development of ammunition is crucial not only for security, but also for socio-economic progress of the country. For India to become a world power and one of the leading countries in defence production, we must move forward in the indigenous design, development & production of ammunition," stated the Raksha Mantri.

Mr. Rajnath Singh asserted that the government understands the crucial role private sector can play in strengthening the defence sector and to enhance their participation in the field of ammunition, many barriers, which were earlier prevalent, have been removed. He said, from capping the participation of bidders, criteria of financial eligibility or the issue of credit ratings, the government has given considerable relaxation. He exhorted the public and private sectors, research and development establishments, start-ups, academia and individual innovators to

explore newer avenues which can create a base that caters to the needs of the Armed Forces, ensuring their enhanced preparedness.

The Raksha Mantri also emphasised the importance of precision guided ammunition, saying that it will play a major role in future warfare, equal to weapons/ platforms due to its constantly-evolving nature. "The employment of precision guided ammunition at 'Muntho Dhalo' base played an important role in India's victory in 1999 Kargil war. Precision strike of ammunition during 2019 strikes on terror camps in Balakot also ensured our success in the operation. Ammunition in modern battlefields is emerging in its new avatar, which once programmed can automatically take inputs, make course corrections and target the appropriate location at the right time. Earlier, only the size and explosive capacity of bombs mattered, but now their smartness is equally important," he further said.

Elaborating further on the advantages of a smart, precision and autonomous weapon system, Mr. Rajnath Singh stated that it only targets desired areas. "If any enemy base is to be destroyed, then precision ammunition will selectively target it and not any civil establishments. This is not the case with traditional ammunition. Wars are fought with the country's military, not with its people. Through precision ammunition, destruction of civil establishments can be avoided and the values of peace and humanity in times of war can be preserved," he said.

The Raksha Mantri reiterated the Government's commitment to achieve 'Aatmanirbharta in Defence' and said that


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all efforts are being made to empower the domestic industry, which can equip the Armed Forces with home-grown world-class weapons/systems, crucial for bolstering national security. He pointed out that the three positive indigenisation lists notified by Ministry of Defence clearly indicate the Government's emphasis towards indigenous manufacturing of ammunition. "Be it Guided Extended Range rockets for Pinaka, Advanced Light Weight Torpedo, Anti-Radiation Missiles or Loitering Munition, there are 43 such items in the third list. This reflects our commitment to achieve self-reliance in the field and indicates our confidence in the research, development and manufacturing prowess of the domestic defence industry. These lists of existing weapon systems and ammunition will encourage our industry to take up new challenges and ensure their progress," he stated.

Mr. Rajnath Singh appreciated the fact that six of the seven new defence companies, which were carved out of the erstwhile Ordnance Factory Board, have reported profit within six months of their inception. Munitions India Limited has received export orders worth Rs 500 crore, he said, terming the achievement as an indicator to the huge potential of the ammunition industry in the country.

The Raksha Mantri listed out many other reforms taken by Ministry of Defence, including earmarking of 68 per cent of the capital acquisition budget for the domestic industry in 2022-23 and allocating 25 per cent of the domestic capital procurement budget for promotion of private industry, MSMEs and start-ups. He also shed light on the policy which allows DRDO-Industry Special Purpose Vehicle to develop essential advanced defence products. He added that the Government fully understands the role of MSMEs and start-ups in the defence sector, therefore, the scope of Defence Innovation Start-Up Challenges and Technology Development Fund has been expanded to create more opportunities for them.

The two-day conference, jointly organised by Federation of Indian Chambers of Commerce & Industry (FICCI) and Centre for Joint Warfare Studies (CENJOWS), covered an extensive range of ammunition requirements of the Armed Forces. The conference comprised sessions on ammunition for tanks and armoured fighting vehicles; artillery including fuses; air defence, aerial munitions; munitions for precision attacks by drones and counter drone systems; naval munitions and ammunition for small arms; explosives and mines. It provided a unique platform to all stakeholders i.e. industry, users, DRDO and academia to meet and work towards achieving self-reliance in Ammunition manufacturing and moving towards 'Aatmanirbhar' in the defence sector.

Collaboration with foreign OEMs intrinsic to Atmanirbhar Bharat: Chief of the Army Staff

General Manoj Pande, Chief of the Army Staff at the event exhorted that self-sufficiency in critical defence requirement is a strategic imperative now more than ever. "Our external dependence on armaments and ammunitions have been a matter of concern and the reversing of this trend which we are witnessing is quite encouraging".

Addressing the special session on the second day of the 2nd conference on Military Ammunition 'AMMO INDIA 2022', the Chief of Army Staff while highlighting the potential for domestic and foreign players in the Indian defence production, stated that Atmanirbharta does not mean isolating from the world, but it is self-sustaining and self-generating to promote efficiency, quality and resilience. "It has been unequivocally stated that collaboration with foreign OEMs is intrinsic to Atmanirbhar Bharat and we have moved from a relationship of buyer-seller to a co-development and co-production with our foreign partners," he said.

General Pande stated that the ongoing reforms in the defence sector offer opportunity for the foreign OEMs to partner with the Indian companies and work towards our shared objectives. There is a huge potential for exports which can also contribute to the vision of our honourable Prime Minister's vision of a $5 trillion economy. "Therefore, the vision of achieving Atmanirbharta in ammunition requires a synergised approach from all stakeholders. Together with need to turn the initiative into another success story and a win-win situation for all," he emphasised.

General Pande stated that the contemporary security environment and changing character of war requires the armed forces to handle a wide spectrum of challenges both in conventional and sub-conventional domains. "Our interests are best served by being Atmanirbhar, especially in the defence production. Self-reliance is among the key factors on which the military capability of any nation rest. A holistic, all-encompassing, well calibrated, multi-pronged and futuristic approach in defence production is fundamental to ensure safeguarding our national interest".

Chief of the Army Staff also emphasised that R&D along with technological progression are equally fundamental to self-reliance. "Atmanirbharta in defence production does mean limited to production but it should also encompass evolving homegrown capabilities and technologies. For a holistic and self-reliance strategy, it is imperative that ammunition life cycle management capabilities are concurrently established," he asserted. A significant investment is also needed in establishing R&D infrastructure, testing and evaluation capabilities to meet our ammunition needs.

He further stated that a pragmatic and actionable indigenous defence production strategy is needed to ensure a secure and sustained supply of ammunitions and armaments as per our national security needs. There is also a need to share the experiences and technical knowledge of DRDO, OFBs and other PSU units with the industry to build new capabilities. We need to have a more collaborative and cooperative framework in which all stakeholders to work together to reduce import dependence and provide required impetus to the domestic capabilities, added the Chief of the Army Staff.

India's Ministry of Defence 2022 Year End Review (Some extracts)

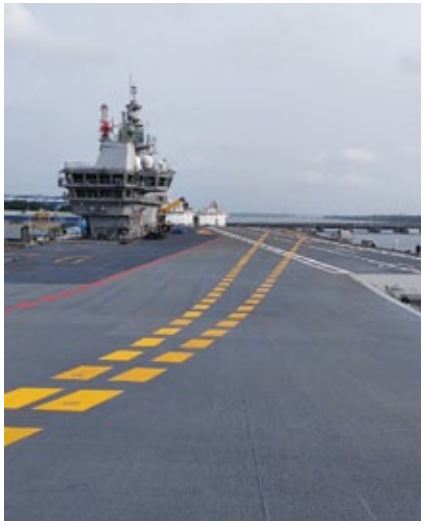
The year 2022 was of path-breaking reforms for Ministry of Defence as giant strides were made with Raksha Mantri Rajnath Singh at the helm to transform the military into a youthful, modern and 'Aatmanirbhar' force, as envisioned by Prime Minister Narendra Modi. While the Armed Forces were equipped with state-of-the-art weapons/ equipment/ technologies manufactured by a self-reliant indigenous industry, a major reform was rolled out with the aim to build a youthful and tech-savvy military ready to meet future challenges. Continuous efforts to increase defence exports in order to achieve the collective goal of global peace and prosperity, in line with the 'Make in India, Make for the World' vision, bore fruit as many countries showed keen interest in Indian platforms, resulting in record defence exports. Border area development, Nari Shakti, expansion of National Cadet Corps (NCC) and setting up of new Sainik Schools to instill patriotism among youth moved forward with renewed thrust.

Agnipath– Major Transformative Reform

The AGNIPATH scheme for recruitment of youth in the Armed Forces was launched in June, allowing patriotic youth (Agniveers) to don the sacred uniform and serve the country for a period of four years. The scheme has been designed to enable a youthful profile of the Armed Forces and bring about a transformational shift towards a more tech-savvy military. The response from youth towards the scheme has been encouraging. Over 54 lakh registrations, including by female aspirants, were received by the three Services for recruitment into the Armed Forces (Indian Army 37.09 lakh; Indian Navy 9.55 lakh and Indian Air Force 7.69 lakh). Training centres are geared up to commence training shortly with improved training infrastructure.

INS Vikrant – Red letter day for 'Aatmanirbhar Bharat'

India's first indigenous aircraft carrier INS Vikrant was commissioned by the Prime Minister at Cochin Shipyard Limited in September. The commissioning showcased the country's growing prowess of indigenous manufacturing and a major milestone in the path towards 'Aatmanirbhar Bharat'. With 76% indigenous content, the 262.5 m long and 61.6 m wide ship is equipped with state-of-the-art equipment/systems, designed for a crew of around 1,600 officers and sailors.



LCH 'Prachand': The Raksha Mantri presided over the formal induction of Light Combat Helicopter, designed and developed by Hindustan Aeronautics Limited (HAL), 'Prachand' into the Indian Air Force in Jodhpur in October 2022. The LCH is the first indigenous Multi-Role Combat Helicopter which has potent ground attack and aerial combat capability. It possesses modern stealth characteristics, robust armour protection and formidable night attack capability.

Indian Naval Air Squadron: Indian Naval Air Squadron (INAS) 325, operating the indigenously built Advanced Light Helicopter (ALH) Mk-III, was commissioned into the Indian Navy in a ceremony held at INS Utkrosh, Port Blair, Andaman & Nicobar Command in May 2022. The unit was the second ALH MK III Squadron commissioned into the Indian Navy. The state-of-the-art multi role helicopter has been developed and manufactured by HAL.

Missile Destroyers/Frigates: The Raksha Mantri launched two frontline warships of the Indian Navy – 'Surat' and 'Udaygiri' - at Mazagon Docks Limited, Mumbai in May. 'Surat' is the fourth Stealth-Guided Missile Destroyer of P15B class, while 'Udaygiri' is the second Stealth Frigate of P17A class. Project 15B class of ships are the next-generation stealth guided-missile destroyers of the Indian Navy which are follow-on class of the weapon intensive P15A (Kolkata Class) Destroyers. P17A Frigates are warships that are follow-on class of the P17 (Shivalik Class) Frigates with improved stealth features, advanced weapons and sensors and platform management systems. Y-12705 (Mormugao), the second ship of Project 15B, was delivered to Indian Navy in November, while fifth Stealth Frigate 'Taragiri' of P17A was launched in September.

Diving Support/Survey vessels: Two Diving Support Vessels (DSVs) - Nistar and Nipun - built by Hindustan Shipyard Ltd, Visakhapatnam were launched in September. DSVs equipped with an array of complex Diving Support systems and Deep Submergence Rescue Vessel are being deployed for deep sea diving and submarine rescue operations. The ships are also capable of conducting Search and Rescue operations and carrying out Helicopter Operations at sea.

ICG ALH squadrons: In a major boost to further strengthening the capabilities of Indian Coast Guard, ALH Mk-III squadrons - 835 Sqn (CG) and 840 Sqn (CG) - were commissioned in Porbandar and Chennai in June and December respectively.

ICG-Offshore Patrol Vessel: Indigenously built Offshore Patrol Vessel for Indian Coast Guard, Saksham was inducted in February. The ship has been designed and built by Goa Shipyard Ltd and is fitted with advanced technology navigation and communication equipment, sensors and machinery.

C-295 transport aircraft manufacturing facility: The Prime Minister laid the foundation stone of C-295 transport aircraft manufacturing facility, the country's first in the private sector, in Vadodara, Gujarat in October. The facility will manufacture C-295 aircraft for the

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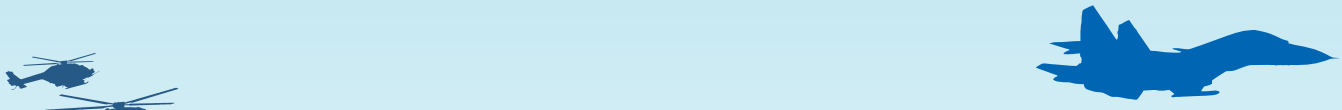

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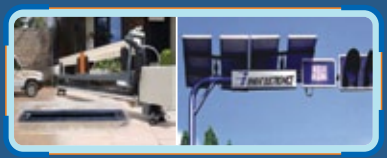
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Indian Air Force through collaboration between Tata Advanced Systems Limited and Airbus Defence and Space. This is the first project of its kind in which a military aircraft will be manufactured in India by a private company. The total cost of the project is Rs 21,935 crore. The aircraft can be used for civilian purposes as well.

Positive Indigenisation Lists: Four lists– two of 101 items each and two others for Defence PSUs of 780 and 107 items respectively – were notified by Ministry of Defence.

Union Budget 2022-23: Total allocation under capital outlay of Defence Services was enhanced to Rs 1.52 lakh crore in Budget 2022-23. 68% of capital procurement budget was earmarked for domestic industry to promote self-reliance and reduce import dependency.

Defence exports: Due to the Government's persistent efforts, defence exports grew by 334% in the last five years. They touched a record Rs 13,000 crore in Financial Year 2021-22. India is now exporting defence equipment to over 75 countries.

BrahMos: A contract was signed for procurement of 35 combat and three practice BrahMos missiles for two P-15B ships from BrahMos Aerospace Pvt. Ltd, India for an amount of Rs 1,723 crore.

EWSA/IEWR: Two contracts for procurement of 42 D-29 EW Systems and Associated Equipment and one Instrumented Electronic Warfare Range (IEWR) for Indian Air Force from BEL, Bengaluru and Hyderabad for a total cost of Rs 1,993 crore and 1,109 crore under Buy (Indian) category respectively were signed in March.

Commander Thermal Image: A contract for procurement of 957 Commander Thermal image (Ti) cum day sight for T-90 Tanks from Bharat Electronics Limited (BEL) was signed in February. The total cost of contract is Rs 1,075 crore.

Fast Patrol Vessels: A contract for construction of eight Fast Patrol vessels (FPVs) for Indian Coast Guard with Goa Shipyard Limited (GSL), Goa at a total cost of Rs 473.47 crore under Buy (Indian) category was signed in March.

Multi-Purpose Vessels: Contract for procurement of two Multi-Purpose Vessels (MPVs) for Indian Navy from Larsen & Tubro Limited, Mumbai for a total cost of Rs 887 crore under Buy (Indian) category was signed in March.

Bollard Pull Tugs: Contract for construction of six 25-Ton Bollard Pull Tugs was concluded with Titagarh Wagons Ltd, Kolkata. These tugs, with a service life of 30 years, will be capable of assisting naval ships and submarines in berthing and un-berthing, turning and manoeuvring in confined waters.

Major successful missile tests:

Brahmos Extended Range Version: In May, India successfully fired the Extended Range Version of BrahMos Air Launched missile from Su-30 MKI fighter aircraft. The launch from the aircraft was as planned and the missile achieved a direct hit on the designated target in the Bay of Bengal region.

Prithvi-II: A successful training launch of a Short-Range Ballistic Missile, Prithvi-II was carried out in June from the Integrated Test Range, Chandipur, Odisha. The missile is a proven system and is capable of striking targets with a very high degree of precision.

Agni: India carried out a successful training launch of Intermediate Range Ballistic Missile, Agni-3 from APJ Abdul Kalam Island, Odisha in November. It was part of routine user training launches carried out under the aegis of the Strategic Forces Command. The launch was carried out for a predetermined range and validated all operational parameters of the system. Earlier, in June, a successful training launch Agni-4 was carried out. It, too, validated all operational parameters as also the reliability of the system. The successful test reaffirms India's policy of having a 'Credible Minimum Deterrence' Capability.

Submarine Launched Ballistic Missile: INS Arihant carried out a successful launch of a Submarine Launched Ballistic Missile in October. The missile was tested to a predetermined range and impacted the target area in the Bay of Bengal with very high accuracy. All operational and technological parameters of the weapon system have been validated.

Helina: In April, indigenously-developed helicopter launched Anti-Tank Guided Missile 'HELINA' was successfully flight tested twice at different high-altitude ranges as part of user validation trials. The flight tests were jointly conducted by DRDO, Indian Army and Indian Air Force. The flight trials were conducted from an Advanced Light Helicopter and the missile was fired successfully engaging simulated tank target.

Laser-Guided Anti-Tank Guided Missile: Indigenously-developed Laser-Guided Anti-Tank Guided Missile was successfully test-fired from Main Battle Tank Arjun by DRDO and Indian Army at KK Ranges with support of Armoured Corps Centre & School, Ahmednagar in June. In the test, the ATGM hit the bull's eye with textbook precision and successfully defeated the target at minimum ranges. The all-indigenous ATGM employs a tandem High Explosive Anti-Tank (HEAT) warhead to defeat Explosive Reactive Armour (ERA) protected armoured vehicles.

Naval Anti-Ship Missile: DRDO and Indian Navy successfully conducted maiden flight-test of indigenously-developed Naval Anti-Ship Missile launched from a Naval Helicopter from Integrated Test Range (ITR), Chandipur off the coast of Odisha in May. It was the first indigenous air launched anti-ship missile system for the Indian Navy. The missile followed the desired sea skimming trajectory and reached the designated target with high degree of

accuracy, validating the control, guidance and mission algorithms. It employed many new technologies, including an indigenously developed launcher for the helicopter.

Quick Reaction Surface to Air Missile: DRDO and Indian Army successfully completed six flight-tests of Quick Reaction Surface to Air Missile (QRSAM) system from ITR Chandipur off the Odisha coast. The flight tests were conducted as part of evaluation trials by the Indian Army. The flight-tests were carried out against high-speed aerial targets mimicking various types of threats to evaluate the capability of the weapon systems under different scenarios, including long range medium altitude, short range, high altitude manoeuvring target, low radar signature with receding and crossing target and salvo launch with two missiles fired in quick succession.

Medium Range Surface-to-Air Missile: Medium Range Surface-to-Air Missile Army weapon system has once again proved its effectiveness as two missiles, during the flight tests, achieved direct hits against high speed aerial targets at Integrated Test Range, Chandipur off the coast of Odisha in March. The launches were carried out establishing the accuracy and reliability of the weapon system against targets covering the sea skimming and high altitude functionality within the envelope.

Vertical Launch Short Range Surface-to-Air Missile: Vertical Launch Short Range Surface to Air Missile (VL-SRSAM) was successfully flight-tested by DRDO and Indian Navy from an Indian Naval Ship at ITR, Chandipur. The system will further strengthen the Indian Navy for neutralising various aerial threats at close ranges including sea-skimming targets.

Phase-II Ballistic Missile Defence interceptor: DRDO conducted a successful maiden flight-test of Phase-II Ballistic Missile Defence interceptor AD-1missile with large kill altitude bracket from APJ Abdul Kalam Island off the coast of Odisha in November. The flight test was carried out with participation of all BMD weapon system elements located at different geographical locations. The AD-1 is a long-range interceptor missile designed for both low exo-atmospheric and endo-atmospheric interception of long-range ballistic missiles as well as aircraft.

Man Portable Anti-Tank Guided Missile: In January, DRDO successfully flight tested the final deliverable configuration of Man Portable Anti-Tank Guided Missile. The indigenously developed anti-tank missile is a low weight, fire & forget missile and is launched from a man portable launcher, integrated with thermal sight. The missile impacted the designated target and destroyed it.

Autonomous Flying Wing Technology Demonstrator: Maiden flight of Autonomous Flying Wing Technology Demonstrator was carried out successfully by DRDO from the Aeronautical Test Range, Chitradurga, Karnataka in July. Operating in a fully autonomous mode, the aircraft exhibited a perfect flight, including take-off, way point navigation and a smooth touchdown.

IAF Weapon Systems branch

In a historic step for the Indian Air Force, Government approved the creation of a new branch 'Weapon Systems (WS) branch'. It would entail unification of all weapon system operators under one entity dedicated to the operational employment of all ground-based and specialist airborne weapon systems. The branch would encompass operators in four specialised streams of Surface-to-Surface missiles, Surface-to-Air missiles, Remotely Piloted Aircraft and Weapon System Operators in twin/multi-crew aircraft.

of Force Multipliers, modernisation and improvement of infrastructure are progressing well.

The Indian Army's modernisation plan is essentially based on developing 'Force Capabilities' as per the enunciated national security requirements. Modernisation plan encompasses developing critical combat capabilities, besides overcoming the obsolescence in core capabilities. Currently our acquisition plans are focussing on enhanced capabilities incorporating modern technologies and simultaneously improving the lethality, accuracy and reliability

into a leaner and agile Army driven by technology, the Integrated Battle Groups were conceptualised. All formations of the IA will be structured on an IBG model in a phased manner. IBG-isation is progressing well and Phase 1 is near completion.

Indian Navy

Commissioning of INS Vikrant: The first Indigenous Aircraft Carrier of India, INS Vikrant, was commissioned. During the event, the Prime Minister also unveiled the new Naval Ensign, doing away with the colonial past and befitting the rich Indian maritime heritage.

Indian Army

The Indian Army primarily focused on maintaining its operational preparedness in line with India's desire to ensure stability and dominance along the Line of Actual Control, Line of Control, carried out relentless counter insurgency/counter terrorist operations and maintained high training standards while constantly monitoring and reviewing emerging and future threats to national security. The Indian Army remains prepared for all military contingencies emanating out of the collusive threat from the military modernisation and aggressive actions by the country's adversaries while, creating capacities to deal with emerging threats in cyber, space and info domains due to blurring of physical borders. The endeavour to progressively increase the capabilities through infusion of technology, induction of existing equipment. Acquisition of platforms like Akash Missile System, Satellites, Modular Bridges, Utility Helicopters, Electronic Warfare Systems, Surface to Air Missiles, Towed Gun Systems are fine examples of 'Aatmanirbharta'. Currently 140 schemes valued at over Rs 2 lakh crore are at various stages of acquisition. To invest in futuristic as well as disruptive technologies, impetus is being given to projects through Make in India and Innovation in Defence Excellence also.

Indigenous manufacturing of ammunition has been achieved in some ammunition of artillery guns and missile systems leading us to the goal of self-reliance. The process of procuring Indigenously Designed and Developed, advance Loitering Weapon System with enhanced strike capability has also progressed well. In an attempt to reform the Indian Army

INS Mormugao: INS Mormugao, the second ship of Project 15B will be commissioned in Mumbai on 18 December 2022.

Sea Trials Vagir (SM#5) followed by Commissioning: Vagir, the fifth submarine of Project-75 is undergoing sea trials. The submarine is planned to be commissioned into the Indian Navy in 2023.

Launch of ships

Udaygiri (Yard 12652). The Launch Ceremony of 2nd ship of P17A at MDL 'Udaygiri' was held in May 2022 at MDL Mumbai.

Dunagiri (Yard 3023). The Launch Ceremony of 2nd ship of P17A at GRSE 'Dunagiri' was held in July 2022 at GRSE, Kolkata.

Taragiri (Yard 12653): The Launch Ceremony of 3rd ship of P17A at MDL 'Taragiri' was held in September 2022 at MDL, Mumbai.

Survey Vessel (Large) (Four Ships at GRSE)

Nirdeshak (Yard 3026): The launch of Yard 3026 'Nirdeshak' (second ship of SVL) was held in May 2022 at L&T, Kattupalli from shiplift.

Yard 3026 at L&T, Kattupalli: Project 75 (Six Submarines at MDL with Transfer of Technology and Naval Group, France as the collaborator).

Vaghsheer: Vaghsheer, the sixth submarine of Project-75 was launched in April 2022.

Nistar and Nipun: Diving Support Vessels (Nistar and Nipun) were launched successfully in September 2022.

Naval Aviation: Naval Aviation is poised at a crucial juncture on its path towards modernisation. Numerous initiatives have been undertaken in the quest towards ensuring a potent, professionally competent and operationally ready Naval Air Arm of the future.

Induction of aircraft

In the year under review, the following aircraft have been inducted into the Indian Navy:

1. 16 ALH Mk III helicopters
2. 4 P8I aircraft
3. First batch of 3 out of 24 Multi-role helicopters (MH 60Rs). The remaining helicopters would be inducted by mid-2025, from USA. (Three other helicopters have been accepted by IN and were retained in USA for training of IN personnel).
4. Twin Engine Deck Based Fighter (TEDBF). Indian Navy along with ADA/DRDO are proactively pursuing design and development of an indigenous Twin Engine Deck Based Fighter (TEDBF).
5. Commissioning of Air Stations/Air Squadrons. IN has commissioned three new Air Squadrons in the last one year. The second P8I Squadron INAS 316 was commissioned at INS Hansa, Goa in March 2022. Two ALH Mk III Squadrons, INAS 324 and INAS 325 were been commissioned at Visakhapatnam and Port Blair on 4 July 2022 and 31 May 2022 respectively.

Indian Air Force

'Aatmanirbhar Bharat': In 2022, the IAF continued to modernise its airfield infrastructure under project - Modernisation of Airfield Infrastructure (MAFI) with a major Indian company Tata Advanced Systems Limited (TASL). The upgradation of navigational aids and infrastructure under this project is enhancing the operational capability by facilitating air operations of military and civil aircraft even in adverse weather conditions.

Support to Drone Industry: The unmanned aerial vehicles, popularly known as the Drones, have globally caught the imagination for its military application and challenges globally. The Drone industry in the country holds tremendous potential for growth. The IAF has done its bit by launching Mehar Baba-2. The competition is aimed at developing indigenous technology for a 'Swarm drone based system to detect foreign objects on aircraft operating surfaces'.

Rafale: The teeth of IAF got sharper as France completed the delivery of all 36 Rafale aircraft. The final fighter jet of the deal landed in India in December. Both Rafale Squadrons also became fully operational.

Diamond Jubilee of Chetak Helicopters: This year, Chetak helicopters in the inventory of Armed Forces completed 60 years of glorious service to the nation. To commemorate this, momentous event celebrations were held under the aegis of IAF's Training Command at AF Stn, Hakimpet. The Raksha Mantri was the Chief Guest on the occasion.

Defence Research & Development Organisation (DRDO)

The achievements of DRDO, other than the successful missile tests mentioned above, are as follows:

New Generation Akash Missile (Akash-NG): The successful flight trial of New Generation Surface to Air Akash-NG Missile was conducted from a land-based platform with all weapon system elements such as Multifunction Radar, Command, Control & Communication System and launcher participating in deployment configuration.

Akash Prime Missile: A new version of the Akash Missile 'Akash Prime' was successfully flight tested from ITR, Chandipur. It is equipped with an indigenous active Radio Frequency seeker for improved accuracy.

Short Span Bridging System-10 m: The SSBS-10 m was inducted into Indian Army. It plays a crucial role of bridging the gaps as a single span providing a wide, fully decked roadway, ensuring faster movement of the troops. The system will help in quick movement of troops and enhance the mobilisation of resources.

Advanced Chaff Technology: The technology was developed by DRDO to safeguard the fighter aircraft of Indian Air Force against hostile radar threats and enemy missile attack. Chaff is a passive expendable electronic countermeasure technology used worldwide to protect naval ship from enemy's radar and radio frequency missile seekers.

Long-Range Bomb: DRDO and IAF successfully flight-tested indigenously developed Long-Range Bomb from an aerial platform. The Bomb, after release from the IAF fighter aircraft, guided to a land-based target at a long range with accuracy within specified limits.

Abhyas: The High-speed Expendable Aerial Target was successfully flight-tested from ITR, Chandipur. Abhyas can be used as an aerial target for evaluation of various missile systems. This indigenous target aircraft, once developed, will meet the requirements of High-speed Expendable Aerial Targets.

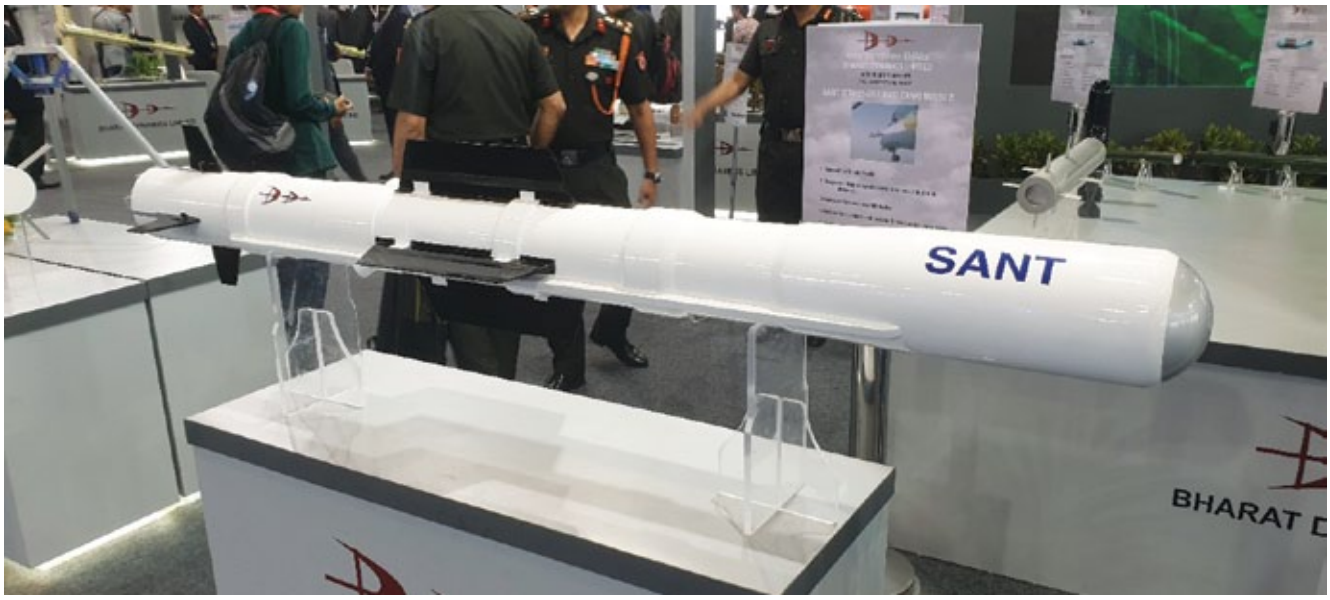
Smart Anti-Airfield Weapon: Two successful flight tests of indigenously-developed Smart Anti-Airfield Weapon (SAAW) was carried out jointly by DRDO and IAF at Chandan ranges at Jaisalmer, Rajasthan. DRDO has indigenously designed and developed SAAW capable of engaging ground enemy airfield assets such as radars, bunkers, taxi tracks, and runways etc. The high precision guided bomb is light weight as compared to weapon system of the same class.

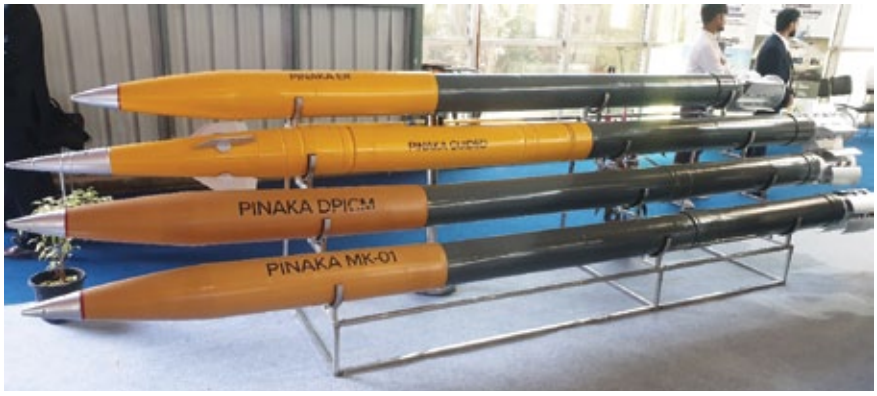
Pralay: The maiden flight test of indigenously developed surface-to-surface missile 'Pralay' was successfully conducted by DRDO from Dr APJ Abdul Kalam Island. The missile can be launched from a mobile launcher. This was a new generation missile equipped with modern technologies and induction of this weapon system will give necessary impetus to the Armed Forces.

Supersonic Missile assisted Torpedo System: DRDO developed supersonic

missile assisted torpedo (SMART) system was successfully launched from Wheeler Island in Odisha. The system is a next generation missile-based standoff torpedo delivery system. It has been designed to enhance anti-submarine warfare capability far beyond the conventional range of the torpedo. The system will further enhance the strength of our Navy and promote self-reliance in defence, harnessing of expertise and capabilities.

Stand-Off Anti-Tank Missile: DRDO and IAF flight-tested the indigenously designed and developed Helicopter launched Stand-off Anti-tank (SANT) Missile from Pokhran ranges. The missile





is equipped with a state-of-the-art MMW seeker which provides high precision strike capability from a safe distance.

Pinaka: Pinaka Mk-I (Enhanced) Rocket System (EPRS) and Pinaka Area Denial Munition (ADM) rocket systems were successfully flight-tested by DRDO and Indian Army at Pokhran Firing Ranges. The EPRS is the upgraded version of Pinaka variant which has been in service with the Indian Army for the last decade. The system has been upgraded with advanced technologies enhancing the range to meet the emerging requirements.

Solid Fuel Ducted Ramjet Technology: DRDO successfully flight tested Solid Fuel Ducted Ramjet booster, which demonstrated the reliable functioning of all critical components involved in the complex missile system. The SFDR-based propulsion enables the missile to intercept aerial threats at very long range at supersonic speeds. With the successful trial of SFDR, the range of air-to-air missiles can be enhanced.

Very Short Range Air Defence System: DRDO conducted two successful test flight of Very Short Range Air Defence System from a ground based portable launcher at ITR, Chandipur. It is a Man Portable Air Defence System designed and developed indigenously by DRDO in collaboration with Industry Partners.

BrahMos contract with Philippines: BrahMos Aerospace Private Limited (BAPL) signed a contract with the Department of National Defence of Philippines for supply of Shore Based Anti-Ship Missile System. The BAPL is a joint venture company of DRDO. The contract is an important step forward for Government of India's policy of promoting responsible defence exports.

Flight Control System Integration complex: The state-of-the-art seven story Flight Control System Integration facility at Aeronautical Development Establishment, Bengaluru was constructed in record 45 days, with in-house hybrid technology consisting of conventional, pre-engineered and precast methodology. The technology has been developed by DRDO with the help of Larsen & Toubro. This facility will support R&D activities for developing Avionics for Fighter Aircraft and FCS for Advanced Medium Combat Aircraft being undertaken by ADE, Bengaluru. The complex will also provide simulator training to the pilots of combat aircraft.

Courtesy: India MoD
Photos: Vayu, IAF, Indian Army, Indian Navy, DRDO, MoD

Dr. Kandarpa Kumar Sarma's analysis on Galwan and Tawang

Turmoil along the Northern Border

Credit: CCTV/AFP Photo

Credit: Getty Images

The 3400 km Indo-China border (or line of actual control (LAC)) continues to be in turmoil with the recent Tawang incident while the memories of the 15 June 2020 Galwan standoff is floating around. The LAC in Ladakh saw bloodbath of unprecedented scale on 15/16 June 2020 when a team of the Indian Army's 16 Bihar Regiment (BR) led by its commanding officer (CO) Col. Santosh Babu came under heavy attack from the Chinese People's Liberation Army (PLA) troops at Patrol Point 14 (PP14) in the Galwan valley. No guns were used but mediaeval tools were applied in the ice-cold night when PLA troops entrapped and attacked the 16 BR team with nail studded wooden clubs, iron rods, stones etc on the ridge overlooking the fast flowing Galwan river. The Indian Army lost 20 brave men including the CO of 16 BR while as reported later by the Russian news agency TASS, PLA suffered around 45 causalities though the Chinese government officially accepted five dead.

In contrast, at Tawang, the PLA had lost the element of surprise and the Indian Army was ready. The tranquility in the Tawang sector was broken early morning on 9 December 2022 when a group of 300 PLA troops armed again with melee weapons attempted to overwhelm the outpost of the Indian Army holding the ridge line in Yangtze at 17,000 feet with about 50 personnel. A stiff resistance was put up, with more men pouring in and the combined force started to face the onslaught, outnumbered the invaders and ensured an early retreat by the PLA troops. Casualties without reported death happened among troops of both sides.

The news of the intrusion was radioed to nearby units and reinforcements came in as quick reaction teams (QRT) were on stand-by alert. There was intelligence inputs including satellite photographs and drone feeds about the PLA preparation regarding the probable capture of the mountain top and the ridge line at Yangtze. The 25-minute free for all brawl started with abuses and stone pelting slowly converting to fisticuffs and then ending in a fierce hand to hand combat leading to the overpowering of the PLA troops. For the PLA men, falling back was the only option left but there was no relenting of the Indian Army counter assault and went after the retreating troops who were running for their lives. The Indian Army force chased the PLA troops into their territory, held position for hours, captured a few injured retreating soldiers, provided medical help and reached close to the Chinese camp.

Warning shots were fired by the PLA troops to save their camp from getting overwhelmed. After a flag meeting between the commanders, the captured soldiers were returned, and sanity was restored. During the previous few days, there was increased ground and air activities in the other side of the LAC. The Indian Air Force (IAF) scrambled Sukhoi Su-30MKI fighters in response to aggressive flying of Wing Loong dones by the PLA and was followed by combat air patrols by the IAF Rafale and Sukhoi Su-30MKI fighters for several days thereafter.

The Indian position at Yangtze on a mountain top is at a dominant location which disrupts PLA's build-up and supply lines spread around both sides in the north. It holds key to Indian infrastructure development and deployment in this area. There has been efforts earlier also by the PLA to dislodge the Indian Army units from the area. Surprising the PLA didn't have much knowhow regarding Indian Army infrastructure and deployment in this area which has improved considerably during the last few years. The stationing of additional troops close to the outpost in Yangtze, advance information, improved infrastructure and training helped the Indian Army to surround the PLA troops on 9 December and stall its misadventure.

This assault by the PLA also was intended to test the Indian Army's preparation along the LAC in the Tawang sector. No official word from the Chinese side have so far come regarding the casualties suffered by the PLA during the Tawang intrusion. But it was different in case of the Galwan

incident. The Chinese government accepted that the PLA suffered casualties and one of the military commanders associated with Galwan Qi Fabao was accorded a celebrity status. Accepting killed in action (KIA) by PLA in Galwan and displaying it in the opening session of the Communist Party of China (CPC) 20th national congress at the Great Hall of the People in Beijing on 16 October 2022 is extraordinary, a clear policy adopted to play the victim card in this stand-off which started from 5 May 2020 all along the Ladakh border. It escalated despite several rounds of military level talks which resulted in de-escalation at several points yet a few areas still remain disputed. The PLA unilaterally has been attempting to change the status quo of the LAC in several sectors with special emphasis on Ladakh and Tawang by adopting the classic Sun Tzuvian philosophy "the supreme art of war is to subdue the enemy without fighting".

Together with this Sun Tzu philosophy, the PLA also adopts asymmetrical warfare tactics where there is a complex mixture of psychological, media, information and cyber warfare at strategic level and unpredictability at tactical level with less stress on professional ethics. Unlike the Indian Army, most of the philosophy of warfare management of the PLA is oriented towards attaining certain strategic objective which makes it a dominant power. At the formation level, the PLA is a politico-military organisation in complete contrast to the Indian Army. In case of the Indian Army every decision at unit level is militarily driven and tactics oriented with nearly no political interference under certain defined national objectives. Hence, the Indian Army is naturally a professional force with lot of stress on training, refinement, ethical practice and professional conduct. Observers say that due to a the presence of a commissar of the CPC in a military unit and the equal say that the official has along with the CO in decision making even at tactical level, there are differences in opinion leading to resentment and fitful behaviour by the personnel. Such erratic behaviour of a CPC commissar led to the 1967 Nathula incident where about 80 Indian Army and 340 PLA men died. This behaviour was also on display in 1969 Ussuri river conflict with the erstwhile Soviet Union where the PLA effort to takeover an island was slaughtered in a short-sharp war. Similarly, use of overwhelming force and disregard to enemy's ability made the PLA suffer in the hands of the battle hardened Vietnamese Army in 1979.

But the 1962 Indo-China war was driven by the Sun Tzuivan ideals (of complete subjugation of the enemy by the use of overwhelming force) with the objective to achieve a surprise victory primarily to establish China as a significant power and ensure Chairman Mao's survival in the backdrop of economic hardships and widespread resentment. In 1962, the PLA was battle hardened with its participation in the Korean War (1950), suppression of several internal mutinies and annexation of Tibet, Manchuria, Inner Mongolia etc while India's defence preparedness was at its infancy. However, as time went by from 1962, several factors including the one child policy, international isolation, more reliance on unconventional and non-kinetic warfare methods have brought in variations in PLA's war fighting abilities.

Further, observing India's economic and military growth, the PLA has started to accept that the Sun Tzu's enunciation of overwhelming force is no longer relevant in the LAC. It has changed its tactics and adopted the policy of salami slicing resorting the policy of grabbing land in smaller portion and laying claim over it even with manipulation of maps and historical records. China also claims that there are issues of perception of the spread of the border, a notion which PLA has often misused. This is evident from its earlier efforts in Depsang (2013), Doklam (2017), more recently in Nakula etc though in all these cases PLA had to retreat.

All throughout these years, the PLA is displaying a pattern along the Himalayan border as part of which its troops intend to control the heights of the mountains in a 4-5 year period while India continues with its aggressive border area infrastructure development and troop deployment. The change of status of Jammu and Kashmir state post 5 August 2019, perceived threat to Pakistan Occupied Kashmir (POK) and Gilgit-Baltistan (GB), future of China Pakistan Economic Corridor (CPEC), India's assertion, Indo-US bonhomie, post-Covid 19 world order, President Xi Jinping's future with the setbacks in Taiwan etc are some of the notions that has driven the PLA to become so belligerent in Ladakh, Tawang and all along the LAC.

Despite the PLA's continuous belligerence, recently India carried out a few major ground and air exercises in the north-east during the second half of December 2022. In the recent air exercise during 16-17 December 2022 along eastern parts of Assam and Arunachal Pradesh over 40 aircraft including Rafales and Su-30MKIs took part. The Indian Army recently conducted a significant Special Forces exercise Yudh Abhyas 2022 with the US Army in Uttarakhand at a location close to 100 km from the LAC. Also, a major experimental flight of the 5400 km range Agni 5 missile took place on 15 December 2022. The Chinese missile tracking vessel Yang Wang entered Indian Ocean for this missile test but was reported to have left immediately after the Tawang drubbing.

India's steadfast approach have helped in improving border and defence infrastructure all along the LAC. In terms of manpower available for deployment, the Indian Army has achieved parity with PLA which is also the situation in case of armour, artillery and self-propelled howitzers. In case of air power, India enjoys a decisive advantage in terms of deployment, platforms, technology, quality of combat crews, experience and tactics. Most of the IAF bases are in the plains which allows deployment of offensive payload and range to the maximum limits possible. In contrast, the PLA Air Force (PLAAF) has its bases in Tibet well above 12,000 feet putting severe restrictions on maximum take-off weight. The Indian Navy (IN) is very much capable of enforcing a blockage of Chinese maritime trade along the Malacca straits. Further, the US has already expressed its willingness to share real time data regarding deployment and movement of Chinese warships and submarines. Apart from the nuclear arsenal, PLA's rocket force is the most damaging component upon which China places lot of strategic value.

While the PLA always refers to the 1962 debacle that India suffered, things have changed a lot since then especially in terms of infrastructure and capability. While the 17 Mountain Strike Corps is operational at Panahgarh (West Bengal), there are three Sukhoi Su-30MKI squadrons in Assam, a Rafale squadron in Hasimara (West Bengal), US made M777 155 mm howitzers are deployed close to the Tawang sector, a new aviation brigade is active along the Assam-Arunachal border equipped with Israeli

Credit: AFP

Heron drones, Chinook helicopters, AH-64 Apache and LCH Prachand gunships are also available for deployment. Soon the Sukhoi Su-30MKIs shall start to deploy the 250 km range Rampage air launched ballistic missile to enhance its offensive capability along with the already deployed ground and air launched Brahmos.

The recent flare-ups along the Himalayan border starting with Doklum (2017), East Ladakh (2020) and now in Tawang bears signs of a probable all-out war with China in the near future. In a short-sharp war India has the edge but if the effort is a prolonged one it will give advantage to China. Further, the political resolve must be more inspiring and the loss of 20 Indian Army men in Galwan should not be forgotten.

In the ground level, after the Ladakh incident, the Indian Army field commanders have been authorised to use force where and when required but use of firearm was not done in Tawang as a deterrent element. It leaves the scope of a repeat of such incidents in the near future with the possibility of the PLA coming back better armed and prepared looming large. The 16 BR men putting up a brave fight against a treacherous PLA camp in PP14 in Galwan valley has very few parallels in chronicles of modern warfare. The troops of J&K Light Infantry, Sikh and Jat Regiments displaying a resolute defence against the marauding PLA men also is part of Indian Army's rich tradition of courage and tenacity. But the Indian Army troops are not border guards and must be authorised to fire instead of always using unconventional means to deter the PLA and overwhelm them numerically as has been the case in Tawang. The military leadership should be accorded the freedom to act decisively to deter incidents like those that happened in Galwan and now in Tawang. Some historical facts are pertinent. During 1967, when Lt Gen Sagat Singh was the GOC 17 Mountain Division, the Nathula incident took place where the PLA suffered massive causalities and never ventured out in this sector. During the tenure of another exceptional military leader Brigadier Hannot Singh (later Lt. Gen and one of the heroes of 1971 Indo-Pak war in the western front), all the Indian Army units patrolling the Nathula sector were asked to carry weapons and were instructed to be ready to use these if required against the PLA which made the Chinese very careful.

While the Indian Army's fearlessness is legendary, the only way possible to avoid an all-out war shall be to act decisively against the PLA in all areas of active confrontation. With the PLA's aggression along the LAC, India's effort to assert itself shall continue to be a national objective. A probable debacle of the PLA in the hands of the Indian military in the near future shall build the scenario to make India the next emerging power.

Article by Dr. Kandarpa Kumar Sarma Professor and Head, Department of ECE, Gauhati University, Assam.

(All images for representational purposes only)

Credit: theweek.in

Kalyani Rafael Advanced Systems rolls out 100th MRSAM missile kit

Kalyani Rafael Advanced Systems Pvt Ltd (KRAS), on 13 December 2022, rolled out the 100th Medium Range Surface to Air Missile Kit for delivery to the Indian Armed Forces. The kit is part of the MRSAM Air Defence Missile jointly developed by Rafael Advanced Defense Systems Ltd and DRDO and manufactured in collaboration with Indian industry comprising of both private and public sector players including MSMEs. The delivery of the 100th MRSAM Missile Kit takes place close on the heels of the delivery of the first firing unit to the IAF at Air Station Jaisalmer on 9 September 2021.

Dr BHVS Narayana Murthy, Distinguished Scientist and Director General Missiles & Strategic Systems handed over the 100th MRSAM Missile Kit to senior officers of the Indian Armed Forces in the presence of Mr Baba N Kalyani Chairman, and Managing Director, Bharat Forge Ltd and Maj Gen (Retd.) Yoav Har-Even, President & CEO Rafael Advanced Defense Systems Ltd, Israel.

Speaking on the momentous occasion, Mr Baba N Kalyani Chairman, and Managing Director, Bharat Forge Ltd stated, "KRAS is proud to accelerate the delivery of the 100th MRSAM Missile Kit for the Indian Armed Forces. This delivery is not only a shining example of synergy between India and Israel and the private and public sector but also reinforces our commitment to AatmaNirbhar Bharat as envisioned by our Prime Minister Narendra Modi". He also added that "apart from the missile kits, we will extend our support in Maintenance and Repair Operations of in service Air Defence Missile Systems to the Armed Forces".

During his address Major General Retd Yoav Har-Even President and CEO Rafael lauded the joint efforts of all stakeholders in this programme. He stated, "We have been a reliable partner to the Indian Armed Forces for almost three decades and these missile kits are a testimony of our commitment to AatmaNirbhar Bharat". He also stated that KRAS being a joint venture is a testament to the enhance cooperation between Israel and India in the strategic defence sector, as it leverages the technology of Rafael with the engineering strength of the Kalyani Group.

Mr. Rajinder Singh Bhatia, President & CEO, BFL Defence, Air Cmde Abhijeet Nene, Mr. U Raja Babu, Dir. RCI, Maj Gen Yoav Har- Even (Retd) President & CEO, Rafale, Dr BHVS Naryana Murthy, DS& DG MSS/DRDO, Mr. Baba N Kalyani, Chairman & MD Bharat Forge Ltd, Gp Capt. Deswal and Brig Gen. Pinni Youngman (Retd), Executive VP & GM AMDS Division.

Tata Boeing Aerospace 1st fuselage for Indian Army AH-64 Apache

On 19 January 2023, Tata Boeing Aerospace Limited (TBAL) delivered the first fuselage for six AH-64 Apache attack helicopters ordered by the Indian Army from its state-of-the-art facility in Hyderabad.

"This is a proud milestone and a testimony of our commitment towards Aatmanirbhar Bharat and the world-class manufacturing capabilities at our joint venture Tata Boeing Aerospace Limited at Hyderabad. The Apache will provide the Indian Army with a significant boost in capability just as the AH-64 has for the Indian Air Force," stated Salil Gupte, President, Boeing India. Boeing had completed the deliveries of all 22 AH-64E Apache helicopters to the Indian Air Force in 2020.

TBAL's 14,000 sqm facility in addition to being a global sole source supplier for

Apache fuselages, produces complex aero-structures for Boeing 737 and 777 models. The joint venture between Boeing and Tata Advanced systems Limited (TASL) employs over 900 engineers and technicians and utilises cutting-edge robotics, automation and advanced aerospace concepts in its manufacturing processes.

"Successful delivery of the first fuselage for Boeing AH-64 Apache combat helicopters for Indian Army is the result of the hard work and seamless collaboration of the teams at TBAL, India. This delivery also positions TBAL and India as an important manufacturing base in overall Boeing operations. We stay committed towards progression of indigenous defence manufacturing with strong focus on the quality and timely delivery," stated, Sukaran Singh, Managing Director and CEO, Tata Advanced Systems Limited (TASL).

TBAL has produced and supplied Boeing's Apache final assembly plant in Mesa, Arizona with over 190 fuselages. More than 90 percent of the parts used in these aerostructures assemblies are manufactured within India through over 100 Micro, Small and Medium Enterprises (MSME) suppliers in support of the government's vision for Make in India. Tata Group recently won the "Supplier of the year" award 2022 from Boeing, from among more than 11,000 suppliers worldwide.

With more than 1,275 AH-64 Apaches in operation accumulating over 4.9 million flight hours globally, 1.3 million of which have been in combat, the attack helicopter holds the reputation of being the world's most advanced and proven attack helicopter.

(Images from Twitter)

Exercises and visits

Exercise Malabar 2022 at Japan

The Opening Ceremony of the multi-national maritime exercise Malabar 2022 hosted by Vice Admiral Yuasa Hideki, SDF Fleet Commander was held onboard JS Hyuga at Yokosuka, Japan on 8 November 2022. This edition of the exercise took place 8-15 November 2022. It marked the 30th anniversary of exercise which began in 1992 as bilateral exercise between India-US and gained further eminence with joining of Japan and Australia. The ceremony was attended by the crew and planning staff of participating ships, aircraft and Special Forces from Australia, India, Japan and United States.

The Indian delegation comprised Commanding Officers and crew of INS Shivalik, INS Kamorta, P8I and Marine Commandos was led by Rear Admiral Sanjay Bhalla, Flag Officer Commanding Eastern Fleet. Vice Admiral Karl Thomas, Commander, US Navy Seventh Fleet and Real Admiral Jonathan Earley, Fleet Commander Royal Australian Navy also participated in the ceremony along with personnel from their respective navies. Indian Navy was represented by indigenously built ships Shivalik, Kamorta, Marine Commandos and a maritime patrol aircraft P8I.

Indo-French Garuda-VII culminates

The seventh edition of the bilateral air exercise between the Indian Air Force (IAF) and the French Air and Space Force (FASF), 'Exercise Garuda-VII' concluded at Air Force Station, Jodhpur on 12 November 2022. The FASF participated in the exercise with Rafale fighter aircraft and A-330 Multi Role Tanker Transport (MRTT) aircraft, while the IAF contingent comprised Su-30MKI, Rafale, LCA Tejas and Jaguar fighters. This fighter element was complemented by the IAF's Flight Refuelling Aircraft, AWACS and AEW&C, as well as Mi-17 helicopters and the newly inducted LCH Prachand.

Exercise Garuda-VII provided the two Air Forces with the opportunity for professional interaction and sharing of operational knowledge and experience. With meticulous planning and execution of various phases of the exercise, personnel of the IAF and the FASF were exposed to realistic air combat simulations and the associated Combat Support Operations. This enabled the participating contingents to engage in wide ranging interactions, providing valuable insight into each other's best practices.

Exercise Sea Vigil-22

The third edition of the 'Pan-India' Coastal Defence Exercise 'Sea Vigil-22' was conducted on 15-16 November 2022. This National Level Coastal Defence Exercise was conceptualised in 2018 to validate various measures that have been instituted towards enhancing maritime security since '26/11'. Coastal Security being a major sub-set of Coastal Defence construct, the concept of 'Sea Vigil' was to activate the coastal security apparatus across India and assess the overarching coastal defence mechanism. The exercise was undertaken along the entire 7516 km coastline and Exclusive Economic Zone of India and involved all the Coastal States and Union territories along with other maritime stakeholders, including the fishing and coastal communities. The exercise was conducted by the Indian Navy in coordination with the Coast Guard and other ministries entrusted with the task of maritime activities.

INS Trikand and Operation Sea Sword 2

INS Trikand participated in the Combined Maritime Forces (CMF) led Focused Operation "Sea Sword 2" in the Northwest Arabian Sea from 6 to 14 November 2022. The ship participated with other multinational forces and regional partner navies to counter terrorism, prevent narcotics trade and stop smuggling entities from using the seas for their nefarious activities. The Indian Navy's long range maritime patrol aircraft also participated in the operation and provided air support.

Exercise Garuda Shakti with Indonesia

As part of military-to-military exchange programmes, a contingent of Indian Special Forces troops engaged in a bilateral joint training Exercise Garuda Shakti with Indonesian Special Forces at Sangga Buana Training Area, Karawang, Indonesia. Exercise Garuda Shakti is the eighth edition of the series of bilateral exercises under this banner. The exercise which commenced on 21 November 2022 aimed at enhancing understanding, cooperation and interoperability between the Special Forces of both armies.

India-Singapore exercises

The bilateral training exercise with the RSAF culminated on 18 November 2022. Operating in simulated complex scenarios, participants from both the Air Forces "learnt valuable lessons while further enhancing bilateral ties and mutual cooperation".

Exercise Agni Warrior with Singapore

The 12th Edition of Exercise Agni Warrior, a bilateral exercise between the Singapore and Indian Army, which commenced on 13 November 2022 concluded at Field Firing Ranges, Devlali (Maharashtra) on 30 November 2022. Exercise Agni Warrior, involved showcasing joint firepower planning, execution and use of new generation equipment by the artillery arm of both armies.

Exercise Naseem AL BAHR with Oman

The Indian Navy's guided missile stealth frigate, INS Trikand, offshore patrol vessel, INS Sumitra, and Maritime Patrol Aircraft, (MPA) Dornier, participated in the 13th Edition of the Indian Navy-Royal Navy of Oman bilateral exercise 'Naseem Al Bahr' (Sea Breeze).

The exercise was conducted from 19 to 24 November 2022 off the coast of Oman and had three phases: harbour phase, sea phase and debrief. Activities undertaken during the harbour phase included professional interactions between IN and RNO operations teams and friendly sports fixtures between the two navies. IN Ships Trikand and Sumitra, along with RNO Ships Al Shinas and Al Seeb, sailed for the sea phase. IN MPA Dornier, RNO MPA and shore based RAFO fighter aircraft Hawks joined the exercise at sea.

Joint HADR Exercise Samanvay

Indian Air Force conducted the Annual Joint Humanitarian Assistance and Disaster Relief (HADR) Exercise 'Samanvay 2022' from 28 November 2022 to 30 November 2022 at Air Force Station Agra. With an aim to assess the efficacy of institutional Disaster Management structures and contingency measures, the exercise comprised a seminar on Disaster Management, a 'Multi Agency Exercise' involving static and flying displays of various HADR assets and a 'Table Top Exercise'. The exercise aims to provide a unique platform for exchange of domain knowledge, experience and best practices with the participating ASEAN member countries.

INS Shivalik and Kamorta in South Korea

Indian Naval Ships Shivalik and Kamorta, during their stay at Busan from 21 to 23 November 2022, participated in multiple activities with the RoK Navy that included official and social interactions,

cross-deck visits and sports fixtures. The Commanding Officers of both IN ships also called on Vice Admiral Kang Dong Hun, Commander Republic of Korea Fleet, who welcomed the IN ships and discussed avenues to further strengthen maritime cooperation between Indian Navy and the RoK Navy. On departure from Busan, Shivalik and Kamorta undertook a Maritime Partnership Exercise with RoK Navy Ship No Jeok Bong.

India-US Exercise Yudh Abhyas 22

In November 2022, towards enhancing team integration and interoperability, soldiers of the Indian Army and US Army conducted joint training in unarmed combat, rock craft, trap shooting and logistic procedures etc at Auli, Uttarakdand, India. Additionally, IAF Chinook helicopters carried out a Combat Enabling Operation as part of the Annual High Altitude Exercises.

Australia/India Exercise AUSTRA HIND

The bilateral training exercise "AUSTRA HIND 22" between contingents of the Indian Army and the Australian Army took place at Mahajan Field Firing Ranges (Rajasthan) from 28 November to 11 December 2022. This was the first exercise in the series of AUSTRA HIND with participation of all arms and services contingent from both armies. The Australian Army contingent comprised soldiers from the 13th Brigade of the 2nd Division and the Indian Army was represented by troops from the Dogra Regiment. Exercise "AUSTRA HIND" will be a yearly event that will be conducted alternatively in India and Australia. Aim of the exercise is to "build positive military relations, imbibe each other's best practices and promote the ability to operate together while undertaking multi-domain operations in semi deserts terrain under a UN peace enforcement mandate".

India-Malaysia Exercise Harimau Shakti

India-Malaysia joint military Exercise "Harimau Shakti 2022" commenced at Pulai, Kluang, Malaysia on 28 November and culminated on 12 December 2022. Exercise HARIMAU SHAKTI is an annual training event between the Indian and Malaysian Army which is being conducted since 2012. Combat-experienced troops of the Garhwal Rifles Regiment of Indian Army and the Royal Malay Regiment of the Malaysian Army participated in the exercise this year to share experiences gained during operations in order to enhance inter-operability in planning and execution of various operations in jungle terrain. The scope of this exercise involved a Command Planning Exercise (CPX) at the Battalion level and Company level Field Training Exercise (FTX) on sub-conventional operations in jungle terrain.

INS Shivalik and Kamorta visit Vietnam

Indian Naval Ships, Shivalik and Kamorta which are forward deployed in the South China Sea visited Ho Chi Minh City, Vietnam. The ships undertook numerous professional interactions with the Vietnam People's Navy during the visit. The visit was part of the bilateral defence cooperation activities to further enhance the robust ties between the two navies as also to mark the 50th anniversary of diplomatic relations between India and Vietnam. The visiting Indian Naval ships Shivalik and Kamorta form part of the Indian Navy's Eastern Fleet based at Visakhapatnam.

IN ships participate at IFR-22 at Bangladesh

The Indian Navy delegation led by Vice Admiral Biswajit Dasgupta, the Flag Officer Commanding-in-Chief, Eastern Naval Command and three warships of the Indian Navy participated in the maiden

International Fleet Review (IFR) hosted by Bangladesh at Cox's Bazar on 7 December 2022. HE Sheikh Hasina, Prime Minister of Bangladesh reviewed the International Fleet comprising ships from Bangladesh Navy and eight ships from six foreign countries. With three ships, the Indian Navy contingent was the largest amongst the participating foreign navies in this IFR. The other five participating ships were from China, Malaysia, Myanmar, Thailand and USA.

The three ships representing the Indian Navy, the guided missile destroyer INS Kochi, anti-submarine warfare corvette INS Kavaratti and offshore patrol vessel Sumedha are all indigenously designed and constructed warships. The presence of these ships at this multinational event at Bangladesh contributed towards "showcasing the indigenous shipbuilding capabilities of Indian Shipyards".

39th Edition of India-Indonesia CORPAT

The 39th edition of India-Indonesia Coordinated Patrol (Ind-Indo CORPAT) between the Indian Navy and the Indonesian Navy was conducted from 8–9 December 2022. Indian Naval Ship (INS) Karmuk, an indigenously built missile corvette participated in the pre-deployment briefing at Belawan, Indonesia. The CORPAT was executed along the International Maritime Boundary Line (IMBL) from 15 to 16 December 2022 and concluded with debrief at Port Blair. Along with INS Karmuk, L-58 (indigenously built landing craft utility vessel) and Dornier maritime patrol aircraft participatied in the CORPAT. KRI Cut Nyak Dien, a Kapitan Pattimura Class corvette, represented the Indonesian side.

Indo-Kazakhstan Exercise Kazind 2022

The 6th Edition of Indo-Kazakhstan joint training exercise KAZIND-22 was conducted at Umroi (Meghalaya) from 15 to 28 December 2022. Joint annual training exercise with the Kazakhstan Army was instituted in 2016 as Exercise Prabal Dostyk, which was later upgraded to a company level exercise and renamed as Ex Kazind in 2018. Kazakhstan Army soldiers comprising troops from the Regional Command, South and Indian Army soldiers from the 11 Gorkha Rifles participated. Aim of the exercise was to build positive military relations, imbibe each other's best practices and promote the ability to operate together while undertaking counter terrorist operations in semi urban/jungle scenarios etc.

India-Nepal Exercise Surya Kiran 2022

An Indian Army contingent reached Nepal on 15 December 2022 to participate in the 16th Edition of India-Nepal Joint Training Exercise Surya Kiran 2022. The exercise aimed to share experience gained by both Armies in counter terrorism and disaster relief operations.

Royal Navy's HMS Tamar visits India

The Royal Navy's offshore patrol vessel HMS Tamar sailed to the Andaman and Nicobar Islands on 6 January 2023 as part of its permanent deployment in the Indo-Pacific. Over the next five days, the ship and her crew undertook capability demonstrations and maritime exercises with the Indian Navy. HMS Tamar is one of two Royal Navy vessels on permanent deployment in the Indo-Pacific as set out in the UK's Integrated Review. The ship's visit to India is an opportunity to further strengthen the shared maritime domain awareness effort, and "underlines the UK's and India's intent to collaborate in the Indian Ocean Region and wider Indo-Pacific".

Indian Army Western Command exercises in December 2022

Golden Arrows division conducted Special Heliborne Operations training with Mi-17 V5 helicopters; the special training "will enhance insertion capability and swift action in enemy territory thereby augmenting operational preparedness". A field exercise and validation of joint communication and data transfer in adverse Electronic Warfare environment was also carried out. Meanwhile, the Panther Division conducted Exercise Panther Sanchar to practice radio communication through electronic jamming as also to validate ground to air communication with ALH-WSI. The exercise "will enhance synergy and coordination between various arms and services".

Kharga Corps undertook validation of airlifting of assault brigades to augment battlefield capability of strike corps in obstacle ridden terrain. Lastly, troops of Charging Ram Brigade trained for Special Heliborne Operations by practicing insertion through Slithering and Low Hover jumps with Mi-17 V5 helicopters. Training once again displayed seamless synergy and coordination between the Indian Army and IAF.

The Black Arrow Brigade conducted integrated training on battle manoeuvres thereby "enhancing battle readiness of the formation to undertake swift operations and achieve decisive victory".

The DFFSS seminar

2023: Security challenges confronting India

The inception of Delhi Forum For Strategic Studies (DFFSS), a think tank was conceived jointly by the eminent Air Power historian, S. Pushpindar Singh Chopra and the founder Director General of India's Defence Intelligence Agency (DIA), Lt Gen Kamal Davar (see photo above right) about seven years back. They had conducted many useful and thought-provoking seminars with the cream of India's strategic fraternity attending and sharing their thoughts. The sudden and unfortunate demise of S. Pushpindar Chopra, owing to COVID 19, the DFFSS did not conduct any events since the last three years. This year on the initiative of its dynamic President, Lt Gen Kamal Davar, it decided to once again get active in India's strategic analysts community! Accordingly, a Roundtable was organised by the think tank at the India International Centre on 11 January 2023 to discuss "2023: Security Challenges Confronting India". A large number of renowned strategic analysts, retired armed forces senior officers and diplomats attended the deliberations.

In his Introductory Remarks, the DFFSS President, Lt Gen Kamal Davar flagged certain important aspects of the four major security cum strategic challenges likely to confront India in the foreseeable future. He flagged major aspects of the challenges emerging from both the collusive and independent threats obtaining from an assertive and overly ambitious China and its client-state Pakistan. He emphasised the point that we have to be more than resolute and firm in our actions in dealing with the perfidious Chinese and should take "mirroring actions" whenever they indulge in mischief against us. He further exhorted all present that India must not harp on referring to variance in perceptions of the Line of Actual Control (LAC) as it gives a handle to the wily Chinese to linger on the so-called differing perceptions of the LAC despite the fact that they are in possession of all areas conforming to their 20 November 1962 claim-lines. They, not discussing in depth, matters to resolve the LAC alignment clearly showed that they would endeavour to indulge in their infamous "salami-slicing tactics" eastwards in E. Ladakh and try to gobble more territory. We should be prepared for a limited kinetic conflict with them in E. Ladakh in the very near future.

Gen Davar emphasised that it was high time that we go all out to strengthen the sinews of our Comprehensive National Power (CNP) to adequately thwart the Chinese and Pakistani challenges to our security. Gen Davar also opined that India had not truly exploited the many faultlines of Pakistan which the latter must be made aware of. He felt that till the time the Deep State in Pakistan enjoyed unbridled powers, improvement in our relations with them were truly not possible.

Director USI, Maj Gen BK Sharma, spoke at length on the military, strategic, diplomatic and economic lessons for India from the ongoing Russia-Ukraine War. He exhorted that the nation would have to take many innovative measures to prepare ourselves against the myriad threats to our security. Gen Sharma emphasised that though "this is not the era of war", but war is a reality and we have to be thus prepared for all eventualities. Gen Sharma stated that the Indian Armed Forces must reduce their weaponry, arms and equipment imports from Russia (60 percent dependency in total military hardware) and from other nations too. He opined that since decades we have been preparing for "short, intense wars" but the ongoing nearly a year old Ukrainian war has brought forth totally different lessons including the duration of wars in the current context. Thus we have to carefully build up adequate stocks and our GS reserves. He emphasised on the need to be self-reliant in equipment by increasing the prowess to produce indigenously with an "inbuilt surge capability." He, however, cautioned that cutting imports of critical military hardware and ammunition which was only available abroad would not be in our interest as we build up our stocks/ GS reserves to the desired levels. The government would have to increase the defence budget from the paltry 1.5 percent of the GDP it allots to it. He also suggested a "Whole of Nation Approach" to matters afflicting the security of the country.

Former Kashmir Corps Commander and currently Chancellor of the Central University in Kashmir, Lt Gen Ata Hasnain, spoke at length on the emerging spectrum of Information Warfare (IW) and Communication Strategy. Highlighting the criticality of Information Warfare in shaping perceptions both in peace and war, Gen Hasnain suggested a "whole of government approach" in conceiving and formalising an Information Warfare policy. He lamented that while formulating India's policy towards Information Warfare and Communication Strategy, the military was usually left out despite it carrying out and furthering, in its hallowed mission, the nation's voice while dealing with people even in insurgency-hit regions. He mentioned how effectively Pakistan's Inter Services Public Relations organisation spread a lot of lies to further their nefarious agendas. Gen Hasnain suggested that ministries like the MHA, MOD, IB and all other governmental agencies involved in spreading the nation's aspirations and message must synergise their agendas and their resources for the overall national good. He suggested the formation of a National Strategic Communication Authority to coordinate IW and centric- warfare strategy.

Renowned current member of the National Security Advisory Board, Tilak Devasher spoke on his prognosis regards the foreseeable trajectory of India-Pakistan relations. He mentioned that Pakistan was suffering from acute internal political stability and a gravely adverse economic situation. In addition, the ill effects of climate change were also substantially affecting Pakistan. Pakistan, which was, the epicentre of global terrorism, was now itself suffering from its evil ways. The Tehrik-e-Taliban Pakistan (TTP) in concert with Pakistan's earlier protégé, Taliban in Afghanistan were now carrying out terrorist acts inside Pakistan specifically and successfully targeting frequently Pakistan's security forces. He opined that till Pakistan did not get over its obsession with J&K, which is an integral part of India, relations with India may never improve. However, India as a larger and more powerful country, could keep its doors open for any constructive engagement with Pakistan without letting its guard down.

Veteran diplomat Suresh Goel spoke about the future of the vexed India-China relationship. He stated that despite China being economically far ahead of India with its GDP seven times that of India, we must traverse the path leading to economic growth and internal political stability. He expressed confidence, like of the rest of India in the Indian military to thwart China's aggressive designs. He cautioned our establishment that as we militarily prepare, we should also be aware of the economic costs of war and cited the example of a powerful country like Russia in its current conflict with Ukraine. To improve India-China relations, he felt that we should think of ways and means other than military conflict. However, he agreed with the majority view, that in today's context, neither cultural diplomacy nor leveraging trade relations with China would help. Augmenting the CNP was most essential in keeping our preparedness vis-à-vis China in check. He also suggested strengthening of our intelligence system to monitor China's mischief against us.

After an interesting Question and Answer session, the internationally renowned Counter Terrorism expert, Dr Ajay Sahni who heads the Institute of Conflict Management delivered a hard-hitting Closing Address. Dr Sahni mentioned that of the 39 countries that have disintegrated after World War II, only 5 were as a result of external aggression and 34 nations due to internal factors. He cautioned against growing aggressive hyper-nationalism and polarising politics. He also drew the attention of the audience on the State's increasing reliance on unprincipled coercion and progressive erosion of institutional integrity and autonomy. He felt that erosion of public and global trust and legitimacy were prospects that could undercut India's economic and "great power" ambitions.

Dr Sahni wondered that despite Chinese incursions in E. Ladakh and subsequent announcement of import cuts from China, today Chinese imports to India are a record high and Indian exports to China have badly slumped! Concluding, Dr Ajai Sahni lamented the increase of criminalisation in Indian polity. He opined that India will have to be militarily well prepared, economically sound and morally lofty if it desires to take its rightful seat on the global high table.

The VAYU Editorial Team

(Photo: DRDO)

TAPAS/Rustom-II: India's high-end military drone

Aerial warfare has come a long way from bows and arrows to fighter jets to military drones. As per former US Army General, Stanley McChryshtal, the military drones are an 'all seeing eye' permanently on call which can give reliable, real-time intelligence and apparently riskless, pinpoint accurate strike capability. The recent Azerbaijan-Armenia war and the ongoing Ukraine-Russia war have also highlighted the importance of military drones in modern-day warfare. India is not far behind in drone technology, where various concurrent projects on different types of drone development is going on. One such project which is set to begin its user trials soon is TAPAS BH-201 or Rustom-II.

Rustom-II/Tapas BH-201 (Tactical Advanced Platform for Aerial Surveillance Beyond Horizon-201) is a Medium Altitude Long Endurance (MALE) drone being developed by Aeronautical Development Establishment (ADE) and Defence Research & Development Organisation (DRDO).

Evolution of TAPAS BH-201

It all started with the development of manned, twin-seater Light Canard Research Aircraft (LCRA) by the National Aerospace Laboratories (NAL) team headed by Prof Rustom Damania. The design of Rustom-I, a MALE drone developed by ADE, was derived from LCRA. In Rustom-I, necessary sensors and avionics were integrated and tested with the required aerodynamic configuration which later proved as a test bed for the development of Rustom-II. But it had its limitations of payload, endurance and altitude. To improve these limitations, Rustom-H was developed with a completely new and improved design. It featured a larger airframe, higher payloads, an increase in composite materials in the airframe, increased Lift to Drag ratio, higher redundancy (to enable safe operation in case of failure of the hydraulic systems), and stronger data link (for better communication with the ground stations) and better propulsion systems. Rustom-II or TAPAS BH-201 is the improved version of Rustom-H in user configuration to meet the specified Qualitative Requirements.

Timelines & Updates

- The first maiden flight of Rustom-II was carried out on 16 November 2016 Aeronautical Test Range (ATR) in Chitradurga, Karnataka.
- As per then DRDO Chief, S. Christopher, 9 prototypes would be built, advanced from the initial aircraft for testing purposes before the process of certification.
- The first flight of Rustom-II/TAPAS BH-201 in user configuration with the

(TAPAS BH-201, Image credit: Unknown)

higher capacity engine was carried out at Chitradurga on 25 February 2018.

- The sixth Rustom-2 prototype AF-6 crashed on 17 September 2019 due to link loss with the ground station and rough turbulence beyond the capacity of the control law.
- The first take-off using GPS-SBAS (Satellite Based Augmentation System) based auto mode was successfully carried out on 7 November 2020. GPS Aided Geo-Augmented Navigation (GAGAN) was utilised for augmenting the accuracy of the GPS.
- The indigenous retractable landing gear was handed over by Combat Vehicle Research & Development Establishment (CVRDE) to ADE on 10 January 2021.
- Automatic Take-off and Landing (ATOL) was carried out successfully using the GAGAN satellite communication (SATCOM) system on 13 November 2021.
- The first external pilot-assisted night landing on Tapas was successfully performed in the month of April 2022.
- The project started at the cost of Rs 1,540.74 crores but was later revised to Rs 1,786 crores as of 2022.
- TAPAS BH-201/Rustom-II is undergoing certification by the Centre for Military Airworthiness and Certification (CEMILAC) and the Directorate General of Aeronautical Quality Assurance (DGAQA). It will be the first ever indigenous R&D prototype UAV to get certified by CEMILAC and DGAQA.
- Hindustan Aeronautics Limited (HAL) will produce the first five airframes for limited production between September 2022 and April 2023 in a staggered manner. It will be handed over for user trials before actual orders are placed for the aircraft by the user. Bharat Electronics Limited (BEL) will be the primary partner to produce onboard avionics and electronic systems. The flight control systems, avionics, and data-link systems for the first five aircraft have already been procured.
- 76 TAPAS BH-201/Rustom-II drones are planned to be inducted as of now, 60 by the Indian Army, 12 by Indian Air Force, and 4 by the Indian Navy.

Key Features of Tapas BH-201

- **Altitude and Endurance:** It has a service ceiling of 30000 feet altitude and an endurance of 18 hours currently. As per former ADE Director, Dr. S. Venugopal, ADE has an 'alternate plan' to meet the requirements of 24-hour endurance.
- **Range:** It has a range of 250+ km Line of Sight (LoS) from the data link (uses C Band frequency) developed by Defence Electronics Application Laboratory (DEAL) by DRDO. Also, it has a 1000+ km range from SATCOM (uses K_u Band frequency) using the GAGAN system.
- **Sensors:** Various sensors are used in the aircraft to communicate it with ground stations, other aircraft and satellites. Some key sensors are:

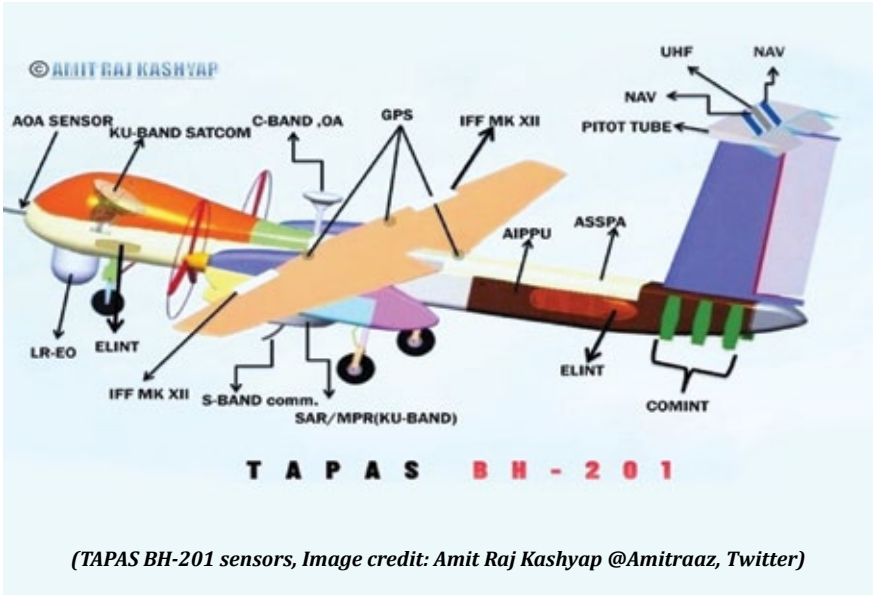
i. Airborne Integrated Payload Processing Unit (AIPPU) & Ground Integrated Payload Processing Unit (GIPPU): It uses 3 wide bands and 4 narrow band channels. The role of these sensors is to compress, encrypt the video input and send it to ground stations or satellite as it is both LoS & SATCOM compatible.

ii. Airborne Spread Spectrum Modem (ASSM): It processes the spectrum of radiation the aircraft operates; does data level encryption and counter the jammers.

iii. Radio Finger Printing System (RFPS): It stabilises a wide band of frequencies through a particular channel and also helps in the cancellation of noises.

iv. Solid State Power Amplifier (SSPA): It supports wide band operation, perform the thermal management of the system, manages heat dissipation, generates 20W output power and helps in open circuit protection.

v. Traffic Collision Avoidance System (TCAS): It is an aircraft collision avoidance system designed to reduce the incidence of a mid-air collision between aircraft.



(TAPAS BH-201 sensors, Image credit: Amit Raj Kashyap @Amitraaz, Twitter)

vi. Radar Warning Receiver (RWR): It detects the radio emissions of radar systems and issues a warning when a radar signal might be a threat. This warning can then be used, manually or automatically, to evade the detected threat.

vii. Identification, friend or foe (IFF): It is a system used to differentiate between friendly aircraft (within the same armed force) and adversary aircraft. Currently, IFF Mk XII is used as a common sensor for most operating aircraft of the Indian armed forces.

viii. COMINT: It is a high-performance airborne solution allowing to search, detection, listen and localize all types of civil and military communication signals (fixed frequency, frequency hoppers, burst).

ix. ELINT: ELINT usually means the evaluation of 'non-communication' signals (signals from radars, missiles and guidance systems, aircraft etc.). The intercepted signals are then further analysed to information like the angle of arrival, frequency of electromagnetic radiation by the emitter, pulse width, pulse repetition period, beam width of the emitter's antenna, etc. This information is then used to identify the type of emitter, its travel path and its location.

- **Radar:** It features Synthetic Aperture Radar (SAR) made by Electronics and Radar Development Establishment (LRDE), DRDO. It is a mechanically steerable radar, capable of performing functions such as map generation, 3D mapping, patrol missions etc. It works in 3 modes:
  i. Strip mode: Scans a large area in the form of a strip (Resolution: 3-6m).
  ii. Spotlight mode: Scans a particular immovable target (Resolution: 0.6-1m).
  iii. Ground Moving Target Indication (GMTI) mode: Scans a moving target on the ground (Resolution: 25m).
- **Propulsion:** Currently the aircraft features Austro E4 engines with a power of 168 HP. The engines will be replaced by indigenous higher-powered diesel engines from CVRDE. ADE floated a tender for the same earlier in 2022.
- **Payload:** It has a total payload capacity up to 350kgs. The payload consists of various devices and sensors such as Medium Range/ Long Range Electro Optic (MREO/LREO), Electronic Intelligence (ELINT), Communication Intelligence (COMINT), Synthetic Aperture Radar (SAR), Maritime Patrol Airborne Radar (MPAR); Situational Awareness Payloads such as Identify Friend or Foe (IFF), Traffic Collision Avoidance System (TCAS), UAV Communication Repeater/Relay (UCR).
- **Stealth aspect:** Kevlar as Radar Absorbent Material (RAM) along with Carbon Fibre Composites (CFC) is sandwiched into a layer of 3mm thickness in the airframe. This layer on the airframe is responsible for minimal radar deflections, thus improving the stealth characteristics of the aircraft.
- **Combat capability:** As per Y Dilip, Director ADE, though the primary role of Tapas is ISR (Intelligence, Surveillance and Reconnaissance), it is pre-designed to carry certain weapons and can be converted into an armed platform as and when required by the user.
- **Indigenous Content:** The aircraft currently has 75% indigenous content with most of the critical subsystems developed indigenously. The indigenous content will rise further when the indigenous engine from CVRDE is integrated in near future.

Importance of TAPAS/Rustom-II

India is a multi-billion dollar market for military drones which currently have very useful applications such as monitoring of LoC and LAC, striking terrorist hubs, monitoring of sea lanes, longer duration missions etc. Tapas will be a significant step in the military drone market for India as with its development many important, critical technologies, components and subsystems have been developed indigenously and mastered. Tapas can prove to be a great template for the upcoming drones similar to the Tejas project where experience gained in the consolidation of the mastered technologies has contributed to the development of bigger and more capable platforms like Tejas Mk2, TEDBF etc. It will also provide a window of opportunity for private industry involved in the manufacturing of various Line Replacing Units (LRUs) for HAL under a modular approach.

Tapas/Rustom-II project is a significant development in the Indian drone industry and even has the potential of becoming an 'industry coming off age' for the development of military drones in India similar to the Tejas project. It's high time the user, i.e. Indian armed forces order it in good numbers than rely on foreign silver bullets for a similar role. This will move India a step closer to self-reliance or 'Atmanirbhar Bharat' and will also place India in the list of a few nations that manufacture high-end military drones.

Article by Udit Tripathi
(Twitter @i_udit_t)

The article first appeared in "Air Power Asia."

VAYU Interview with

Admiral R. Hari Kumar,
Chief of Naval Staff, Indian Navy

VAYU: What kind of missiles is the IN acquiring for its surface fleet?

Ans. Surface fleet would be augmented with indigenous Surface to Surface missiles and Surface to Air missiles under production. A comprehensive design and development programme for State of the art missile systems is underway and future ships will be equipped with these missiles.

VAYU: There has been talk on the Indian Navy at some point ordering/ inducting the IMRH helicopter from HAL as of now called the DBMRH. Is this true and what is the roadmap?

Ans. In keeping with the Make in India and AatmaNirbhar Bharat Vision of the Government, a case for design and development of Medium Lift Helicopter (MLH) of 12.5 to 14 T category is being progressed for Indian Defence Forces. This caters for requirement of Medium Lift Helicopters for IAF/ IA and Multi Role Helicopters for Indian Navy.

The case would be progressed under Buy (Indian-IDDM) categorisation with Special Purpose Vehicle wherein HAL along with suitable private player(s) would undertake design and development of envisaged variants of IMRH and DBMRH.

The case is at pre-AoN stage wherein requisite provisions are being incorporated in DAP 2020 to execute the Government's mission to achieve self-reliance in defence products. Design and development process is expected to take about 7 to 8 years to enable realisation of the platform commencing from ninth year of project sanction.

DBMRH for Indian Navy would be in three variants, viz, ASW/ ASuW, Special Ops and AEW.

VAYU: A question you have been asked numerous times: how are the trials going on for the IAC aircraft plans, ie Rafale and F-18?

Ans. Rafale M and F/A 18 have completed the Op Demo at SBTF, Goa in Jan 22 and Jun 22 respectively towards verifying that the aircraft meet IN requirements as well as compatibility with the aircraft carriers. Staff Evaluation of both the aircraft is under deliberation. Post finalisation of the selection of the aircraft, an intergovernmental procurement process would be followed in accordance with the Defence Acquisition Procedure.

VAYU: Can you tell us how useful have the General Atomic's UAS been for the Indian Navy ISR needs and are you satisfied enough to order more or lease more?

Ans. Though IN has been operating RPAs for the last two decades, operations of Sea Guardian has greatly enhanced our surveillance capabilities. Sea Guardian RPA has enabled IN to increase surveillance activities over vast areas of Indian Ocean region ranging from Sunda Strait to Gulf of Aden. The high endurance of the aircraft has enabled IN to maintain persistent surveillance over larger areas.

IN's experience with leased operations of Sea Guardian has been good and therefore, IN is actively pursuing a case for procurement of these aircraft.

Reference photo of the Sea Guardian (Photo: GA-ASI)

VAYU : As for the MH60R, on which class of warships are these to be deployed? Would the 24 ordered be enough?

Ans. MH-60R would cater for the Air ASW/ASV requirements of the fleet. The helicopters would be primarily based on ships of frigate size and above. In addition, these helicopters would also be employed for operational tasks from ashore at naval bases.

IN is also progressing a case for development of indigenous Deck Based Multi-role Helicopter (DBMRH) through HAL for operations from ships in the near future. These aircraft would be capable of undertaking Airborne Early Warning, Anti Surface/ Anti-submarine warfare as well as Special Ops roles. These platforms would be the mainstay of Naval Aviation in the near future.

VAYU : In brief, can you tell us about the Indian Navy warship Acquisition plans?

Ans. Indian Navy is evolving continuously to meet emerging challenges to our maritime interests. The modernisation programme of IN is centered on Aatmanirbharta which defines India's growth story. Threats, missions, capability development and affordability have, remained dominant factors in the force structure planning of the Service. The expansion plan in future includes induction of aircraft carriers, state-of-the-art Next Generation Warships, nuclear powered and conventional submarines, revitalisation of aviation and sub-surface assets, augmentation of unmanned solutions to enhance combat capabilities, and induction of niche technology and equipment to address emergent and future threats. Further, development of technical and support infrastructure for maintenance of these new inductions is also being progressed. In consonance with the GoI initiative of 'Make in India', 43 out of 45 ships and submarines presently on order are being constructed in Indian Public and Private Shipyards. Further, AoN has been accorded for acquisition of 49 ships and six submarines all to be constructed indigenously in Indian Shipyards.

Indian Navy Day 2022

Extracts from Admiral R Hari Kumar, Chief of the Naval Staff's press conference on 3 December 2022

This occasion grants us an opportunity to take a closer look at the year gone by. In this period, our ships, submarines, and aircraft have sustained a high operational tempo. Our units have maintained a mission ready presence across vast sea areas that impact our national interests. Our extensive operational deployments and exercises have honed our skills and polished our procedures – keeping the sword sharp. Our personnel have trained hard, practiced diligently, and performed magnificently at sea, under the sea, in the air, as well as wherever duty called. The Navy has remained a Combat-ready, Credible, Cohesive, and Future Proof force – enabled by what we call our SHIPS FIRST outlook – where every single action that we take is aimed to enable our women and men in operational units – mandated to go into harm's way when needed.

While the past year has been operationally busy and satisfying, it has also been transformational in many ways. I will highlight only a few aspects in this regard, and the rest will be covered during the subsequent presentation.

The most notable aspect was commissioning of India's first indigenous Aircraft Carrier INS Vikrant on 2 September this year - without a doubt a seminal event in the history of the Nation and the Navy. Vikrant's commissioning was a manifestation of sustained efforts of generations of naval leadership – planners – designers – yard workers – industry partners – and numerous others. The ship will remain the torch bearer of AatmaNirbhar Bharat, inspiring our future generations towards self-reliance.

At the same time, Vikrant's commissioning, was also marked by another momentous change, as the Navy adopted a new Naval Ensign. This change, reflecting the larger National intent to shed colonial vestiges, was brought about in a swift and decisive manner – reflecting the Navy's organisational agility and responsiveness. Vikrant, for the foreseeable future, will remain a shining symbol of aspirational India, and will contribute to enhancing India's global stature, proudly flying our Tiranga across the far reaches of the world's oceans.

As regards flying the Tiranga, a notable achievement for the Indian Navy was the Tiranga being hoisted on six continents by seven Indian Naval ships on 15 August 2022. This was also reflective of the Navy's ability to deploy far and wide across our areas of interest.

This ability to deploy extensively and project our capabilities is underpinned by a clear-eyed focus on Aatmanirbharta across all sectors, including fostering R&D in niche technology. Towards this end, we conducted the 'Swavlamban Seminar' during which the Prime Minister unveiled 75 challenges for the defence industry. I must say that the response thus far has been overwhelming and we look forward to inducting some of these 'Made in India, Made by India, and Made for India' security solutions.

In driving self-reliance and technology development, the Indian Navy is well established on a path of budget optimisation. The Navy's share of the Defence Budget this year was 17.8 %, and in using this judiciously, we have achieved a Revenue to Capital expenditure ratio of 32% - 68% - which accords us flexibility in pursuing our capability developments plan.

A critical aspect related to capability accretion, is human resource development. Towards this end, implementation of Agnipath has been a much needed transformational change. We have already inducted our first batch of Agniveers – comprising 3000 recruits who are currently undergoing training at our training base - INS Chilka. Importantly, this batch of Agniveers includes 341 women trainees – once again – a transformational step. While we already have women officers posted on frontline units, they will soon be joined by women in all ranks.

As you would realise, a lot has changed in the past year. I have briefly touched upon some salient aspects that will bear influence on the Navy of today and the one of tomorrow.

You have just heard about how we as a Navy traversed the year gone by. I will now highlight the broad way-points that we will pursue to navigate the future.

First and foremost, maintaining credible deterrence, while remaining ready to go

into harm's way to protect, preserve, and promote our national interests will remain our principal priority. Our vision of being a 'Combat Ready, Credible, Cohesive, and Future-proof Force' underpins this aspect.

As recent global events have amply underscored, this vision cannot be met in letter and spirit if we remain dependent on others for our security needs. To that end, the Government has clearly spelt out the need for AtmaNirbharta. The Indian Navy, on our part, has made an unequivocal commitment to be fully AatmaNirbhar by 2047.

The rapid pace of advancements in technology – spanning a wide array of sectors – impose the inescapable need for us to, not only catch-up with the developments, but to go above and beyond them. We will passionately pursue and adopt niche and disruptive technologies. Towards this end, we will follow SPRINT or 'Supporting Pole-Vaulting in R&D through iDEX, NIIO and TDAC' approach. The aim is to seamlessly meld the elements of 'innovation' 'indigenisation' and 'self-reliance'.

In terms of fiscal resources, it is well appreciated that, budget always has to be balanced between a host of national imperatives – security, development, social, etc. The Indian Navy will continue to focus on making every valuable rupee count towards enhancing our combat readiness.

Both these aspects – budget and combat readiness – are now increasingly being looked at 'jointly' by the three Services. To my mind, jointness is the only way forward, as we prepare to fight and win the wars of tomorrow. The Late Gen Bipin Rawat had laid the foundations for increased synergy between the Armed Forces, and the present CDS, Gen Anil Chauhan, has provided renewed impetus to this effort. The Indian Navy remains fully committed to greater jointness and cohesion towards collective and effective outcomes. This could be gauged by the Navy instituting a trophy in the memory of Late General Bipin Rawat - one at INS Chilka – the sailors' ab-initio training establishment, and one at the Naval War College, Goa – a premium training institute for strategic and operational leadership.

As far as inspiring initiatives go, the prime Minister articulated Panch Pran from the ramparts of the Red Fort, which included Gulami ki Mansikta Se Mukti. In pursuance of that end state, the Navy will continue to proactively identify redundant or archaic practices, process or symbols that could, either be discontinued, or modified in consonance with modern day realities.

Among modern day realities, one is the increasing recognition of the vast potential of the oceans – be it Blue Economy, our trade and energy lines, or scope for enhanced maritime connectivity. Concomitantly, there is greater emphasis and acknowledgement of the criticality of maritime security - the Prime Minister chairing a meeting on Maritime Security at the United Nations, during India's presidency of the Security Council last year, is reflective of this. Clearly, as India grows, our maritime interests and investments will also expand proportionately which, in turn, will mandate expansion in the Indian Navy's responsibilities and operational footprint to protect these interests. At the same time, as a responsible maritime power, with significant capabilities at our disposal, India also endeavours to be the Preferred Security Partner as well as First Responder in the region – guided by the overarching vision of SAGAR – Security And Growth for All in the Region. In furthering and strengthening these vital goals, the Indian Navy will remain diligent in pursuit of building bonds of friendship and operational cohesion with like-minded nations across the Indo-Pacific and beyond.

These are some of the strategic lines of effort that the Navy is committed to follow, in pursuit of remaining a 'Combat Ready, Credible, Cohesive and Future-proof Force'.

Last but not the least, I wish to convey the Navy's eternal gratitude to our veterans, who sailed these waters before us and stood firm at the helm, and whose efforts are seen today in an eminently capable, powerful and reliable maritime force, serving the Nation with pride and strength.

All images: Indian navy

New design of President's Standard and Colour and the Indian Navy Crest

The President of India has approved the introduction of a new design for the President's Standard and Colour and Indian Navy Crest for the Indian Navy, which were unveiled at Visakhapatnam on Navy Day on 4 December 2022.

Resonant to the ongoing National endeavour to move away from the colonial past, the Naval Ensign was amended to a new Design that draws inspiration from our history where in the Red Horizontal and Vertical Lines on the White Ensign were replaced with an Blue Octagon with Twin Golden Borders encompassing the National Emblem atop a clear anchor and 'National Emblem 'Satyamev Jayate' inscribed on the stock of the Anchor. Further, the National Flag was retained on the upper left canton.

The erstwhile design of the President's Standard and Colour for the Indian Navy was instituted on 6 September 2017. The design comprised one each horizontal and vertical red bands intersecting at the centre and the National Emblem inserted at their intersection. The National Flag was at the upper left canton adjacent to the staff and a Golden Elephant was at the lower right canton on the fly side. This design was inspired from the erstwhile Naval Ensign.

The Indian Navy adopted a new Naval Ensign on 2 September 2022, and the new design of the President's Standard and President's Colour awarded to the Indian Navy incorporates this change. The new design of the President's Standard and Colour comprises three main constituents - the National Flag in the upper left canton adjacent to the staff, the State

Emblem underscribed with 'Satyamev Jayate' in Golden Colour on the upper right canton on the fly side, and a Navy Blue - Gold Octagon below the Golden State Emblem. The Octagon has twin golden octagonal borders, encompassing the golden National Emblem (Lion Capital of Ashoka – underscribed with 'Satyamev Jayate' in blue Devnagri script) resting atop an anchor; and superimposed on a shield. Below the shield, within the octagon, in a golden bordered ribbon, on a Navy Blue background, is inscribed the motto of the Indian Navy 'Sam No Varunah' in golden Devnagri script. The Golden State Emblem signifies 'Power, Courage, Confidence and Pride' whilst the Navy Blue – Golden Octagon shape draws inspiration from Shivaji Maharaj Rajmudra or the Seal of Chhatrapati Shivaji Maharaj, and represents the eight directions (four cardinal and four inter cardinal), symbolising the Indian Navy's maritime outreach. The new design of President's Standard and Colour highlights India's glorious maritime heritage and also symbolises a powerful, courageous, confident and proud Indian Navy.

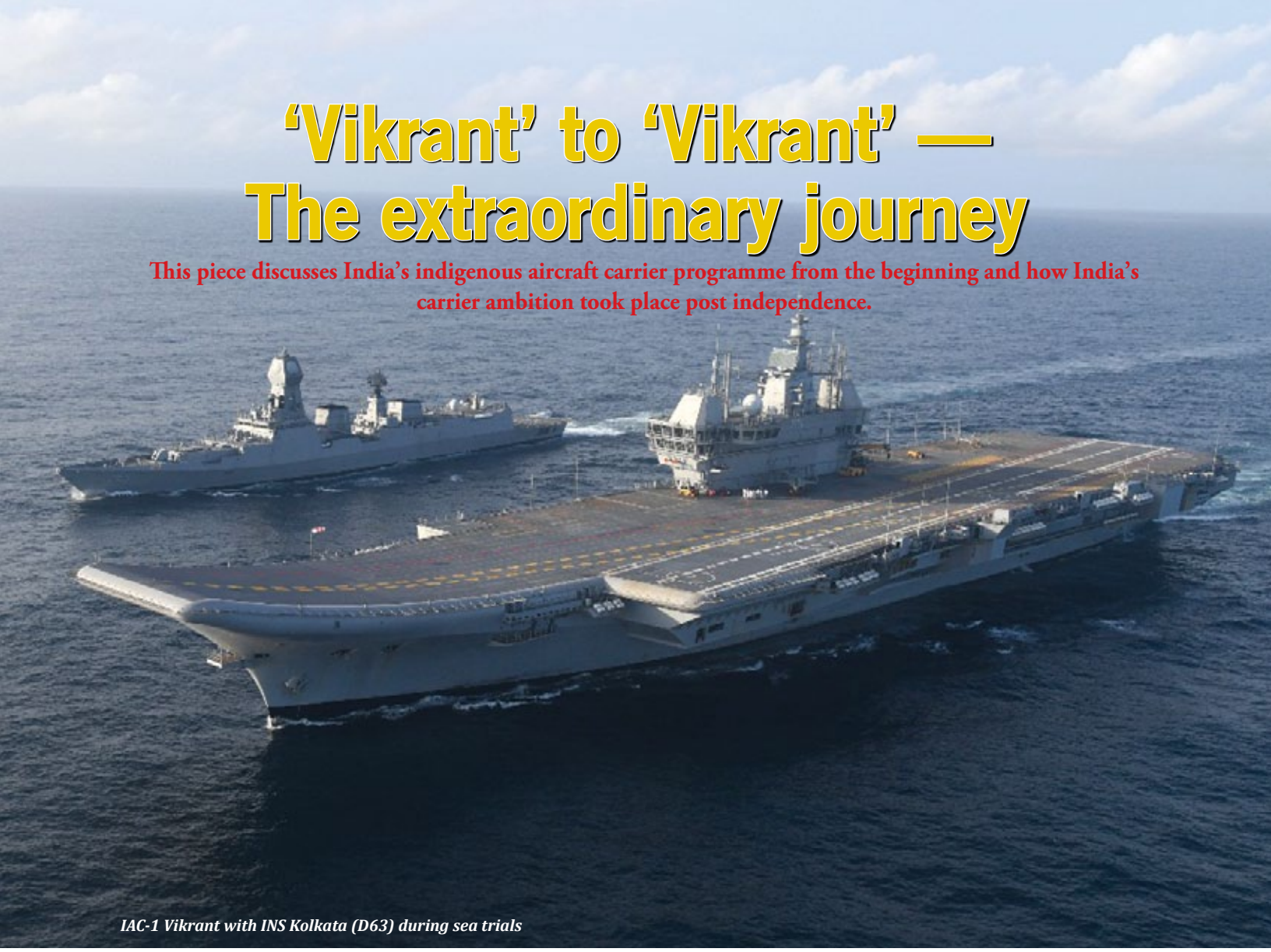
The Indian Navy Crest has been amended to replace the foul anchor with a Clear Anchor. The clear anchor depicts steadfastness of the Indian Navy to deter any challenge in maritime domain, and represents clarity in vision, mission and aspirations of its sailors. The Clear Anchor also depicts Indian Navy's commitment towards securing the Coast and Maritime Interest of India. The change would imply removal of the symbolic nautical rope in the Crest Designs. The Modified Indian Navy Crest has been introduced with effect from 4 December 2022 on the occasion of the Navy Day 2022.

In line with the change in the Indian Navy Crest, minor amendment to the Crest of the Indian Naval Command Headquarters (which has the Indian Navy Crest in the inset) has also been approved by the President of India.

The President's Standard and President's Colour are awarded to static and mobile formations of the Indian Navy respectively, to acknowledge their distinguished and meritorious service to the Nation. The Indian Navy was the first among the three Services to be awarded the President's Colour on 27 May 1951 by the then President Dr. Rajendra Prasad. In the Indian Navy, the President's Colour has been awarded to the Western, Southern, and Eastern Naval Commands, both Western and Eastern Fleets, the Submarine Arm, the Naval Air Arm, INS Shivaji, INS Valsura and the Indian Naval Academy. The 22nd Missile Vessel Squadron was the first Naval Combatant Squadron to be honoured with the President's Standard.

‘Vikrant’ to ‘Vikrant’ — The extraordinary journey

This piece discusses India’s indigenous aircraft carrier programme from the beginning and how India’s carrier ambition took place post independence.



IAC-1 Vikrant with INS Kolkata (D63) during sea trials

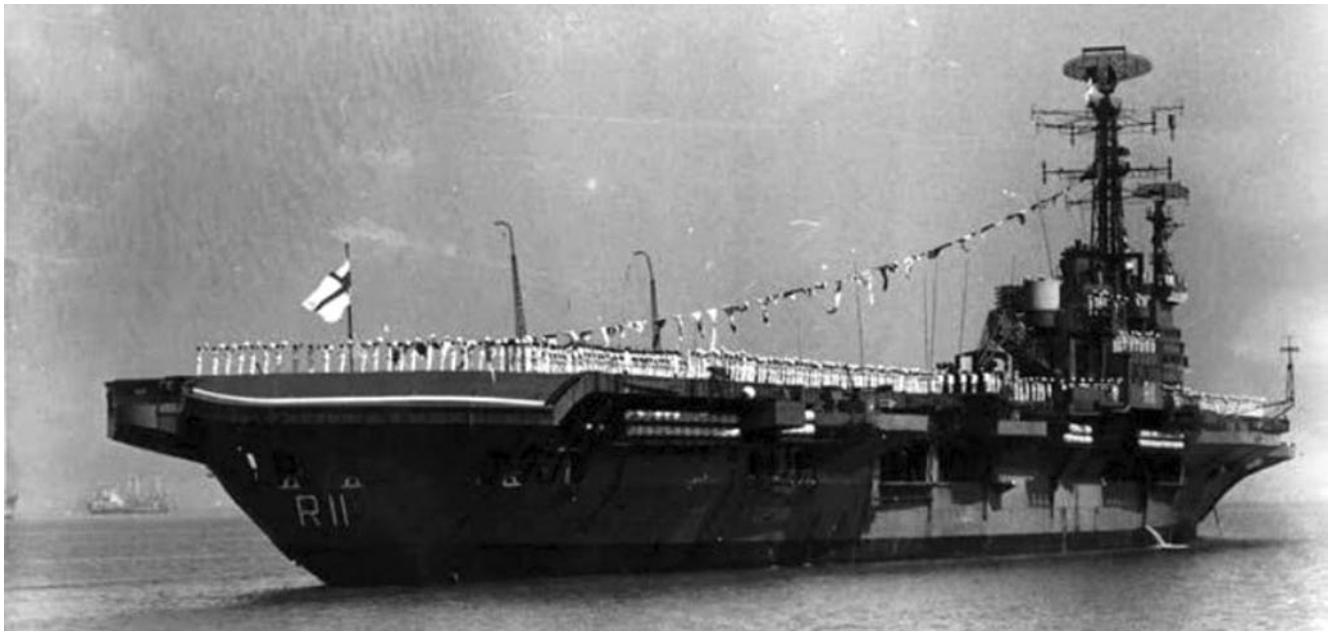
The 2 September 2022 was a red letter day for India as the Prime Minister Narendra Modi commissioned the first indigenous aircraft carrier INS Vikrant. During the same event he unveiled the new ‘Naval Ensign’ as well. It is the fourth carrier ever operated by the navy and the largest warship ever made in the country indigenously. Designed by the Warship Design Bureau and constructed by the Cochin Shipyard Limited (CSL), the INS Vikrant has a displacement of around 45,000 tonnes. The 262 meter long ship can carry 30 aircraft and features STOBAR (short rake-off but arrested recovery) configuration.

The strategic requirement of an aircraft carrier was articulated in the first Naval Plans Paper of 1947! Under the fifteen year plan for refurbishing post Independence, four fleet carriers were recommended to maintain India’s dominance at sea and protect maritime interests. However, several reasons soon forced the navy to abandon the highly ambitious plan in favour of a much approachable a revised six year plan and only a single light fleet carrier was planned by 1954. Just for the reference, for a time a second carrier had also been planned to be procured by 1956 but was abandoned. The need of a carrier was accepted in 1956 and navy eyed a British Majestic Class platform, the HMS Hercules. The procurement was approved on 30 April 1957 and renamed as Vikrant. INS Vikrant was commissioned into on 4 March 1961 and it entered the Indian waters on 3 November same year only to witness war of ‘Goa Liberation’ from the Portuguese colonial power. Thus the first aircraft carrier of Asia, in a post WW 2 era, saw military action in the bud of its service! Ten years later it would lead operation in the Bay of Bengal paving the way for Indian victory and liberation of Bangladesh in 1971. At that time it featured CATOBAR (Catapult Assisted Take-Off But Arrested Recovery). The navy got her second aircraft carrier when a British Contour Class vehicle, the HMS Hermes was sold to India in 1986. HMS Hermes was a Vertical/Short Take-Off and Land (V/STOL) configured platform. The Vikrant would later be modified to this configuration in 1989. Viraat was commissioned by the Indian Navy on 12 May 1987. Since then it witnessed several military operations. India got her third carrier on 16 November 2013 when INS Vikramaditya was commissioned. Originally known as Admiral Gorshkov, an ‘Aircraft Cruiser’ as the Soviet’s called, had been modified and sold to the Indian Navy on 20 January 2004. It became the first carrier in India to feature STOBAR (Short Take-Off But Arrested Recovery) system followed by indigenous INS Vikrant in coming years. But in the meantime two earlier carriers bid adieu to the service. INS Vikrant was decommissioned on 31 January 1997 and Viraat on 6 March 2017. So

currently the Indian Navy is operating two aircraft carriers simultaneously.

The carrier naval wing also has witnessed evolution with the time. During the initial days, INS Vikrant carried Sea Hawk and Alizé. Later the legendary Sea Harrier became mainstay of INS Vikrant and INS Viraat. The INS Vikramaditya operates MiG-29K, which will be operated from the new INS Vikrant as well. Further enhancing the capability, a new multi-role fighter jet will procured and two contenders: the US F/A-18 Super Hornet Block III and the French Dassault Rafale M have taken part in the competition to grab the mega multi-billion dollar deal. It must be noted that to meet India's requirement, both the contenders are modified to STOBAR configuration. But the most magnificent point should be India's own programme to shed dependency on foreign origin platform, ie, the TEDBF (Twin Engine Deck Based Fighter) which will be the mainstay of the future. The indigenous platform will feature next generation technology to face the future potential threats. The rotor fleet is also being indigenised as well.

India's quest to have an indigenous aircraft carrier date backs to 1979! What initially started as a low displacement platform evolved with time to a larger carrier to meet the concurrent requirements. Prior the procurement of the second aircraft carrier (HMS Hermes) alternate options were evaluated as well. The Garibaldi Class even drew attention. For the potential assistance, Indian naval staff toured the US, the UK, France, Spain and Italy. As France was preferred, a contract with DCN (Direction des Constructions Navales) was signed in 1989 (under the Indo-French MOU of 1988) for the design study of "Sea Control Ship". With the assistance of the Indian Naval Design and Liasion Team (INDLT) a 40,000T platform was envisioned based on then under construction "Charles-de-Gaulle" class! And most interestingly it featured both the CATOBAR and V/STOL variants! The only difference from the French carrier was, it would be powered by conventional means. It would be constructed at the Cochin Shipyard. But the financial crunch forced navy to abandon the plan in 1991 in favour of much smaller Garibaldi Class platform of Italy. Sea Harrier would be the mainstay of air wing. The sudden downsizing wasn't



taken well by many and intense debate halted any progress for some time. But in the 1998 work on a larger carrier restarted. The staff-requirements were finalised for a gas turbine propelled 37,000T STOBAR platform to carry 30 aircraft. Italian firm Fincantieri was roped into by the CSL for assistance in several works, inputs were provided by the Russians as well. Initially known as the "Air Defence Ship" (ADS) soon would be known as "Indian Aircraft Carrier" (IAC). The CCS accorded approval of the construction in 2003.

After the IAC-I the navy is eyeing the IAC-II, a second indigenous aircraft carrier. The navy seeks a three carrier force where two carriers will always keep safeguarding the seas in case one platform has to go under refit or maintenance. Back in 2007 then the CNS (Chief of the Naval Staff) Admiral S. Mehta confirmed that second IAC had been on the drawing board and the plan for at least three indigenous aircraft carriers! Popularly dubbed as INS Vishal, the second indigenous carrier, was reported to be a 65,000T flat-deck platform to carry around 55 aircraft including AEW (Airborne Early Warning) aircraft. It would feature Electro-Magnetic Aircraft Launch System (EMALS) powered CATOBAR. In August 2015, Indian delegation even visited then under-construction American super carrier Gerald R. Ford. Initially it was envisaged to be a nuclear-powered platform but limitations of available technology forced the navy to favour Integrated Electric Propulsion System (IEPS). But the dream to have a super-carrier might have to wait longer. As time passes, chances of getting a 65,000T carrier is becoming narrower. The current CNS Admiral R. Hari Kumar in December 2022 stated that the Navy had been discussing the feasibility of going for a repeat of IAC-I design, instead of much costlier larger platform, to capitalise on the available expertise.

While the threats against India are rising rapidly, the IAC-II has become a hot topic of debate where many are skeptical of its viability against much needed submarine fleet. There will be debates, but the glorious journey which started with the Vikrant definitely not will stop with just the new Vikrant. The progress might have halted for some time, but only to embrace the future success.

Sankalan Chattopadhyay
(Twitter-@vinoddx9)

INS Mormugao commissioned

Indian Naval Ship (INS) Mormugao (D67), second warship of the P15B class of stealth guided-missile destroyers, was commissioned in the presence of Raksha Mantri Shri Rajnath Singh at Naval Dockyard, Mumbai on 18 December 2022. The event marked the formal induction of the second of the four 'Visakhapatnam' class destroyers, indigenously designed by the Indian Navy's in-house organisation Warship Design Bureau and constructed by Mazagon Dock Shipbuilders Limited (MDL), Mumbai.

In his address, the Raksha Mantri described INS Mormugao as one of the most powerful indigenously-built warships "which will significantly enhance the country's maritime capabilities and secure national interests. INS Mormugao is one of the world's most technologically-advanced missile carriers. With over 75% indigenous content, it is a testimony to India's excellence in design and development of warships and a shining example of our growing indigenous defence production capabilities. The warship will meet the present and future needs of our country as well as of our friendly countries across the globe," he stated.

Speaking on the occasion, Chief of the Naval Staff Admiral R Hari Kumar stated that the commissioning of INS Mormugao is indicative "of the large strides India has taken in warship design and building capability over the last decade. He added that the warship is a true illustration of 'Aatmanirbhar Bharat' and 'Make in India' initiative and it reinforces the Navy's commitment to supporting India's transformation into a global ship-building hub. The warship, with her multi-dimensional combat capability, will form part of the Western Fleet - the sword arm of the Indian Navy".

Measuring 163m in length and 17m in breadth with a displacement of 7,400 tonnes, INS Mormugao is packed with sophisticated state-of-the-art weapons and sensors such as surface-to-surface missile and surface-to-air missiles. The ship is fitted with a modern surveillance radar which provides target data to the gunnery weapon systems. Its anti-submarine warfare capabilities are provided by the indigenously-developed rocket launchers, torpedo launchers and the ASW helicopters.

Named after the historic port city of Goa on the west coast, the ship is equipped to fight under nuclear, biological and chemical warfare conditions. It is propelled by four powerful gas turbines, in a combined gas and gas configuration, capable of achieving speeds in excess of 30 knots. The ship has enhanced stealth features resulting in a reduced radar cross section. INS Mormugao has a complement of about 300 personnel.

With over 75% indigenous content, all her major weapons and sensors have been developed and manufactured in India either directly through design and development by Indian Original Equipment Manufacturers (OEMs) or through strategic tie-ups and Transfer of Technology with reputed foreign OEMs.

The ship was launched on 17 September 2016 and commenced sea trials on 19 December 2021, coinciding with 60 years of Goa Liberation. The commissioning on 18 December is significant as it was the same date in 1961 when Operation Vijay was launched to liberate Goa from Portuguese rule.

Commissioning of INS Vagir

On 23 January 2023, INS Vagir, the fifth P75 Kalvari-class submarines, was commissioned within the Indian Navy in presence of the Chief of Naval Staff, Admiral R Hari Kumar and several other senior dignitaries. The event was also attended by Naval Group's Executive Vice President for Submarines, Mr Laurent Espinasse along with the Naval Group team in India.

INS Vagir is built by Indian shipyard Mazagon Dock Shipbuilders Limited (MDL) based on the Naval Group Scorpene design. Launched on 12 November 2020, INS Vagir successfully completed all her sea trials and now enters into service within the Indian Navy. She will join INS Kalvari, INS Khanderi, INS Karanj and INS Vela which had already been commissioned respectively in December 2017, September 2019, March 2021 and November 2021. The last submarine of the P75 series, the Vagsheer, is currently completing her sea trials in order to be delivered in 2024.

Laurent Espinasse, EVP Submarines stated, "The commissioning of INS Vagir is a major milestone for the Indian Navy, MDL, Naval Group and all our industrial partners. We are proud to be part of the P75 programme and remain fully committed to deliver the last unit of the series and to enhance the level of indigenisation in future projects of the Indian Navy."

The commissioning of INS Vagir highlights the success of indigenous submarines construction programme of the Government of India. This submarine has been completely built by MDL having successfully absorbed the technology transfer from Naval Group, in line with Indian Government's "Make in India" policy. The series of six submarines of the P75 programme is fitted with a number of equipment built in India by qualified and highly trained industrial Micro, Small and Medium Enterprises (MSMEs). MDL and Naval Group have developed a rich industrial ecosystem of more than 50 Indian companies, along with an Indian subsidiary with more than 70 Indian engineers to support Indian Navy, thus contributing to industrial and technological sovereignty. Such cooperation allows Naval Group's industrial partners to have access to new markets by putting forward the know-how and experience acquired through the programme. Naval Group thus contributes to the development of a robust Indian naval industrial ecosystem.

The Scorpene is a 2000 tons conventional-propulsion submarine designed and developed by Naval Group for all types of missions, such as surface vessel warfare, anti-submarine warfare, long-range strikes, special operations or intelligence gathering. Extremely stealthy and fast, it has a level of operating automation that allows a limited number of crew, which reduces its operating costs significantly. Its combat edge is highlighted by the fact that it has 6 weapon launching tubes and 18 weapons (torpedoes, missiles).

Naval Group is present in India through its 100% subsidiary Naval Group India. Established in September 2008, Naval Group India's mission has been to support the indigenisation of equipment for Scorpene submarine, to develop the Indian defence eco-system, as well as to develop design services in India with talented Indian engineers.

Naval Group India "endeavours to implement the vision of AatmaNirbhar Bharat and evolve as centre of excellence for support and maintenance of P75 submarines by further empowering Indian industries and creating a robust eco-system that can cater to the varied defence needs of the country".

News and updates from HAL

HAL Hands Over 16th ALH Mk III

HAL handed over the last of the 16 ALHs (Mk-III, Maritime role) contracted with the Indian Coast Guard at a programme on 15 November 2022 to DG Coast Guard V S Pathania in the presence of senior officials from CG, Defence and HAL. "We are proud to be associated with HAL and happy to issue a Letter of Intent (LoI) for nine more helicopters. Despite COVID-19, HAL delivered all the helicopters at the shortest time with seamless production activities and this allows us to strengthen India's Maritime security", he stated. The CG had signed a contract with HAL for supply of 16 ALH Mk III in March 2017.

Mr. C B Ananthakrishnan, CMD, HAL said a unique feature of the contract has been the Performance Based Logistics (PBL) – the one stop solution for maintenance of these helicopters by HAL. "This will serve as a benchmark for all our future contracts and boost our resolve to work with private partners to speed up the work in the interest of all our customers and strengthen Make-in-India activities in the Defence eco-system", he added.

Mr. S Anbuvelan, CEO (Helicopter Complex), HAL in his address pointed out the major challenges in execution of the contract that included integration of new systems sourced from foreign OEMs, conducting flight trials for certifications and overcoming disruptions in the supply chain due to lock-downs.

ALH Mk III is indigenously designed, developed and produced by HAL. The company has so far produced more than 330 ALHs, a versatile helicopter which has logged more than 3.74 lakh flying hours.

ICG 840 SQN (CG) commissioning

In a major boost to further strengthening the Coast Guard Region East, 840 Sqn (CG), an Indian Coast Guard Advanced Light Helicopter (ALH) Mk-III squadron was commissioned by Director General VS Pathania, Director General Indian Coast Guard at ICG Air Station, Chennai on 30 November 2022. The occasion was graced by various military and civil dignitaries based at Chennai and Tamil Nadu area.

ALH Mk-III helicopters have been indigenously manufactured by HAL, features state of art equipment including advanced radar as well as electro optical sensors, Shakti engines, full glass cockpit, high-intensity search light, advanced communication systems, automatic identification system as well as search-and-rescue homer. This feature enables the helicopter to undertake maritime reconnaissance as well as carry out search and rescue at extended ranges whilst operating from ships, both by day and night. The aircraft has the ability to switch roles from an offensive platform with heavy machine gun to that of a benign one carrying a Medical Intensive Care Unit to facilitate transfer of critically ill patients.

840 Sqn (CG) will be commanded by Commandant Atul Agarwal, and manned by 10 Officers and 52 men. The commissioning of 840 Sqn (CG) is a major fillip to the abilities of Indian Coast Guard in the security sensitive waters off Tamil Nadu and Andhra region.

ICG DG sortie in LUH

Director General V S Pathania, Director General Indian Coast Guard lead a delegation of ICG officials to Helicopter Division, HAL Bangalore on 14 November 2022 and visited the design and development facilities of indigenously built state-of-art helicopters. The visit was aimed at strengthening the procurement of aviation assets developed, designed and manufactured by Hindustan Aeronautics Limited (HAL) in India, in tune with Aatmanirbhar Bharat initiatives.

HAL and IAI in MoU

HAL signed an MoU with Israel Aerospace Industries (IAI) Limited for leasing, operation and maintenance of fixed wing UAVs to the Indian Defence Forces. Through this MoU, HAL and IAI will collaborate on a prospective programme of Leasing of UAV systems to Indian Defence Forces. The MoU was signed by Mr Deepak Singhal, GM, AMD Nashik and Mr Moshe Levy, Executive VP, MAG Malat, IAI.

HAL and L&T in MoU

HAL's LCA Tejas Division signed an MoU with Larsen & Toubro Ltd for manufacturing 22 sets of Wing Assembly for LCA Tejas MK1A. The MoU was signed by Mr K Ravi, General Manager, LCA Tejas Division and Mr Laxmesh BH, VP & Head-Missiles & Aerospace Business of L&T.

HAL MRO for RD33 of MiG-29K/KUB

Hindustan Aeronautics Limited (HAL) signed an MoU with the Indian Navy for positioning of HAL team at Naval Aircraft Yard, Goa for supporting maintenance and repair of RD 33 Mk Engine of MiG 29K/KUB aircraft and imparting specialised training at Naval Institute of Aeronautical Technology (NIAT) Kochi. The MoU was signed by Mr D Maiti, Chief Executive Officer, MiG Complex and Rear Admiral Deepak Bansal, Assistant Chief of Naval Staff (Air Material) in the presence of Mr C B Ananthakrishnan, CMD, HAL, Vice Admiral Sanjay Mahindru, Deputy Chief of Naval Staff, AVSM, NM, Indian Navy and other HAL senior officers.

UNITED AIRCRAFT CORPORATION

MiG-35

The MiG-35 multi-role fighter is designated to destroy aerial targets around-the-clock under clear and adverse weather conditions and to engage mobile and stationary ground (sea-surface) targets.

THE TECHNOLOGY OF FLIGHT

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Great 2022 for Dassault Aviation Group

Aircraft ordered and delivered in 2022: 92 export Rafale were ordered (80 United Arab Emirates, 6 Greece, 6 Indonesia), compared to 49 (37 Export and 12 France) in 2021. 64 Falcons were ordered, compared to 51 in 2021. 14 Rafale's (13 Export and 1 France) were delivered, while 13 had been guided plus 25 Export Rafale's were delivered in 2021. 32 Falcon's were delivered, while 35 deliveries had been guided (30 Falcon's were delivered in 2021).

Backlog: As of 31 December 2022, the backlog included 164 Rafale's compared to 86 Rafale's as of 31 December and 87 Falcon's compared to 55 Falcon's as of 31 December 2021.

With over 10,000 military and civil aircraft (including 2,500 Falcons) delivered in more than 90 countries over the last century, Dassault Aviation has built up expertise recognised worldwide in the design, development, sale and support of all types of aircraft, ranging from the Rafale fighter, to the high-end Falcon family of business jets, military drones and space systems. In 2021, Dassault Aviation reported revenues of €7.2 billion. The company has 12,400 employees.

Photo: PS Chopra

Photo: Tim Felce

Photo: PS Chopra

Photo: Joshua A. Hoskins

Rosoboronexport: Indo-Russian JV starts manufacturing Kalashnikov AK-203's

Indo-Russian Rifles Private Limited, a joint venture between Russia and India, registered and located in India, whose founders on the Russian side are Rosoboronexport and Kalashnikov Concern (both are subsidiaries of the Rostec State Corporation), has started producing Kalashnikov assault rifles according to a press statement on 17 January 2023.

"Russia and India are linked by strong partnership relations. Military-technical cooperation between the two countries has resulted in the construction of the joint venture Indo-Russian Rifles Private Limited. With the launch of series production of Kalashnikov AK-203 assault rifles, high-quality, convenient and modern small arms will begin to enter service with India's defence and law enforcement agencies. The model combines excellent ergonomics, adaptability to different shooters and high performance characteristics, it is one of the best assault rifles in the world," stated Sergey Chemezov, General Director of Rostec.

The joint venture plans to ensure 100% localisation of the production of AK-203 rifles in India. In future, the company may also increase output and upgrade its production facilities to manufacture advanced rifles based on the Kalashnikov assault rifle platform.

"Korwa Ordnance Factory in Amethi, Uttar Pradesh, has produced the first batch of 7.62 mm Kalashnikov AK-203 assault rifles. The beginning of deliveries to the Indian Army is expected soon. At the same time, the factory's capacity makes it possible to fully equip the personnel of other law enforcement agencies in India with AK-203 assault rifles, which, due to their high adaptability, are suitable for various operators. In addition, the joint venture will be able to export its products to third countries," stated Alexander Mikheev, Director General of Rosoboronexport.

"Indo-Russian Rifles Private Limited fully complies with the Government of India's Made in India initiative and DAP 2020. Today, India is the first country to start producing the AK-200-series assault rifles of the world-famous brand", he further stated.

The AK-200-series assault rifles have retained all the advantages of the traditional AK scheme: reliability, durability and ease of maintenance. At the same time, they fully meet the latest requirements for firearms in the world in terms of ergonomics and the ability to mount high-tech additional equipment.

Russia and India continue to implement military-technical cooperation projects. Their current and future programmes are maximally focused on technological cooperation, including on the basis of joint ventures, in the format of licensed production and joint R&D projects. Rosoboronexport aims to cooperate on terms of transfer of technology put forward by the Indian side and in accordance with the Make in India initiative.

Rosoboronexport is Russia's sole state agency for export of the full range of defence-related and dual-use products, services and technologies. It is part of Rostec State Corporation. Rosoboronexport is among leaders in the global arms market. Rosoboronexport accounts for over 85% of Russia's exports of arms and military equipment. Rosoboronexport cooperates with more than 700 Russian defence industrial enterprises and organisations. The geographical scope of Russia's military-technical cooperation encompasses more than 100 countries.

Rostec State Corporation is the largest industrial company in Russia. It unites more than 800 scientific and industrial organisations in 60 regions of the country. Its key areas of activity are aircraft engineering, radioelectronics, medical technologies, innovative materials, etc. The corporation's products are delivered to more than 100 countries worldwide. Almost a third of the company's revenue comes from the export of high-tech products.

Boeing's P-8I: 21st Century Maritime Security for the Indian Navy

The Indian Navy continues to shoulder India's increasing strategic and geopolitical responsibility in the Indian Ocean region. The role of naval aviation in defending India's maritime interests is only expected to grow. Mission ready and capable, the Indian Navy's air fleet supports the entire mission spectrum – ranging from countering piracy and asymmetrical warfare to neutralising maritime terrorism. The strength of the partnership for Indo-Pacific will be determined by the abilities of the countries to work together seamlessly. Commonality and interoperability of defence assets contribute not only towards efficient operations of the partner countries but also offer significant enduring strategic benefits to the partners.

A formidable part of the Indian Navy's fleet, the P-8 is a proven system with more than 155 aircraft in service that have executed more than 450,000 mishap free flight-hours around the globe. Along with the Indian Navy, the P-8 family includes the US Navy, the United Kingdom's Royal Air Force, Royal Australian Air Force, Royal New Zealand Air Force and Royal Norwegian Air Force. Militaries that have selected the P-8 include the Republic of Korea Navy and German Navy. The P-8's performance and reliability delivers confidence in an uncertain world — in any condition, anywhere, anytime.

The P-8 delivers highest levels of quality, reliability, and operability. A true multi-mission aircraft, it is defined by a unique combination of state-of-the-art sensors, proven weapons systems, and a globally recognised platform. Notably, the Indian Navy was the first international customer for the P-8 and today operates one of the largest non-US fleet. In addition to unmatched maritime reconnaissance and anti-submarine warfare capabilities, the P-8I has been deployed to assist during disaster relief and humanitarian missions.

The P-8s Indian variant, referred to as P-8I, is an aircraft designed for long-range anti-submarine warfare (ASW), anti-surface warfare (ASuW), and intelligence, surveillance and reconnaissance (ISR) missions. With 12 P-8Is the Indian Navy is rapidly increasing its capability to seal and protect its vast coastline while also playing a greater role in regional maritime security. The patrol aircraft is an integral part of the Indian Navy's fleet and has surpassed 35,000 flight hours since it began operations. Earlier in December, 2022 we completed a decade since the first P-8I was delivered to the Indian Navy. This is a significant milestone in our growing relationship with the navy. We believe there is a need for long-range maritime surveillance and ASW requirements in the Indian Ocean Region and the Indian Navy may have a requirement for more P-8Is and also more Harpoons and we stand ready to support them.

The P-8 combines the most advanced weapon system in the world with the cost advantages of the most operated commercial airliner on the planet. The P-8 shares 86% commonality with the commercial 737NG, providing enormous supply chain economies of scale in production and support. Boeing's expertise in commercial fleet management and derivative aircraft sustainment also provides customers with greater availability at a lower operational cost. The P-8 is engineered for 25 years/25,000 hours in the harshest maritime flight regimes, including extended operations in icing environments.

Support solutions for higher mission readiness

Since the induction of the P-8I in the Indian Navy, Boeing has been supporting the fleet to ensure high rates of mission readiness. We've been supporting India's growing P-8I fleet by providing performance-based logistics, spares, ground support equipment and field service representative and on-site engineering support. Specifically, for India, a PBL strategy helps resolve

Alain Garcia, Vice President, India Business Development, Boeing Defense, Space & Security and Global Services

operational issues, enable further growth of Aatmanirbhar Bharat in strengthening India's national defence industry.

We continue to support the Indian Navy's P-8I fleet through Boeing's services business; providing spares, ground support equipment and by positioning field service representatives at INS Rajali and INS Hansa so they are available to the Navy on 24x7x365 basis. Boeing's integrated logistics support has helped the Navy attain the highest state of fleet-readiness. Boeing has built a 60,000 sq. ft. Training Support & Data Handling (TSDH) Centre at INS Rajali, Arakkonam in Tamil Nadu as part of a training and support package contract signed in 2019. The facility was handed over to the Indian Navy last year. The indigenous, ground-based training will allow the Indian Navy crew to increase mission proficiency in a shorter time, while reducing the on-aircraft training time resulting in increased aircraft availability for mission tasking.

Boeing India's strategic collaboration with Air Works was an important first step under the Boeing India Repair Development and Sustainment (BIRDS) hub that envisions a collaboration with key local companies and businesses to develop India into an aviation and defence repair and sustainment hub. They have successfully concluded Phase 32 maintenance checks on six P-8I long-range maritime patrol and anti-submarine warfare aircraft operated by the Indian Navy so far. Three of them were in heavy maintenance checks concurrently, demonstrating a maturity and scale at par with developed global MRO hubs. An important aspect of the hub is training programmes to increase skilled manpower by developing sub-tier suppliers and Medium, Small and Micro Enterprises (MSMEs) to build high quality MRO capabilities in India. Our programmes have skilled close to 4,000 frontline aerospace manufacturing workers and aircraft maintenance engineers.

Boeing's commitment to delivering leading-edge solutions and its partnerships with the Indian Navy ensures that the P-8I will remain integral to India's defence readiness for years to come in defence of the nation.

GE Aerospace driving innovation in India through successful industry-academia collaborations

As one of the fastest-growing economies in the world, it is critical for India to focus on aviation technology innovation as a key priority. The Government as well as industry have several initiatives driving experimentation in materials and manufacturing processes to power the Indian aviation growth story.

As a world-leading provider of engines, integrated systems for commercial, military, business and general aviation aircraft, innovation has been the key driver for GE Aerospace over 100 years.

Engineers and researchers at our India Technology Centre in Bengaluru have been working on advancements in aviation technology since 2000. In the past decade, they have generated over 500 patents. These group of engineers have reached out to and collaborated with industry and academia over the years. These efforts have led to new inventions and opportunities for the Indian industry.

In 2022 we announced a product developed by IIT Madras and GE Aerospace under a joint innovation programme started in 2016 has now entered the testing phase. The locally designed and developed aviation high-speed Micro Turbomachine is being tested at National Aerospace Laboratories (NAL), an important step towards technology maturation.

The development of Micro Turbomachine is a shining example of academia-industry collaboration to drive innovation in India. It was designed and developed as part of Ucchatar Avaishkar Yojana (UAY) launched by the Government of India to promote industrial innovation of a higher order that addresses the needs of local industry.

During the development of the product, engineers and researchers from GE and IIT-M collaborated to establish a local aviation supplier ecosystem for the production of high-precision, high-speed turbomachinery that met global aviation industry standards. The prototype was manufactured and assembled with the participation of two local aviation industry companies, Pragati Transmission Pvt. Ltd. and Turbocam India Pvt. Ltd.

Another 30+ year partnership is with Hindustan Aeronautics (HAL). GE Aerospace and HAL worked together to make GE engines and turbines work for India's Tejas Light Combat Aircraft and frigates and aircraft carriers including the indigenous Aircraft Carrier Vikrant.

GE Aerospace has partnered with Tamil Nadu Industrial Development Corporation Ltd. (TIDCO) to set up a Centre of Excellence (CoE) in Advanced Manufacturing technologies. Governed by TIDCO's special purpose entity (SPV), the CoE aims to create an ecosystem of advanced research and development using additive technologies. Both GE Aerospace and TIDCO signed an MoU in 2021. An investment of about Rs.141.26 crores over five years to be funded by TIDCO and GE in two phases was proposed. The CoE will work towards technology development for additive manufacturing besides taking up projects in development of predictive analytical solutions for additive manufacturing (AM) for Industry 4.0. The CoE will aim to develop Indian intellectual property for the AM technologies including materials, machines, design software to provide specific technology solutions.

These key partnerships show our commitment to growing the Indian aviation industry backed by research, development and local manufacturing skill development.

Article by Sanjeev Jha – Section Leader, Advance Technology, GE Aerospace

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E-mail: roe@roe.ru

www.roe.ru

Rosoboronexport is the sole state company in Russia authorized to export the full range of defense and dual-use products, technologies and services. Rosoboronexport accounts for over 85% of Russia's annual arms sales and maintains military-technical cooperation with over 100 countries worldwide.

Lockheed Martin recognises HELLFIRE II's sole international supplier

At Lockheed Martin's annual Suppliers Conference held in Bengaluru, SASMOS HET Technologies Ltd. was awarded as an Outstanding Supplier by Lockheed Martin RMS and Missiles and Fire Control Global Supply Chain Organisations and the programme teams. SASMOS is a critical player in the HELLFIRE II's supply chain as the producer of its mission-critical cables.

This recognition was for their dedication to the success of the Aegis Low Noise Amplifier (LNA) and HELLFIRE programmes. Lockheed Martin representatives praised SASMOS for their dedicated support and partnership as the sole international supplier for the HELLFIRE II AGM-114R missile for the past two years. Despite the challenges of the pandemic, SASMOS successfully delivered over 18,000 assemblies, showcasing a strong customer-focused approach and meeting or exceeding expectations.

The precision-strike AGM-114R multi-purpose HELLFIRE II consolidates the capabilities of all previous HELLFIRE II variants equipped with semi-active laser seekers into a single missile that defeats a broad range of targets. It can be launched from multiple air, sea and ground platforms, autonomously or with remote designation.

India's Defence Budget announced on 1 February 2023 (for 2023-24)

- **Rs. 5.93 lakh crore (12.95% increase over previous year's Rs 5.25 lakh crore)**
- **Capital outlay up Rs 12,000 crores to Rs. 1.62 lakh crores (Rs. 1.50 lakh crores in 2022)**
- **Indian Army: 37.24 thousand crores**
- **Indian Navy: 52.80 thousand crores**
- **Indian Air Force: 57.13 thousand crores**

Thales: Proud of 70 year-long journey in India

The Indian Defence and Aerospace sector is undergoing a significant wave of indigenisation, boosted by the 'Aatmanirbhar Bharat' vision of the Government of India. The Government policies and industrial collaborations are enabling the country to move towards self-reliance in defence technology.

Thales, celebrating its 70 year long and proud journey in India this year, is a strong supporter of the government's ambitions. It has been a trusted partner to India's growth story by sharing its innovative technologies and expertise across defence, aerospace, transportation, and digital identity and security markets.

Building on its global prowess in technology, the organisation has been proudly supporting the modernisation efforts of the Indian armed forces, enabling them to maintain tactical superiority over any form of risk, with the purpose of building a future that all can trust.

Capabilities to add strength to the Indian Armed Forces

Globally, Thales provides a wide range of products and services to aid the armed forces in achieving and sustaining operational superiority. To serve India's ambitions in defence and aerospace, Thales has created an industrial ecosystem consisting of over 75 supply chain partners. This also includes partnerships with public and private sector enterprises such as joint ventures with Bharat Electronics Ltd and Reliance Aerostructures Ltd, partnership with Bharat Dynamics Limited for STARStreak/laser beam riding MANPAD system (LBRMS), long-term association with Hindustan Aeronautics Limited for avionics, among others. Through this ecosystem, Thales has developed substantial and diverse skill sets in India to cater to programmes in India and rest of the world. Thales and its joint ventures employ more than 1,800 people in India. The organisation is growing its presence in the country by continuing to hire and develop more talent in high-tech roles.

In addition, Thales has been fortifying the local engineering R&D capabilities through our competence centres in Noida and Bangalore. Thales's engineering centre in Bangalore specialises in defence and aerospace, and is working on high-value software areas like air traffic management, complicated avionics systems, cockpit, flight management, connectivity and video systems, and radar softwares. And, the engineeering centre in Noida focuses on digital activities such as data protection and encryption, cybersecurity, biometrics, among others.

Adding teeth to the Indian defence and aerospace sector

A member of the Rafale team led by Dassault Aviation, Thales provides several state-of-the-art equipments and systems aboard the Rafale such as the AESA RBE2 radar, the SPECTRA electronic warfare suite for 360° detection and action modes, advanced man-machine interface with displays in the cockpit, missile electronics, the front-sector optronic with infrared search and track systems FSO-IRST, the CNI suite (communication, navigation, and identification), as well as power generation systems and a logistics support component.

We have several such successful references with the Indian Air Force, Indian Navy, and Indian Army, and others, built over the last 70 years in India. We are committed to take this proud legacy forward and be part of the new India growth story.

Thales has also been actively contributing to India's aviation sector with its services and solutions including the retrofit of avionics to Air India, critical avionics to IndiGo, and navigational aids to Airport Authority of India, among others. It is bringing its technology prowess in UAVs and Counter-UAV measures to support the burgeoning drone focus in the country.

'Make in India' spotlight at Aero India 2023

At Aero India this year, we will bring a spotlight on a range of our cutting-edge technologies across the sectors of land, air, naval defence, as well as space and our 'Make in India for India and for the world' strategy. Some of these include our air defence systems like LBRMS, Lightweight Multi-role Missiles, and Free Fall Lightweight Multi-role Missile, a high-performing, lightweight, precision strike missile designed to be fired from tactical platforms like fixed or rotary winged UAVs and surface platforms, amongst other demos across Connectivity, Optronics, Armaments and Ammunition, and Intelligence, Surveillance and Reconnaissance. Thales is committed to contribute to the "Aatmanirbhar Bharat" vision of the government by bolstering its local teams, collaborations, and innovation in the future as well.

By Mr. Ashish Saraf, VP and Country Director, India, Thales

VAYU Interview with Mr Bhanu Prakash Srivastava, CMD, BEL

VAYU : Please tell us about your participation in Aero India this year.

CMD: BEL will showcase state-of-the-art products and systems spanning every domain of its business at the 14th edition of Aero India 2023. The products and systems to be on display have been clustered as 'Communication', 'Electro-Optics and Laser', 'EW and Avionics', 'Homeland Security & Smart Cities', 'Medical Electronics', 'Naval Systems', 'Network Centric Systems', 'Radar and Fire Control Systems', 'Tank Electronics and Gun Upgrade', 'Weapon System', and 'Outdoor Display Products'. In addition, BEL will also showcase its R&D capabilities by launching/demonstrating some of its new products and technologies. The company has set up an Experience Centre at its stall to showcase its Voice Analysis Software and Augmented Reality/Virtual Reality for Universal Simulator.

The highlight of BEL's outdoor display will be Weapon Locating Radar (mountain version), Akash Air Defence System, Ant-Radiation Decoy System, Surveillance Radar, Air Defence Fire Control Radar, Automatic Manpack SATCOM Terminal, Anti Drone System and Mobile Communication Terminal. The entire set of state-of-art equipment on offer will be a force multiplier for any defence force and civilian requirements.

VAYU : Can you brief us about BEL's financial performance; what has been the impact of the pandemic on your growth?

CMD: BEL continues to be a profit-making PSU, despite challenges posed by the pandemic, global chip shortage and stiff competition. FY 2021-22 saw the company registering a record turnover of Rs. 15,044 Crores, a growth of 9% over the previous year. BEL became the first Defence PSU to cross the landmark market capitalisation figure of Rs.80,000 Crores, and declare the highest ever dividend of 450%. The company has increased its authorised capital three-fold to Rs.750 Cr and issued bonus shares in the ratio 2:1. This year, we are confident of continuing the good show and achieve a revenue growth of 15 per cent and EBIDTA Margin of 21%-23%.

On this occasion, I would like to share with you the good news that the Ghaziabad Unit of BEL has won the twin honour of CII EXIM Bank Business Excellence Award (2022) and the Jury's Commendation for Role Model Organisation. The Award is the highest level of recognition in the CII-EXIM Bank Award for Business Excellence, established by the Confederation of Indian Industry (CII) and Export Import Bank of India in 1994 with the aim of enhancing the competitiveness of India Inc.

VAYU : Please tell us about BEL's exports. What are the major products and who are the customers?

CMD: BEL achieved recorded an export turnover of 33.30 Million USD during FY 2021-22. Major products exported included Coastal Surveillance System, Trans-Receive (TR) Modules, EO-IR Payload System, Compact Multi-Purpose Advanced Stabilisation System (EOS CoMPASS), Solar Hybrid Power Plant, Data Link, Electro-Mechanical parts, Low Band Receivers (LBREC), Medical Electronics, Spares for Radars, etc.

BEL is fast expanding its global presence, putting its best foot forward to give a thrust to exports worldwide. All-out efforts are being made to tap new markets across the globe, including the Indian Ocean Region (IOR) and friendly foreign countries (FFCs).

The Government is encouraging defence exports through many policy initiatives and has set a target of Rs. 35,000 Crs by 2025. BEL has identified Exports & Offsets as one of its thrust areas and has drawn up plans to offer its select products and systems to various export markets.

Some of the other products and systems which are being promoted for exports include Homeland Security solutions, Smart City solutions, Border Protection Systems and Coastal Surveillance System. Having established a Coastal Surveillance System (CSS) for a few neighbouring countries, BEL is interacting with the Ministry of External Affairs for supply of CSS to other friendly countries.

BEL is also focusing on Offset as a potential avenue for revenue generation. BEL is interacting with many foreign OEMs to meet Offset obligations in various programmes of the MoD. BEL has identified contract manufacturing (build-to-print and build-to-spec) for foreign OEMs and partnerships in the form of Transfer of Technology of the latest systems and solutions as areas of emerging export opportunities. Efforts are also on to establish long term supply chain relationship with global players.

VAYU : Tell us about your initiatives to diversify into the civilian business.

CMD: Defence, being the mainstay of BEL, has traditionally been contributing to around 80% of the Company's annual sales revenue. BEL, however, has been continuously exploring opportunities in allied non-defence areas. The Company aims to increase its non-defence share in the overall business in the coming years.

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+91 9912706712 | aerospace@bharatforge.com | www.bharatforge.com/businesses/aerospace

Some of the areas BEL is focussing on in non-defence include solutions for Civil Aviation sector including Air Traffic Controller Radars, Anti Drone systems, Space/Satellite Electronics, Satellite Assembly & Integration, Unmanned Systems, Solar Business, Railway and Metro solutions, Software as a Service, Network & Cyber Security, Energy Storage products for Electric Vehicles (Li-ion & Fuel Cells, Charging Stations, etc), Homeland Security & Smart City businesses, Smart Meters, a range of Medical Electronic and health care solutions, Artificial Intelligence, Communication Radios & Networks, Composite Shelters & Masts, etc. This wide bouquet of businesses in non-defence would play a key role in driving BEL's growth in the coming years.

***VAYU**: In recent years, the Government of India has stressed on the need to involve the MSMEs, private industry and start-ups in the Defence sector. What are BEL's initiatives to promote such initiatives?*

CMD: The Defence Sector is being opened up for private sector participation with the evolution of Defence Procurement Procedure. In this changing business scenario, BEL is focusing on enhancing interactions at various levels and building long-term relationships with customers, emerging Strategic Partners and other key stakeholders in the Indian Defence industry as a trusted and committed partner.

Be it the efforts that the Company has been putting in to engage in collaborative R&D in addition to augmenting its own R&D set up, its recent attempts to outsource work to Indian private industries and MSMEs, or the path breaking decision to go in for Public-Private partnerships to execute turnkey projects, BEL is leaving no stone unturned to ensure that it is in sync with the Government's larger goal of indigenisation and self-reliance.

BEL has formulated a long-term Outsourcing and Vendor Development Policy and has been taking several initiatives in order to broaden the domestic vendor base by implementing online vendor registration and e-procurement processes including GeM. This is in line with the 'Make in India' initiative where enhanced thrust has to be put to develop domestic players. Make in India Display Cells have been established at all Units of BEL. The procurement from MSMEs by BEL has been over 20% in the previous years. BEL also takes part in various events organised by the Government of India to promote MSMEs.

Startup India is a flagship initiative of the Government of India, intended to build a strong ecosystem that is conducive for the growth of startup businesses, to drive sustainable economic growth and generate large scale employment opportunities. BEL has identified several areas for partnership with start-ups in new emerging areas including Machine Learning, Cyber Security, Artificial Intelligence, Embedded Computing and other latest technologies which can be used for Defence electronics applications.

Rafael Advanced Defense Systems and India

Representational images of SPYDER Air Defence System

Rafael is deeply committed to its work and relationships in India, some of which go back more than two decades. Over that time, we've successfully delivered a variety of advanced systems and have established numerous collaborative projects and ventures such as the Kalyani-Rafael (KRAS) and Astra-Rafael (ARC) joint ventures.

Rafael was a pioneer in establishing a 49% FDI JV in India. By creating an ecosystem of over 100 local manufacturers, most of them MSMEs, we have successfully transferred production capabilities and know-how to our partners.

More recently, Rafael has opened manufacturing plants in India; we continue to expand our operations throughout the country. These collaborations and partnerships remain central to Rafael's strategic approach to investment in and support of local manufacturing in India.

Rafael will be supported by its partnered Indian based companies Kalyani-Rafael (KRAS) and Astra-Rafael (ARC) with whom Rafael has joint ventures.

Rafael's operational legacy in India is evidenced by the array of systems and solutions that have been delivered over the last two decades and are still in active operational use. India based subsidiaries KRAS and ARC will be showcasing that legacy in India through various vectors which demonstrate comprehensive and advanced defensive capabilities.

Rafael's LITENING, the world's most widely used targeting and navigation pod, is a single pod incorporating a wide array of sensors enabling target detection, recognition, identification, and electro-optical tracking of multiple stationary targets. Known for its ability to shorten the sensor-to-shooter cycle, LITENING also provides auto-detection of multiple dynamic and aerial targets. LITENING is in operational use with over two dozen global air forces and is carried by over twenty-five platforms including the F-16, F-15, AV8B, F-18, F-4, F-5, A-10, B-52, Jaguar, LCA Tejas, AMX, Mirage 2000, Tornado, Typhoon, MiG-21, MiG-27, M346, KC390, Gripen, Sukhoi 27 and Sukhoi Su-30MKI.

Spice bomb and Litening pod from Rafael. Photo: WikiCommons

Rafael's focus on the local industry within India is also well supported by the local manufacturing of the LITENING 4i.

The latest version of the Litening combat-proven targeting and navigation pod includes sensors enabling Standoff targeting; new Color/MWIR/SWIR sensors operational 24/7 in any weather conditions. It is an upgrade to the operational system used by the IAF, providing an enhancement to day and night attack operational needs; much longer standoff Ranges, much better image Resolutions and automated data analysis tools, Air to Air IRST capabilities. Operational on multiple platforms in the IAF and 22 other countries it is easily integrated into the operational and maintenance structure of older Litening version operators.

In use with the Indian Armed Forces, the SPYDER Air Defence System is the only Israeli-made air defence system that has been incorporated into the aerial defence array of NATO. SPYDER is a quick reaction, low-level surface-to-air missile system designed to counter attacks by aircraft, helicopters, UAVs, and precision-guided munitions. The system provides effective protection of valuable assets and first-class defence for forces located in the combat area. SPYDER's open architecture allows external components to be easily integrated and flexibly combined, affording different configurations with various ranges and capabilities based on customer needs and priorities. Its autonomous capabilities can detect threats while on the move and enables a 360° launch within seconds of the target being declared hostile, in all-weather, multi-launch, and net-centric capabilities. All the SPYDER systems have multiple target engagement capabilities for handling saturation attacks.

SPYDER systems incorporate the most advanced air-to-air-missiles with proven performance: Rafael's PYTHON-5 dual waveband IIR missile, I-DERBY active radar BVR, and the I-DERBY ER long-range missile, each of which can be used for air-to-air missions. The SPYDER-SR and SPYDER-ER variants provide 360° slant launching missile systems that provide quick reaction, lock-on-before-launch (LOBL), and lock-on-after launch (LOAL) capabilities while extending the range of defence to up to a 40 km radius. The SPYDER-MR and SPYDER-LR offer medium and long-range target interception through vertical launch while pushing the defence envelope up to an 80 km radius. The most recent variant, SPYDER All-in-One, incorporates an integrated radar, Toplite EO/IR sensor, and launcher onto a single platform to address a defence force's individualised, operational needs.

Courtesy: Rafael Advanced Defense Systems

Safran in India

Safran has been present in India for more than 65 years and today has 750 employees in eight companies and a training centre, all working in production, design or services in the aeronautics and defence industries.

Aerospace: Safran-HAL, a joint venture between Safran and Hindustan Aeronautics Limited (HAL) in Bengaluru is producing the unit manufacturing components for CM56 and LEAP engines for CFM International (a 50/50 joint venture between Safran Aircraft Engines and GE). The Group is also one of the leading suppliers of wheels and carbon brakes for the commercial Airbus A320 and Boeing 787 Dreamliner aircraft used in India. Inaugurated in October 2016 in Goa, Helicopter Engines MRO Pvt. Limited (HE-MRO) is a joint-venture between Safran and HAL aiming to support local and international operators, including India armed forces.

Defence: Safran is one of the main contributors to the 36 Rafales acquired by India in 2016. The first fighter aircraft was delivered in October 2019. Group companies produce a large proportion of the systems and equipment, for instance the aircraft's M88 engine, the power transmission system, the landing gear, the wheels and carbon brakes, the ring laser gyro inertial navigation system, the gyroscopes for the fly-by-wire system, the auxiliary power unit (APU) and all the wiring systems. Safran is in addition managing the project for the Hammer modular air-to-ground weapon (AASM). It is also the primary supplier of inertial navigation

systems for Indian combat aircraft. Sigma 95N navigation systems are used in the Sukhoi Su-30MKI, LCA Tejas, MiG-29, Jaguar and Hawk fighter planes. Over 500 fighter aircraft used by the Indian Air Force and Navy are equipped with inertial navigation systems produced by Safran.

Helicopter engines: The Group is the leading supplier of turbine engines for the helicopters used by the Indian Armed Forces, with more than 1,500 helicopter engines in service. The Shakti/Ardiden 1H1 engine, certified in 2009, is one of the key components in the partnership between the two countries. Co-developed by Safran and HAL, the engine is currently under construction in Bengaluru, badged as Shakti, using components manufactured mainly in India. It was initially selected for the Dhruv helicopter produced by HAL, which is now in service. It is also being used in the Light Combat Helicopter (LCH). To date, over 350+ Shaktis have been produced. More recently, the Ardiden 1U engine, derived from the Ardiden 1H1, designed specifically for single-turbine helicopters, was selected for the Light Utility Helicopter (LUH), a new and innovative single-turbine multi-function helicopter weighing three tonnes. The first technical flight of the Ardiden 1U in the LUH took place in September 2016 in Bengaluru, and met all its performance objectives. It was certified by Indian Directorate General of Civil Aviation (DGCA) in 2021.

Supporting research: To promote the development of increasingly innovative technologies and solutions, Safran has established a number of partnerships with leading Indian scientific and educational institutions. The collaboration with the Indian Institute of Science (IISc) in Bengaluru and the Indian Institute of Technology (IIT) in Delhi focuses in particular on subjects such as the Internet of Things and processors and parallel processing: topics that relate to current and future challenges.

News from Russia's UAC

MC-21 to prepare for joint pilot operation

The experimental MC-21 aircraft of Irkut Corporation (part of PJSC UAC of Rostec State Corporation), painted in the livery of Rossiya Airlines (Aeroflot Group), arrived early December 2022 at Flight Test and Development Complex of Yakovlev Design Bureau, where it will be prepared for joint pilot operation. As part of the MC-21 joint pilot operation programme, Irkut Corporation and Rossiya Airlines plan to train command and instructor personnel and instructor pilots, gain experience in air transportation on standard airliner routes, and also work out operating procedures.

(Photo: Aleksey Simanovich*/ planespotters.net)*

In total, three experimental MC-21 aircraft will take part in the programme, which will be based at the Ramenskoye airfield, where Flight Test and Development Complex of Yakovlev Design Bureau is located. The pilot operation programme is currently being coordinated with the relevant federal agencies. At the first stage, piloting will be carried out by test pilots of the Yakovlev Design Bureau. MC-21 is a new generation medium-haul passenger aircraft with a capacity of 163 to 211 passengers.

2nd MC-21 prototype flies with Russian PD-14 engines

The second MC-21 aircraft has completed its first flight with domestic PD-14 engines, Russia's state-owned Rostec has announced. The aircraft took off from the airfield of the Irkutsk Aviation Plant, a branch of UAC's subsidiary Irkut Corporation. In addition to installing the PD-14 on the aircraft, the systems were finalised based on the results of past flight tests. Also, in order to integrate the domestic power plant, a number of

(Photo: Denis Fedorko/ russianplanes.net)

imported aircraft equipment components were replaced with Russian counterparts.

After completing the flights, the MC-21 prototype will fly to Zhukovsky to continue certification work on the basis of the Flight Test and Development Complex of the Design Bureau named after AS Yakovlev. Initially, the MC-21 project was developed with two types of powerplants, but the aircraft will go into serial production with the Russian PD-14 engine. Possessing a high bypass ratio, the PD-14 is characterised by low fuel consumption and reduced noise levels.

UAC exhibits a wide range of aircraft

United Aircraft Corporation (PJSC UAC, part of Rostec State Corporation) participated at the international exhibition Indo Defence Expo & Forum 2022, in Jakarta, Indonesia with a wide range of products. The multimedia exposition included a wide range of civil and military aircraft such as MC-21 medium-haul airliner, SSJ-100 regional jet, Su-30SME multifunctional fighter, as well as Yak-130 combat trainer.

One of the key models at the UAC exposition was the MC-21, a new generation medium haul passenger aircraft. This model offers passengers comfort comparable to the cabins of mainline airliners, significant economic advantages to carriers, convenience for the crew and maximum level of environmental safety. Serial production of SSJ-100 is currently carried out by the production centre of Irkut Corporation in Komsomolsk-on-Amur. Prototypes of import-substituted versions of the aircraft (SSJ-NEW) are also being assembled there as a preparation for the serial production of the airliner.

In addition to civil aircraft, the supermaneuverable multifunctional two-seat Su-30SME fighter was presented as part of the UAC exposition. The aircraft is designed for attacking aerial targets in free airspace and against the background of the earth, as well as ground and surface targets day-and-night in favorable and adverse weather conditions.

Another aircraft demonstrated was the combat trainer Yak-130. This model is characterised by high maneuverability and modern avionics complex, typical for advanced combat aircraft. Yak-130 has a subsonic aerodynamic configuration and flight performance characteristics. It can be successfully employed to train pilots in conditions close to a combat situation with the use of air-to-air/air-to-ground weapons.

MBDA showcases the IAF's latest missiles during Aero India 2023

Photos: Tejaswi Singh

MBDA, longstanding partner to the Indian Air Force, is showcasing the newest missiles in Indian service during Aero India 2023, as well as the systems that could help equip all branches of the Indian Armed Forces in the future.

At the centrepiece of the company's presence this year in Bangalore, are the weapon systems that arm the IAF's latest Dassault Rafale combat aircraft. These highly potent set of weapons from MBDA give the IAF an air combat capability that is unrivalled by any of India's neighbours. The most famous of these weapons is the Meteor beyond visual range air-to-air missile, which is widely recognised as a game changer for air combat. The Meteor is powered by a unique rocket-ramjet motor that gives Meteor far more engine power, for much longer than any other missile. This means it can fly faster, fly longer, and manoeuvre more than any other missile, giving Meteor the ability to chase down and destroy agile hostile fighters at even the furthers of ranges. As a result, Meteor has a no-escape zone many times greater than any other air-to-air missile.

India's Rafales are also be equipped with the SCALP deep-strike cruise missile from MBDA to strike hardened and protected targets deep inside hostile territory. The IAF's Rafales are also equipped with MICA, a potent air combat missile the Indian Air Force knows very well as it is also part of the upgrade package for the IAF's Mirage 2000 aircraft. MBDA is a longstanding industrial collaborator for India, with MICA being a prime example--L&T MBDA Missile Systems Ltd, MBDA's joint venture with Larsen & Toubro, is exhibiting also at Aero India 2023 where it showcasing the work it performs in Coimbatore on MICA missiles and MICA missile launchers, delivering Make in India projects in support of Atmanirbhar Bharat.

MBDA is also proposing all these potent weapons, as well as the famous Exocet AM39 air launched anti-ship missile for the Rafale M for the new Indian aircraft carrier.

MBDA is not new to partnership with the Indian Armed Forces and Indian industry, indeed it 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. The company then is fully committed to the 'Make in India' programme, which aligns with MBDA's long-term strategy.

Other examples of technological edge equipping the Indian Air Force include the ASRAAM within visual range (or dogfighting) missiles. ASRAAM is providing the IAF's Jaguar fleet with a step-change in air combat performance – a capability that will soon also enhance the IAF's new Tejas LCA Mk1A. 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 also has agreements in place with Bharat Dynamics Limited for ASRAAM to be assembled in India to support Make in India.

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. Again, MBDA and BDL have signed an agreement for the establishment of an assembly line for Mistral missiles in India.

MBDA has an excellent track record providing both operational and industrial capabilities in partnership with the Indian Air Force and Indian Defence Industry. The strength of these two pillars make it a long-term true partnership, and one that should only continue to get stronger.

By Ludovic Dumont, Country Head MBDA & MBDA India General Delegate

The industrial benefit multiplier in Saab's Gripen offer

By all accounts, the Indian Air Force's (IAF) Multi Role Fighter Aircraft programme will in many ways be more than just a purchase of aircraft to fill a capability gap. From its very inception, and even in its earlier avatar, it was envisaged as more than just an aircraft purchase. It was meant to be the game changer both for the IAF in terms of delivering future air power and for India's already accomplished aerospace industry in terms of always being at the fore front of technology.

Let's look at some of the benefit multipliers that Saab is putting on the table along with the Gripen proposal. What is evident is that no other aircraft has been procured or offered containing a similar package of benefits.

The procurement was launched by issuing an RFI in April 2018 for 114 aircraft, of which 96 are to be produced in India, in line with the "Make in India" philosophy. The request consisted of both single seat and dual seat variants. Saab comprehensively responded to the RFI in July 2018 with E and F versions of Gripen, single and dual seater variants respectively. Gripen E/F is the most advanced version of the Gripen multi-role fighter, with Gripen E already in use by the Air Forces of Sweden and Brazil, and Gripen F development now commencing in earnest.

Since Saab's RFI response, several interactions with the IAF have been made highlighting key features of the product, its weapon suite, the unique Human Machine Collaboration, the industrial portion and the "Make in India" portion. We are now awaiting IAF to finalise the requirements in order to move towards an Acceptance of Necessity (AoN) decision and the next round of requests.

Saab is going far beyond establishing an aircraft assembly line in India in our offering. Our offer includes building self-reliant skills in India, a production-oriented part and a Gripen related design and development-oriented part. By doing this we provide a capability-oriented design and development ability which is intended to support the indigenous development of advanced fighter aircraft such as AMCA, possibly in close co-operation with ADA and DRDO. Our offer also includes an

extensive indigenous Maintenance, Repair and Operations (MRO) solution that will provide India with capabilities to maintain and upgrade the aircraft.

Our offer is centred around INAC (Indian Aircraft Company), Saab´s working name for the industrial body proposed to be establish as the hub for our industrial approach to Gripen for India. The design and development centre, will be able to sustain and develop the system locally, managing upgrades and integration of new software and hardware, including sensors and weapons. Through this approach we will provide a comprehensive Make in India and Skill India offer to build self-reliance. This provides long term job creation with a focus on intellectual property, indigenous content, substantial production, maintenance and development capability.

INAC will perform final assembly and delivery of the 96 aircraft to be produced in India out of the total order for 114, as well as Maintenance Repair and Overhaul capability. The setup of the Design Centre in India will become the hub of all design related activities including test rigs for various purposes. This would be used to secure self-reliant upgrade capabilities within India, to keep the Gripen continuously operationally relevant.

In combination, INAC and the design centre will have full capability for design, development and upgrade of software and hardware, including integration of new sensors and weapons.

INAC will manage the extensive supply chain established in India for assemblies, structures and systems, enabling us to offer a much higher ratio of indigenous content and industrial benefits compared to any of our competitors.

Like all nations, the defence needs of India are unique, based on their Concepts of Operation and threat perceptions. The future threats will be different to today's threats and will require abilities to upgrade aircraft capabilities quickly and efficiently. These upgrades would most likely not be related to the airframe itself, but rather to the tactical systems on the platform. This means that, over time, India will need to be able to rapidly update their tactical systems, including weapon and sensors, ensuring continuous operational relevance. This requires a platform with an inherent, rapid upgrade capability as well as design capabilities in the country.

For India Saab has therefore taken the approach to focus on providing indigenous capabilities to sustain, develop and adapt the total aircraft system. Through INAC, the design centre and our local supply chain, all future work on the platform will be able to be done locally in India by Indian nationals.

This is our key differentiator as it will significantly speed up the process of executing required changes on the product, providing a much quicker process from development to implementation in hardware and software. As stated before, we will, in parallel, provide transfer of capabilities to support AMCA and other future fighter programmes. Through the Gripen programme, and with the industrial ecosystem we establish, Saab will be able to act as a true partner to ADA and DRDO in the development and production of future fighters.

Saab is providing a complete and capable industrial system that can be used in the future endeavours for a self-reliant India. Saab is the only manufacturer in the competition prepared to offer such extensive transfer of capability and build indigenous competence for longer-term benefit to the Indian nation.

By Mats Palmberg, Chairman and Managing Director, Saab India

Indian Forces, armed with supersonic BRAHMOS, is a military force to be reckoned with

India, being one of the emerging economic powerhouses in Asia, is vitally positioned in the southern sub region of the Asian continent. The country dominates the Indian Ocean and commands an important strategic position in the neighbourhood. India, armed with an strong and effective Armed Forces, has been defending its territorial integrity and sovereignty, while ensuring peace and stability in the region. The country, facing military challenges across several fronts, have systematically modernised its defence manufacturing and military firepower over the years.

Firepower is the military capability to direct force at the adversary. It involves the employment of whole range of potential weapons wherein the enemy forces are destroyed and their will to fight is degraded. Missiles have added a new dimension in the realm of application of firepower. BRAHMOS missile, an exemplary product of Indian-Russian Joint Venture has been a front runner in this class of weapon system. The BRAHMOS weapon system has fulfilled the Indian Armed Forces' operational lead for accurate engagement of high value targets deep inside enemy territory.

The missile deployed in the Indian Army, the Indian Navy and the Indian Air Force has established itself as a major force multiplier in modern-day complex battlefields with its impeccable land attack, anti-ship capabilities and multi-role plus multi-platform abilities.

BRAHMOS weapon system has become the mainstay of the Indian Army's artillery firepower with several regiments raised. Similarly, for many of the Navy's frontline surface ships, BRAHMOS has been deployed as a prime strike weapon in both land-attack and anti-ship configurations. The missile has also proved its 'salvo' launch capability to knock down single or different targets located in different directions. BRAHMOS missile is capable of being launched from submarine from a depth of 40-50 metres. In 2020, a squadron of fourth-generation fighter jets Sukhoi Su-30MKI ('Tigersharks' 222 squadron) equipped with the BRAHMOS supersonic cruise missile was inducted in the Southern India, adding teeth to India's air and maritime dominance in the Indian Ocean Region (IOR). The successful induction of BRAHMOS in all the three services has made India the first and only country in the world to complete the "supersonic cruise missile triad".

BRAHMOS has recently conducted numerous successful launches which boost India's defence indigenisation efforts by significantly highlighting the vital contributions of BRAHMOS missile to the Govt. of India's ambitious "Make in India" initiative. BRAHMOS has also achieved historic milestones in the flagship "Aatmanirbhar Bharat" programme by successfully indigenising major sub-systems of the missile. All launcher systems for the weapon are manufactured domestically. 100% of ground support equipment for the weapon complex are also being made in India.

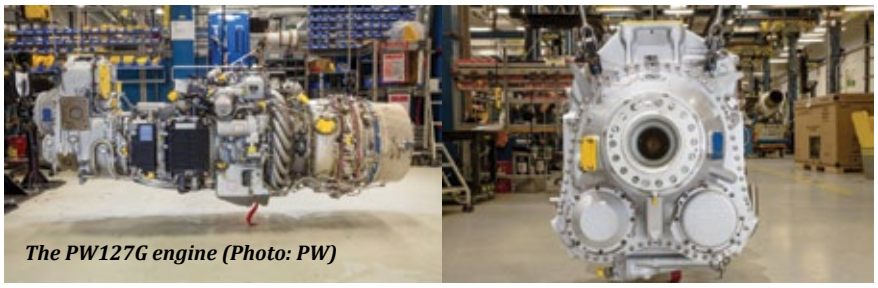
Both Defence Research & Development Organisation (DRDO) of India and JSC MIC NPO Mashinostroyeniya (NPOM) of Russia have made impressive strides in joint design, development and production of the high-technology BRAHMOS. BrahMos Aerospace also prides itself in possessing a full-fledged design centre, an Industrial Consortium for producing different sub-systems, a world-class integration, and check-out facilities with stringent quality control. BrahMos Missile Industrial Complex comprises of more than 200 Indian industries and multiple Russian industries, R&D labs and academic institutions of both the countries.

BRAHMOS has also emerged as a potential weapon of choice with several countries across continents evincing strong desire in possessing the versatile weapon. Philippines in January 2022 signed a mega defence contract with BrahMos Aerospace for the supply of shore-based anti-ship variant of the BRAHMOS supersonic cruise missile to the Armed Forces of Philippines.

Versatile weapons like BRAHMOS Supersonic Cruise Missile will play a significant role in modern battlefields as it supersedes the most popular cruise missiles in the world by three times in terms of velocity, flight range and nine times the kill energy range. It is going to remain a world-class system in the coming years.

Pratt & Whitney: Powering future strategic airlift capabilities with the C-295

Representational image of the C295 (Photo: Airbus)



The PW127G engine (Photo: PW)

Pratt & Whitney is delighted with the Indian Air Force choosing the Airbus Defence and Security C-295 aircraft and that 40 of these aircraft will be made in India in partnership with the Tatas. A next-generation light and medium tactical airlifter, the C-295 is capable of conducting operations across a wide range of mission profiles. Fully certified for all-time, all-weather operations, the aircraft is ideally suited to meet the needs of the Indian Air Force's ever evolving operational requirements across diverse environments. When in service with the Indian Air Force, the 56 C295 will conduct critical missions in support of the country's 1.3 billion residents, just as it does in many other jurisdictions across the world.

With the C-295, we are looking forward to building our already strong partnership with the Indian armed forces. Pratt & Whitney's F117 engines currently power the Indian Air Force's 11 C-17 Globemaster III aircraft that have been enhancing the country's armed forces' strategic airlift capabilities. Our iconic PT6A engines power the Indian Air Force's fleet of 75 PC-7 trainers. Furthermore, our Auxiliary Power Unit powers India's Netra Airborne Early Warning and Control System (AEW&CS) that has been indigenously modified from the Embraer E145J.

PW127G for the C-295

We are pleased that our PW127G engines power the C295, which is widely acknowledged as the next generation of Fixed-Wing Search and Rescue (FWSAR) and light and medium transport aircraft. The C295's twin PW127G engines provide remarkable range and endurance for time-critical missions due to its low-fuel consumption during cruising.

Since the maiden flight of the C295 in 1998, we have been supplying these engines to Airbus Defence and Space (ADS) and have shipped over 400 PW127G engines to ADS since then. The PW127G is a member of the PW100/PW150 engine family and the PW127 alone powers not just the C-295, but also the ATR 42-500/600, ATR 72- 210/500/600, Fokker 50 High Performance and the Fokker 60 Utility.

It is noted for its capacity to excel at a range of missions such as regional commercial airline service, firefighting, aerial surveillance, cargo transport, humanitarian services, and civil defence. The PW100/PW150 engine family, originally designed for regional aviation, now powers 90% of regional turboprop aircraft in the 30-90 passenger format flying today. We have refined our engines' dispatch reliability to industry-leading levels over the years. Given the stakes involved in any nation's FWSAR and associated missions, the ability to fly on command can sometimes mean the difference between life and death.

PW100/150 Series: Proven, future ready excellence

PW100 powered aircraft utilise 25 to 40% less fuel and emit up to 50% less CO2 than comparable-sized jets, resulting in lower greenhouse gas emissions. 38 PW100 models have been produced, ranging in shaft horsepower power from 1,800 shp to 5,000 shp.

No other engine family delivers higher propulsion at takeoff and climb when it comes to powering aircraft of this weight class. We have built our reputation on the reliability of our engines. The PW150A engine, for example, has a dispatch availability of more than 99.96%. Our PW100/PW150 engines have four times more flying hours than our nearest competitor.

We are developing next-generation engine technology to address the different business needs of our many customers. We intend to provide more power, improved fuel efficiency, improved noise and emissions performance, and increased maintainability while maintaining the durability and dependability that our customers have come to expect.

By Ashmita Sethi, President and Country Head, Pratt & Whitney

NAMMO in the news

NAMMO .50BMG ammunition for longer ranges

NAMMO has developed a polymer-cased .50 BMG round, with polymer replacing approximately two-thirds of the case, only the brass head remaining in that material. The two parts are mechanically connected and the round – which is already 27% lighter overall – comes with a polymer link that saves a further 7% by comparison with a more traditional metal strap link.

The weight saving imparted by the round – which is fully compliant with MIL-DTL-10190F – is particularly noticeable when deployed from a light helicopter such as the AH-6 Little Bird or H145M LUH SOF. The weight savings translate to greater fuel carriage and therefore a greater operational radius, while other advantages lie in constant internal volume and higher accuracy.

Developing 120mm ammunition for Korea's K2 MBT

Nammo has secured an agreement to develop new and modern 120mm ammunition for Hyundai Rotem Companies' K2 main battle tank. "This is a major milestone for Nammo. The agreement with Hyundai Rotem Company (HRC) enables us to integrate and further develop our modern ammunition portfolio for the K2 main battle tank (MBT). This means more powerful ammunition for NATO countries using the K2, including Norway", stated Audun Dotseth, Vice President Large Caliber Systems at Nammo.

The agreement between the two companies has an initial value of $5 million for the R&D part, and likely more than $100 million if Nammo ends up producing and delivering 120mm ammunition to K2 users. Poland recently signed a contract to procure close to two hundred K2 tanks, in a deal where HRC will deliver a total of 1000 K2 MBTs with successive contracts. Norway is currently in the final stage of choosing a new MBT for its Army – the K2 is one of two candidates.

Delivering 12.7mm ammunition to Sweden

Nammo has signed a new contract with the Swedish Defence Materiel Administration (FMV). The agreement sets up Nammo as the sole supplier of 12.7mm ammunition until 2029. This means that Nammo is the only main supplier of 12.7mm ammunition to the Swedish Armed Forces for the coming 6 years. The initial contract value is 120 million Swedish kroner, but the end value could rise to around 500 million Swedish kroner if all options are used.

Updates from Rafael

Rafael's FOOTPRINT

As part of the Army Warfighting Experiment (AWE), ground troops of the British Army conducted a set of rigorous trials with the Rafael's FOOTPRINT system through varying scenarios. The system proved its ability to allow soldiers to navigate and self-position in situations where they are unable to rely on traditional GPS capabilities. As part of AWE and under The Defence Science and Technology Laboratory (DSTL) and the Future Capability Group, the British soldiers tested FOOTPRINT system in scenarios simulating modern mission requirements, including between and inside buildings, down into basements as well as in open areas.

Drone Dome recommended by US DoD

The US Department of Defence's (DoD) Joint Counter-small Unmanned Aircraft Systems Office (JCO) has named and recommended for C-sUAS As A Service (CaaS) the DRONE DOME system, provided via Rafael Systems Global Sustainment (RSGS). This is following a series of demonstrations of the system completed at Yuma Proving Ground, Arizona. DRONE DOME successfully demonstrated its C-UAS capabilities, which included accurate detection, identification and soft-kill capabilities against a variety of drone targets and is now eligible and has been recommended to compete for future CaaS contract opportunities.

Rafael contract with Asian navy for Typhoon Mk30-C

Rafael Advanced Defense Systems Ltd. announced it has been awarded a contract to supply its Typhoon Mk30-C, counter-UAS, Next Generation Naval Remote Weapon Station (NRWS) to an undisclosed navy in Asia. The contract is worth tens of millions of dollars and will be fulfilled over the course of five years, with an option for expansion for more systems over the course of the contract. Equipped with the highly-reliable NGC Mk44S Bushmaster 30 mm gun and its advanced ammunition, the Typhoon Mk30-C offers a superior capability in defending against multiple threats.

R-R Adour powered IAF Hawk

Rolls-Royce reinforces commitment to partner India for combat engine co-development at Aero India 2023

Rolls-Royce is participating at Aero India 2023 show in Bengaluru (Karnataka) from 13-17 February. The show will serve as a platform for the company to reiterate its readiness to partner India for co-development of critical combat aircraft engine technologies.

The company will also take the opportunity to familiarise defence customers with its advanced technology solutions for air defence, and its full range of naval-marine offerings, including the power-dense MT30 marine gas turbine for aircraft carriers, frigates and destroyers.

Kishore Jayaraman, President, India and South Asia, Rolls-Royce, stated, "We firmly believe in India's vision of defence indigenisation with a sharp focus on developing critical defence technologies in-country. We are ready to partner the country for its combat engine co-development programme, and are well-positioned in India with an ecosystem of partners. Such a programme will not only catapult the country's defence production and export capabilities, but also create a strong foundation for technology development in the future."

Commenting on Rolls-Royce's readiness for the partnership, Alex Zino, Executive Vice President, Business Development & Future Programmes, Rolls-Royce, stated, "We are proposing a collaborative, co-development model for the country's fighter engine programme. Our offering is not merely about the transfer of technology, but the creation of a full range of engine capability to boost India's future technology development and add thrust to its vision of being a key global defence player."

Rolls-Royce has a history of many firsts with the Indian Air Force (IAF) - from powering the first IAF aircraft to delivering the first whole engine technology transfer agreement for the licensed production of Rolls-Royce engines in India. Today, the company has successfully created a robust ecosystem of Indian partners, talent, supply chain, digital, service delivery and manufacturing capabilities. With this rich legacy of partnerships, Rolls-Royce continues to contribute to the development of the aerospace and defence ecosystem in India and is committed to supporting the self-reliance journey.

At Aero India 2023, Rolls-Royce will explore opportunities for its MT30 marine gas turbine for future platforms. The naval turbine offers a superior power-to-weight ratio, generating up to 40MW from a 30-tonne packaged unit, and offers ship designers much more options and flexibility in designing the naval vessels of tomorrow.

Courtesy: R-R

Lockheed Martin finalises Lot 15-17 Agreement

The F-35 Joint Programme Office and Lockheed Martin have finalised the contract for the production and delivery for up to 398 F-35s for $30 billion, including US, international partners and Foreign Military Sales (FMS) aircraft in Lots 15 and 16, with the option for Lot 17.

"The F-35 delivers unsurpassed capability to our warfighters and operational commanders", stated Air Force Lt. Gen. Mike Schmidt, programme executive officer, F-35 Joint Programme Office. "This contract strikes the right balance between what's best for the US taxpayers, military services, allies and our foreign military sales customers. The F-35 is the world's premier multi-mission, 5th-generation weapon system, and the modernised Block 4 capabilities these new aircraft will bring to bear strengthens not just capability, but interoperability with our allies and partners across land, sea, air and cyber domains."

The agreement includes 145 aircraft for Lot 15, 127 for Lot 16, and up to 126 for the Lot 17 contract option, including the first F-35 aircraft for Belgium, Finland and Poland.

Lot 15-17 aircraft will be the first to include Technical Refresh-3 (TR-3), the modernised hardware needed to power Block 4 capabilities. TR-3 includes a new integrated core processor with greater computing power, a panoramic cockpit display and an enhanced memory unit.

These aircraft will add to the growing global fleet, currently at 894 aircraft after 141 deliveries this year. The F-35 team was on track to meet the commitment of 148 aircraft as planned; however, due to a temporary pause in flight operations, which is still in effect, necessary acceptance flight tests could not be performed.

The finalised contract caps off a year of the F-35 delivering combat-proven airpower around the world and continued international growth. This year, Finland, Germany and Switzerland signed Letters of Offer and Acceptance (LOAs) as an important step in their procurement of F-35 aircraft.

"Continuing to add new countries to our global F-35 fleet further validates the capability and affordability of this aircraft in providing 21st Century Security to nations and allies," stated Bridget Lauderdale, Lockheed Martin vice president and general manager, F-35 Programme. "There is simply no other aircraft that can do all that the F-35 does to defeat and deter even the most advanced threats."

F-35 programme participants currently include 17 countries. To date, more than 1,870 pilots and 13,500 maintainers have been trained, and the F-35 fleet has surpassed more than 602,000 cumulative flight hours.

Courtesy: LM

News from IAI

German Heron TP (GHTP) awarded Type Certificate

The Type Certificate is the result of years of intensive type certification effort by the prime contractor Airbus DS Airborne Solutions GmbH (ADAS), a 100% Airbus subsidiary and its partner the GHTP OEM Israel Aerospace Industry (IAI) together with the GMAA. The Type certificate attests GHTP's compliance with the latest version of military airworthiness standard (STANAG 4671). The effort included adaptations of multiple systems to be compliant with the required standards, compilation and review of hundreds of documents and multiple reviews and tests, in close cooperation between GMAA, ADAS and IAI. All this was performed, and brought to very successful conclusion, despite the challenges imposed by COVID-19 pandemic.

IAI in European permit to fly UAVs in civil airspace

On the recommendation of EASA, the European Union Aviation Safety Agency, the Greek civilian aviation authority has for the first time issued a permit allowing IAI's Heron 1 UAV to be flown in Greece's airspace. The permit allows the system to be used in the operational activities of the European Border and Coast Guard Agency, whose charter is to provide marine surveillance and coastal protection. The UAV flights are carried out in Europe's civil airspace according to civil flight procedures with no military intervention or control.

The Heron 1 systems are equipped with electro-optical day and night-vision payloads and marine surveillance radars that provide an up-to-date, realtime, accurate intelligence picture. This information is then distributed to decision-makers in situation rooms by means of a specialised system that ensures the smooth coordination, planning, and command of the various tasks and assignments.

IAI electronic intelligence in tactical arena

Israel Aerospace Industries (IAI) has unveiled its latest Tactical Electronic Intelligence (ESM) system: TacSense (ELL-8395). TacSense delivers ESM performance in a compact form factor with minimal SWaP (size, weight and power). This allows TacSense to be deployed from a wide range of platforms including tactical ground vehicles and small UAVs. In addition, a manpack configuration enables the system to be easily carried on foot by one person, even in the most difficult terrain. The system's small size and weight also facilitate highly discreet, camouflaged installation at fixed locations.

Evolution of DRDO's Astra BVRAAM

Self-reliance in air launched missiles and particularly in Beyond Visual Range Air-to-Air Missile (BVRAAM) system is of strategic importance considering the new paradigm of air superiority warfare, and with the service entry of indigenous hypersonic (Mach 4 plus) Active-Radar Homing (ARH) Astra BVRAAM India's Defence Research and Development Organisation (DRDO) seems to have produced a missile that is arguably capable of matching or outmatching similar class of missiles of United States, Russian and European origin. As part of induction phase trial the missile was tested on 18 March 2015 from an Indian Air Force (IAF) Sukhoi Su-30MKI fighter against a simulated live target to verify the control system and missile stability during flight. The prototype of the missile was first tested during on 9 May 2003 from the Integrated Test Range (ITR) at Chandipur-on-sea area off the Odisha coast.

On 27 March 2007, vertical launch of the missile was carried out, suggesting the development of a Surface-to-Air Missile (SAM) variant. Following further tests dual-mode guidance was fully proved during May 2009 followed by captive flight tests on a Sukhoi Su-30MKI were carried out near Pune in November when several sorties were conducted. The series of numerous tests initiated on 20 May 2011, also from the ITR at Chandipur around 0950 hours focussed on evaluating the performance of the smokeless non-metallised high specific impulse propulsion system, rocket motor, and the configurations of the vehicle and aero-dynamics evaluation with the missile incorporating significant changes and incorporating advanced technologies in due course. Today it is very much evident that the ambitious programme has achieved significant milestones in the arena of technical brilliance and self-reliance.

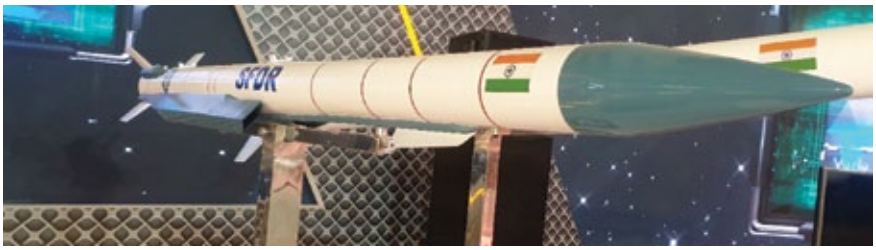
The project is guided and led by the Hyderabad-based Defence Research and Development Laboratory (DRDL). Single stage, smokeless, solid fuelled Astra with a length of 3570-mm, body diameter of 178-mm, weighs 154- kg, is powered by high energy lithium thermal batteries making it the lightest in its class and thus enjoying wide range of applications. The BVRAAM will be capable of destroying manoeuvring 9-g enemy targets at high altitude in the head-on mode at a range of 80-km and in tail-chase mode at 20-km, thanks to its redesigned cropped delta (replacing low drag low aspect ratio) wings and capability to pull a lateral acceleration of 40-g in both yaw and pitch planes which means it should be able to engage a non-manoeuvring targets well in excess of 100-km and capable of operating in the altitude bracket from sea level to 20-km. The missile can to some extent function as a Close Combat Missile (CCM), as the minimum range is around 10-km.

The all-important seeker was initially provided by Russian Agat (possibly more advanced than 9B-1348E integrated to R-77 variants) with an autonomous homing range of 25-km plus enabled off-boresight launches up to an angle of 45-degrees and produced in India through a total transfer-of-technology process. Prior ARH homing during terminal stage Astra follows Fibre Optic Gyro (FOG) based Inertial Navigation System (INS) during midcourse with high g accelerometers along with secure data link to allow midcourse re-tasking. While autopilot and guidance software uses Artificial Intelligence (AI) for accurate guidance and optimised trajectory, the on-board Electronic Counter Counter Measures (ECCM) capability allows it to stay on course in spite of enemy Electronic Counter Measures (ECM) procedures. The 15-kg high explosive warhead is pre-fragmented and Radar Proximity Fuse (RPF) armed plus directional to enhance lethality and Single Shot Kill Probability (SSKP). This RPF weighs approximately 2.5-kg and has a detection range of up to 30-m, a detonation range of 15-m and a missile target velocity between 100-m/s and 1,600-m/s. Additionally DRDO is currently working on a new laser fuse. The choice of an Agat seeker was interesting as the establishment is also highly reputed for development of infra-red seekers and indicative of an Imaging Infra-Red (IIR) version of Astra. As ARH is effective in one set of conditions and IIR in another, the open choice of different seeker heads complicates the problems of the adversary.

As a further step towards indigenisation and self-reliance, on 15 September 2017 Astra BVRAAM was test fired from a Sukhoi Su-30MKI at Kalaikunda Air Force Station (AFS) with an indigenous Ku-band pulse Doppler radar seeker developed by Research Centre Imarat (RCI). With an antenna diameter of 140-mm and weight of 12.5-kg the lock on range is well in excess of 12-km and gimbal angles of plus/minus 55-degrees. The same indigenous seeker is also set to arm the Akash-1S Surface-to-Air Missile (SAM) variant and also QRSAM. The final

development trials were completed in the same month. During user trials in 2019, Astra BVRAAM decimated a manoeuvring target at a distance of 90-km.

Projected to be a game changer on tactical level Astra BVRAAM are reportedly to be integrated with all frontline Indian Air Force (IAF) fighter aircraft such as the Sukhoi Su-30MKI, Rafale, MiG-29UPG/K, Mirage 2000I/TI and the indigenously developed Light Combat Aircraft (LCA) Tejas, and can be launched both in autonomous and buddy mode operation. Reportedly, the Mk2 version of Astra, undergoing tests, have a maximum launch range in excess of 160-km and tail chase range of up to 35-km propelled by a dual-pulse rocket motor similar to United States Raytheon AIM-120D AMRAAM. Astra Mk2 will use the dual-pulse solid rocket motor for extended reach and better kinematics during the kill phase. The missile will share smokeless propulsion of its predecessor Mk1, whilst imbibing newer technologies being implemented in other missile programmes of DRDO like Barak 8 and Rudram-1. Astra Mk-2 variant will make use of indigenous seeker manufactured by Bharat Electronics Limited. DRDO is also looking at rocket/ramjet propulsion to provide greater range and enhanced kinematics performance to the BVRAAM. However adopting a Rocket/Ramjet approach has certain limitations as the need for controlled airflow to the ramjet ducts means that the "skid-to-turn" manoeuvring of a conventional rocket-powered missile is not acceptable (because it will risk masking an intake) yet "bank-to-turn" manoeuvring results in a reduced instantaneous turn rate.



The ambitious Astra Mk3, developed in collaboration with Russia, is projected to be a Solid Fuel Ducted Ramjet (SFDR) powered missile with a range in excess of 350-km. The SFDR missile system utilises a solid fuelled air-breathing ramjet engine and can achieve longer ranges as they do not require oxidisers, as they take oxygen from the atmosphere. The high speed and manoeuvrability of SFDR missiles ensure significantly greater No Escape Zone (NEZ) as SFDR technology takes every performance aspect of the Astra to the next level, crucially range, sustained speed and kinetic energy during the difficult endgame phase when such missiles close in on normally manoeuvring targets. It includes fire suppression material in the fuel tank. The DRDO and Russia have worked together on the development and testing of the nozzle-less booster, boron-based ramjet sustainer and fuel flow controller, in addition to the design of the dual air intakes.

To be designed to fulfil the BVRAAM role for "outer-air battles", Sukhoi Su-30MKI equipped with Astra Mk3 will be able to engage ultra-high-value airborne platforms like Airborne Early Warning & Control (AEW&C), In-Flight Refuelling (IFR), Long Range Maritime Patrol (LRMP) and Joint-Surveillance Target Attack Radar System (J-STAR) platforms, without necessarily having first to deal with their fighter escorts, thus emerging as a formidable aerial sniper. Under such circumstances, the primary concern of the IAF and the Astra development team will be of positive identification of enemy targets at those extended ranges since Identification Friend or Foe (IFF) remains a problem because of incorrect and absent returns and "spoofing". Hopefully in the long term, development of electro-optical seeker technology coupled with on-board threat database will let the missiles themselves determine the legitimacy of the targets. Astra Mk3 has undergone a series of tests and is projected to arm the air forces and navies of both India and Russia plus with significant export potential to trusted allies.

Finally undergoing initial tests, VL-SRSAM is the vertically launched SAM variant with jet vane based Thrust Vector Control (TVC) offering exceptional manoeuvrability at close range and low altitudes and meant for land based and naval applications.

Sayan Majumdar

MBDA's ASMP-A Land-Attack Cruise Missile (LACM)

It is now an open secret that Indian Air Force (IAF) Rafale F3R fleet will be assigned the role of manned airborne nuclear deterrence under India's SFC (Strategic Forces Command), officially raised on January 2003 under a "three-star commander" by India's National Security Cabinet Committee (NSCC) while formally announcing India's long awaited Nuclear Weapons Command and Control Structure. The IAF multi-role strike fighter squadrons spearheaded by the formidable Rafale F3R are being configured as to they become capable of delivering a punishing "retaliatory nuclear strike" on any rouge nuclear aggressor and also capable of conducting pre-emptive conventional "counterforce" precision strike on enemy nuclear arsenals or their communication, command and control nodes, to disable them from launching a "first strike" on Indian forces or homeland.

The French Dassault Rafale F3 version to appear around 2008-2010 were developed as multi-role strike fighters from outset with priorities considerably shifted towards nuclear strike and conventional attack yet at the same time retaining formidable air superiority attributes leading to its classification by its manufacturer Dassault as "omni-role," being capable of performing strike and air superiority tasks in single sortie.

To execute successful nuclear strike and conventional attack missions the Rafale along with its manoeuvrability and a high degree of cockpit automation is designed to make use of terrain following and masking, particularly at night and in adverse weather conditions to fly a terrain/obstacle-avoidance profile at 5.5-g and down to 100-feet in altitude thanks to the Automatic Flight Control System (AFCS) that can operate in either digital terrain following or a radar terrain following mode. With digital terrain following, the

AFCS manoeuvres the Rafale over terrain based on a three dimensional map database which is pre-programmed into the AFCS software.

The radar terrain following mode of the RBE-2/AA Active Electronic Scanned Array (AESA) radar can scan the terrain ahead and safely fly the jet over all obstructions before resuming nap-of-the-earth operations. In these missions its digital Fly-By-Wire (FBW) controls and canard-type fore-planes incidentally allow it to secure all the advantages of delta wing platform including high fuel storage, low drag, increased manoeuvrability with considerably more authority in pitch, fewer control surfaces and reduced Radar Cross-Section (RCS) while minimising most of the instabilities that arise when the aircraft carries significant external stores during low-altitude missions. The digital FBW controls in particular empower the Rafale fleet remarkable manoeuvrability at low altitudes as well as high resistance to g-bump enabling them to fly fast and low, deliver ordnances to targets with a high degree of accuracy and capable of destroying alerted opposing fighters with their formidable defensive weaponry and electronic warfare suite on their way back.

Similar cooperation from Dassault is assured in "hardwiring" of Rafale, including airframe reinforcements especially near the appropriately shorter and thickened central pylon and the inboard wing pylons, with the pylon data bus attaining more complex nature with additional connecting pins well in conjunction of differently programmed attack computers with restricted access.

In French Air Force service the 300-kt thermonuclear MBDA ASMP-A Land-Attack Cruise Missile (LACM) is tasked with airborne nuclear strike. The concept of ASMP-A was derived from ASMP utilising the air vehicle pre-developed for the Vesta activity (ramjet air vehicle) in conjunction with the ANF future anti-ship programme, that was suspended at the end of 1999. The ramjet/stratoreacter mode of propulsion compared to a traditional rocket propulsion system, allows for the significant reduction of both the required space within the missile as well as missile weight in relation to the required range and warhead charge additionally allowing the missile to cover a large part of the flight envelope at high supersonic speeds.

The compactness of the ASMP-A can be judged by the fact that the formidable nuclear missile measures just over 5-metres in length and a mass of only about 850-lb. ASMP-A has a range of about 500-km at a speed of up to Mach 3. The extended range ensures survivability of the launch platform from enemy Integrated Air Defence (IAD) network. The missile still retains a speed of Mach 2 during low-level advanced and complex penetration mode with a high (yet undisclosed) degree of accuracy. The missile in turn is nuclear-attack hardened. The pristine 300-kt TNA (tête nucléaire aéroporté) warheads developed by Commissariat à l'Energie Atomique (CEA) represent medium energy thermo-nuclear charge, first to be developed in France without recourse to separate nuclear tests, using intensive computer calculations and simulations that proved their effective operation. However necessary physical data was generated to validate the concept during the last nuclear testing campaign.

Contrary to popular assumption, the negotiations of Indian government with missile manufacturers MBDA remain a closely guarded secret, especially regarding the types of missiles ordered and their numbers. Therefore whether MBDA ASMP-A will be inducted to IAF inventory remain open to speculation.

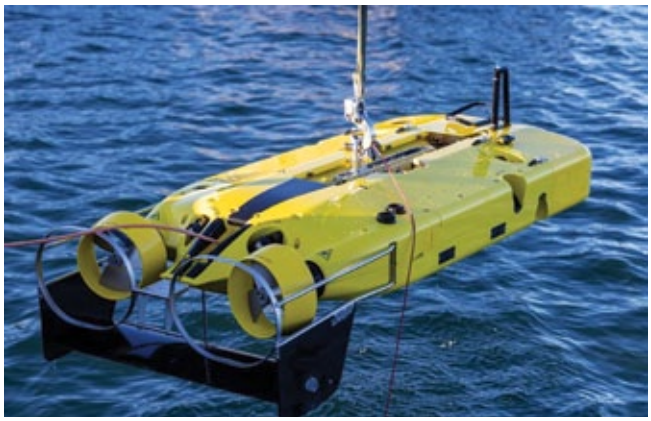
Sayan Majumdar

Saab news

New lightweight torpedo for Sweden

Saab has made the first deliveries of the new lightweight torpedo (Saab Lightweight Torpedo) to Sweden's defence procurement agency FMV. Saab Lightweight Torpedo, named Torped 47 by the Swedish Armed Forces, is Sweden's new lightweight torpedo system for defence against foreign submarines. The torpedo is intended primarily for Swedish submarines and Visby corvettes, but it is also prepared for integration on helicopters. FMV is now undertaking final verification of the torpedo system to ensure it meets their requirements, before commissioning with the Royal Swedish Navy.

Order for Double Eagle SAROV from Poland



Saab has received an order for deliveries of additional underwater vehicles called Double Eagle SAROV (Semi-Autonomous Remotely Operated Vehicle); these are to be used for safe disposing of sea mines. Deliveries of the Double Eagle systems are scheduled with those of new vessels to the Polish Navy during 2026-2027. The Double Eagle SAROV systems are to be carried on the Polish Navy's three new minehunter vessels known as the Kormoran II- class, who will deploy and operate them.

Saab 340B(F) cargo aircraft for IBC Airways

The aircraft, serial numbers 340B-224 and 340B-274, are the first of an ongoing multi-aircraft commitment between Jetstream and IBC, which will result in IBC eventually retiring its fleet of Saab

340A freighters in favor of the more advanced 340B. The aircraft will operate within the airline's scheduled cargo network within the Caribbean.

Two SIGINT ships for Poland

Saab has signed a contract with the Polish State Treasury Armament Agency for design, production and support of two ships for Signal Intelligence (SIGINT) for Poland. The total order value corresponds to approximately EUR 620 million with deliveries planned during 2027. The order is expected to be booked by Saab before year end.

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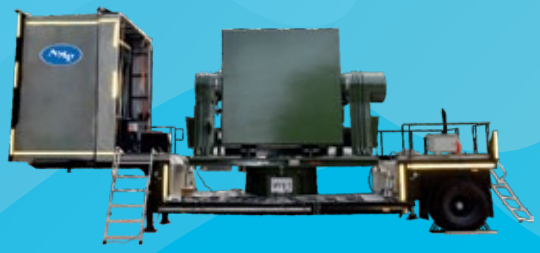

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Gripen E in operation with Brazilian AF

The Brazilian Air Force (FAB) held a ceremony on 19 December 2022 at the Anápolis Air Base (BAAN) marking the beginning of operational activities of the Gripen E fighters (referred to as Gripen F-39 in Brazil) by the First Air Defence Group (1st GDA). This important customer milestone follows the flight test phase in Brazil that started in September 2020 with the arrival of the test aircraft in the country, and which were conducted at the Gripen Flight Test Centre (GFTC) located at the Embraer plant in Gavião Peixoto.

In November, Saab achieved the certification necessary for the military use of Gripen E, which attests that the aircraft has met certain airworthiness and flight safety requirements which was an important step prior to operational activities with the FAB. This was granted by both the Swedish and Brazilian military authorities, represented by the Swedish Military Aviation Safety Inspectorate (FLYGI) and the Industrial Fostering and Coordination Institute (IFI) in Brazil. The joint certification reflects the synergy obtained through the technical cooperation between the two authorities in each country.

Order for upgrade of Gripen C/D

Saab and the Swedish Defence Materiel Administration (FMV) have signed a contract and Saab has received an order to ensure the continued operability of and provide capability enhancements to the fighter aircraft JAS 39 Gripen C/D. The order value is approximately SEK 3.5 billion and the contract period is 2023-2029. The contract also includes options that enable FMV to place additional orders for capability enhancements during 2023.

The enhancements will provide Sweden with a more effective and powerful fighter capability. The aircraft will be equipped with a new version of the engine, which will enhance flight performance. A more effective electronic warfare system will also be introduced and the upgrade will create conditions for increased attack capability with a new payload.

NLAW's for the UK

Saab has reached an agreement with and received an order from the United Kingdom Ministry of Defence for the Next Generation Light Anti-Tank Weapon system (NLAW). The order value is approximately SEK 2.9 billion and deliveries will take place 2023-2026. NLAW is a shoulder-launched, anti-tank guided missile system that attacks the tank from above. NLAW combines the simplicity of light anti-armour weapons with the advantages of heavy, crew-operated guided missile systems. With NLAW, a single soldier can take out a heavily-protected modern main battle tank at ranges between 20 and 800 metres.

NLAW's for Sweden

Saab has received an order for NLAW (Next Generation Light Anti-Tank Weapon) from the Swedish Defence Materiel Administration (FMV). The order value is approximately SEK 900 million with product deliveries scheduled 2024-2026. The order is placed within a framework agreement between FMV and Saab.

Short-range air defence systems for Latvia

Saab has received orders for the RBS 70 NG ground-based air defence system and the Giraffe 1X radar from the Latvian Ministry of Defence. Deliveries will begin in 2022. The Giraffe 1X radar, combined with the RBS 70 NG, will further strengthen Latvia's air defence capabilities by enabling improved performance. RBS 70 NG is used by a number of nations across the world, including Sweden, the Czech Republic and Brazil. The latest version offers an automatic target tracker and a built-in night sight. Giraffe 1X is on contract for a range of customers and is a compact, lightweight high-performing 3D radar.

Finland for RBS 70 missiles

Saab has received an order from Finland regarding missiles for the RBS 70 ground-based air defence system. The order value is approximately SEK 800 million and deliveries will take place 2023-2026. The order includes Saab's latest version of the RBS 70 missile, Bolide, which enables engagement with airborne armored targets and drones. The missile will be used with Finland's current RBS 70 systems, which have been in use in the country for more than 15 years.

VAYU Interview with Mr. Guru Biswal, CEO, Aerospace business division, Bharat Forge Ltd.

VAYU: What is Kalyani Group's vision for the aerospace business?

The Group's vision in Aerospace is to be the preferred partner for manufacturing critical parts, sub-systems, and products for OEMs and end users. We wish to add value to the entire chain of activities starting from aero grade raw material to the MRO. Our goal is to add value to the customer in the life cycle management of their assets.

VAYU: What are the latest updates on the operations of the aerospace vertical of the Kalyani Group?

We have a state-of-art manufacturing facility for critical engine and structural parts along with the assembly and testing facility of Jet Engines. The operational team is supported by a strong team of designers, both in process engineering and CAD/CAE, for the design of turbomachinery products, including micro turbines, along with product testing. This combination of component manufacturing, product design, and validation augmented with core design expertise has made us a very strong team to cater to the market requirements. The entire chain of activities is in a single Digital Thread, thereby giving a strong focus on "Product Integrity", "Traceability" and "Zero Defect" as required in the business.

VAYU: What are the opportunities arising in the sector and how is the group planning to tap the same?

The opportunities arising from the sector are both global and local. We have been seen as a reliant partner by global OEMs for taking up products as alternate sources considering faster new product developments by us. This is not only in parts or products but also in the development of aerospace-grade raw materials for the global supply chain. We have been already approved by a few OEMs and we are in the process with a few others.

The domestic market is largely for product spares and technical support to meet the fleet running needs and also for indigenisation and localisation efforts as part of the Make-in-India.

The Group is well prepared and acquiring capabilities to meet this demand scenario. We have seen a very positive response to our offers from both global and local customers.

VAYU: Has Kalyani Group received any proposal to manufacture items for the IAF?

Yes, we have been actively pursuing several proposals on parts, systems and sub-systems from the IAF, both for manufacturing and MRO.

News from Boeing

Boeing-built X-37B completes 6th mission

The Boeing built X-37B Orbital Test Vehicle (OTV) set a new endurance record after spending 908 days on orbit before landing at NASA's Kennedy Space Center in Florida at 5:22 a.m. ET, 12 November 2022. This surpasses its previous record of 780 days on-orbit. With the successful completion of its sixth mission the reusable spaceplane has now flown over 1.3 billion miles and spent a total of 3,774 days in space where it conducts experiments for government and industry partners with the ability to return them to Earth for evaluation.

For the first time, the vehicle carried a service module to augment the number of payloads it can haul. The module separated from the OTV prior to de-orbiting ensuring a safe and successful landing.

The sixth mission was launched atop a United Launch Alliance Atlas V rocket from Cape Canaveral Space Force Station in May 2020. Hosted experiments included a solar energy experiment designed by the Naval Research Lab, as well as a satellite designed and built by cadets at the US Air Force Academy in partnership with the Air Force Research Laboratory. The satellite, dubbed FalconSat-8, was successfully deployed in October 2021 and remains on orbit today.

This mission also hosted multiple NASA experiments including the Materials Exposure and Technology Innovation in Space (METIS-2), which evaluated the effects of space exposure on various materials to validate and improve the precision of space environment models. This was the second flight for this type of experiment. Mission 6 also hosted a NASA experiment to evaluate the effects of long-duration space exposure on seeds. This experiment informs research aimed at future interplanetary missions and the establishment of permanent bases in space.

The X-37B programme is a partnership between the US Department of the Air Force Rapid Capabilities Office and the US Space Force. Boeing designed and manufactured the spaceplane and continues to provide programme management, engineering, test and mission support from sites in Southern California, Florida and Virginia.

US Navy declares IOC for Boeing's HAAWC

Boeing's High Altitude Anti-Submarine Warfare Weapon Capability, or HAAWC, has satisfied all requirements for initial operational capability status from the US Navy. The all-weather

HAAWC enables the Boeing P-8A Poseidon to deploy MK 54 torpedoes from near or below its cruising altitude. The milestone follows the award of a full-rate production contract for the system to Boeing in August 2022, squadron training, and the receipt of low-rate initial production units.

HAAWC consists of a modular Air Launch Accessory, or ALA, kit that attaches to a MK 54 torpedo, transforming it into a precision-guided glide weapon. Additional fielding of HAAWC units are scheduled through 2024, with the potential for production to continue into 2030 under the current contract.

The long-range anti-submarine warfare, anti-surface warfare, intelligence, surveillance and reconnaissance P-8A aircraft has amassed more than 450,000 mishap-free flight-hours to date in support of broad-area, maritime and littoral operations, and performs humanitarian and search and rescue missions around the globe.

Boeing delivers 20th CH-47F Chinook to RNLAF

Boeing has delivered the 20th CH-47F Chinook to the Royal Netherlands Air Force (RNLAF), concluding the country's latest fleet update. The Netherlands is one of eight NATO countries to operate the Chinook and has fielded the aircraft continuously since receiving its first CH-47D models in 1995. In 2016, the RNLAF purchased14 new CH-47F Chinooks through the US Department of Defence's Foreign Military Sales programme. In 2017, the RNLAF signed an agreement to upgrade their remaining six D-model Chinook helicopters to the latest F-model configuration, ensuring commonality of systems for their entire 20-aircraft fleet.

Japan orders 2 more Boeing KC-46A Tankers

Boeing has been awarded a contract to deliver two additional KC-46A Pegasus tankers to the Japan Air Self-Defence Force (JASDF), bringing the total on contract for Japan to six. Boeing delivered the first KC-46A tanker to Japan in October 2021 and a second in February 2022.

Designed to refuel all allied and coalition military aircraft compatible with international aerial refueling procedures, the Pegasus has flown more than 10,000 sorties and is delivering millions of pounds of fuel every month to allied forces around the globe. In addition to refueling, the KC-46A delivers multi-mission capabilities necessary for the 21st century fleet, including data connectivity and personnel, cargo and aeromedical transportation.

Final Boeing 747 airplane leaves Everett Factory

The last Boeing 747 left the company's widebody factory on 6 December 2022 in advance of its delivery to Atlas Air in early 2023. Production of the 747, the world's first twin-aisle airplane, began in 1967 and spanned 54 years, during which a total of 1,574 airplanes were built. At 250 ft 2 in (76.2 m), the 747-8 is the longest commercial aircraft in service.

Aircraft spotting and building excitement for Aero India!

Photos by Samarth Mahajan (Instagram @indian.spotter05)


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MBDA updates

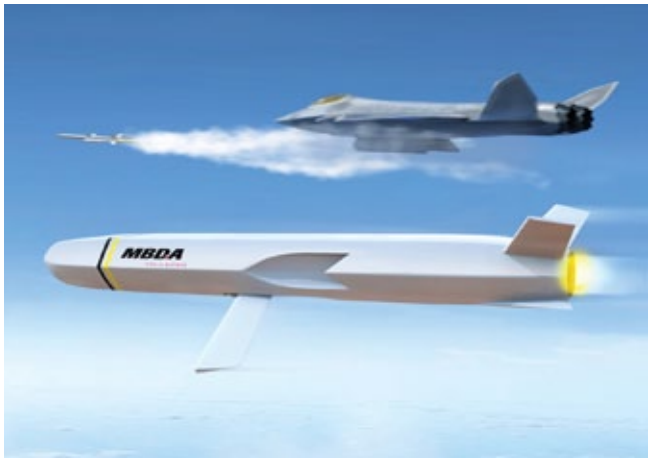
MBDA response to the industrial agreement for the FACS

MBDA welcomes the industrial agreement recently finalised to prepare the Future Air Combat System. Following the first phases of FACS/SCAF work, the signing of this agreement is a change in scale for this programme and lays the foundations for a large-scale European industrial partnership.

Phase 1B is primarily a phase of technological maturation. In co-operation with its partners, Airbus Defense and Space GmbH and the Spanish consortium SATNUS, MBDA will design 'Remote Carrier' demonstrators and conduct experiments in connected collaborative combat, both simulated and in-flight. In particular, MBDA will be responsible for the demonstrator of Remote Carriers that can be fired from combat aircraft.

The Future Air Combat System air combat system of the future is much more than an aircraft: it is a system of systems capable of the collaborative air combat. FCAS and its associated technological innovations will bring a revolution in concepts of operations.

As the leader in effects management, MBDA will principally develop new effectors, the Remote Carriers. They are multipliers of the tactical options available to our armed forces. Remote Carriers



will force adversaries to reveal themselves, will disrupt them, confuse them and/or saturate them to finally neutralise the threats they pose, which continue to become ever more effective. Capable of operating in packs or individually, the Remote Carriers will cover all areas of combat, from air combat, to maritime operations, and ground strikes.

Exocet continues to break records

One of MBDA's longest standing international partners, the Peruvian Navy, set two new range records with two firings of Exocet missiles, carried out during a major joint naval exercise.

Of all the actions organised during this large-scale exercise, the most emblematic and complex was to conduct the Missile Launch Exercise (Missilex), carried out at sea, 90 nautical miles from the coast. However, this was an opportunity to put MBDA's Exocet AM-39 and MM-40 Block 3 (B3) to the test. The first, the AM-39 from a Sea King SH-3D helicopter to a surface target, and the second, the MM-40 B3 from a Lupo-class frigate to the same target.

The two firings broke two range records. With a target hit at a range of 19 nautical miles, the Exocet AM-39 set a new national range record, breaking the previous record of 17 nautical miles set by the Navy in August 2021. The Exocet MM-40 B3 then made headlines again, hitting the target at 92 nautical miles, 11 more than a firing of MBDA's Otomat by Peruvian armed forces in 2008. In this firing, it is not only a national record, but also a world record, a new proof of the excellence of the Peruvian Navy and its complete mastery of MBDA products.

Exocet MM40 B3 had seen the missile its range increased up to 200km, thanks to the addition of a turbojet, while being able to acquire coastal targets using GPS.

The latest generation Block 3C is equipped with a radio frequency seeker developed by Thales. It is also equipped with Coherent Radar Processing (CRP), from which the "C" of "Block 3C" is derived, enabling the missile to detect small speed deltas. It is also capable of recognising surface ships, enabling it to identify a target ship in the middle of a fleet and is more robust against jamming systems.

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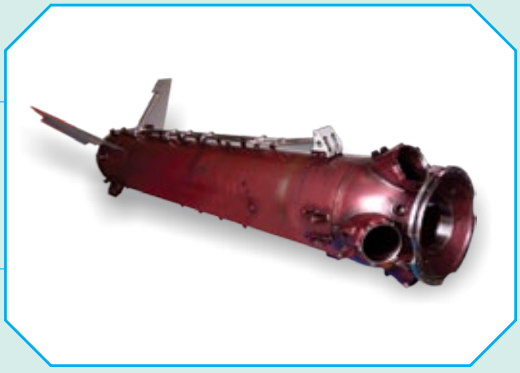

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AMPL marching ahead proudly!

History

Astra Microwave was started by three Microwave Engineers in the year 1991. The founders had taken voluntary retirement from their illustrious careers in DRDO labs and started this organisation with an objective of making critical RF and Microwave components and sub-systems indigenously. Back then all critical components had to be imported and as these are the important building blocks of military systems, they were being imported by the country at exorbitant costs. The journey was not easy. Having started this organisation with their retirement savings, the company had to work on RF/Microwave products for use in fast growing telecom base stations in the country in order to generate cash for building the high end design, assembly, test and qualification facilities in house.

Apart from this, we had to work closely with our customers in various DRDO labs to help them develop the critical components indigenously. We participated at each step in building the specifications of the products required, designed them using our carefully chosen R&D team and then worked with system engineers at DRDO labs to help them integrate our products into their systems. In this process, we overcame several different challenges as the electronics industry was growing at a rapid pace and newer technologies were emerging continuously even as we achieved stringent specifications originally set out for us.

Perhaps the biggest challenge came when the West imposed sanctions on India for the high frequency semiconductor ICs that are again the important building blocks in sub-systems. Overnight it meant that several of the sub-systems we had designed and proven for the DRDO had to be worked on again building new indigenous components to replace the components that were under sanction. Working closely with DRDO and overcoming several such challenges, Astra Microwave today is one of the only companies in India that works in all critical domains of the defense RF and Microwave industry.

We supply critical RF and Microwave Products that are used in Military Radars – Ground, Naval and Airborne, Electronic Warfare systems for Army, Navy and Airforce, Strategic Missile programmes and for Telemetry applications. In parallel we also work with Indian Space Research Organisation for space qualified RF and Microwave sub-systems for major Communication, Geo-synchronous and remote sensing satellites.

Apart from this, we work with Defense Public Sector units for production of the sub-systems we had originally supported DRDO during design stage and we work with Indian Meteorological department for their requirements in Weather products.

In our journey from a startup to a 600 crore company we have overcome several high technology challenges and today we are amongst the very few Indian private sector companies whose core strength is technology in major areas of the defence and space market in India. This journey has seen us being rewarded by the Indian Government's Scientific department for indigenous R&D, by Electronics Industry Associations and Independent Media agencies for Business Excellence, R&D and Quality. Today we are well poised to realise any high end product in India using indigenous technology and are working our way up to the systems domain

Our journey

Our journey in defence products started in the year 1997 when we first supplied the prototypes of a critical sub-system for Surface to Air Missile programs of the DRDO. It was just the first proof of concept and gave DRDO the confidence

that very high technology products can be built indigenously and meeting stringent requirements. From there we worked alongside DRDO over several steps to continuously improve the sub-system until the trials of the Akash Missiles were successfully carried out. For the last 5 years, we have been supplying 2 most important RF sub-systems on board the missile.

Over the course of 30 years, we have contributed to indigenously developing Transmit Receive Modules for Phased array radars in all major frequency bands – V/UHF, S, L, C, X and Ku bands. We have qualified our products for ground, naval and airborne requirements and have been certified by quality agencies like CEMILAC, RNQA, DGAQA etc. One of the most important strategic areas for any country is Electronic Warfare. Simply put, in todays digital era, the edge for countries is clearly using the electronic intelligence of the enemy systems that helps device our strategies to counter them effectively and to gain a significant battlefield advantage. We are *among* the only few companies in India who have worked on Ultra Wide band products for COMINT and SIGINT requirements. The challenge of working in wide band RF systems is quite high and requires a very good understanding of all the RF and Microwave challenges. We have successfully delivered several products for India's naval and airborne EW needs, the latest being the very important system that will be used in the EW POD that will go on the LCA Tejas. In parallel, we have delivered several space qualified products to ISRO for their ground and satellite needs. In fact we are proud to have been associated with every major Satellite Program of ISRO on many occassions – sometimes to screen components to space grade for Chandrayan mission to building about 80% of all electronics on board the Synthetic Aperture Radar Payload for the RISAT programme.

We are also now working to scale up vertically and have already delivered Weather Radars to IMD requirements. Looking back, I am very happy to say that we have achieved what we set out to do – develop several critical RF and Microwave products for the Indian Defence and Space domain indigenously. It is very heartening to see that today our customers call us to ask how we can innovate more and our discussions with DRDO today center around where we should leapfrog to, in terms of technology. It shows we have come a long way in trying to replace foreign components to making our own next gen products.

Our differentiators

The products developed by Astra Microwave have found application in several key military and space projects in India. Major contributions have been made to the Airborne Early Warning and Control Aircraft for all major sub-systems of the primary radar, for the Uttam AESA radar where we have built the Active Antenna Array and all its electronic backbone, major contribution to the EW PODS on the LCA, major contributions to the Naval EW programmes like Samyuktha, Himshakthi, Nayan etc. Apart from this, we have been one of the important suppliers for all ground and naval radars built by LRDE and then productionised by BEL. We have been part of major missile programs like Akash, Astra, Brahmos, AGNI, Nag etc. We have also contributed to several telemetry and weather based products for DRDO and IMD.

Taking advantage of the offset requirements of the Indian Government, we have also supplied several critical modules for export customers in Israel, France, USA etc. for important systems that ultimately come back to India like MPR, MFCR and P8I.

Coming this far has taken a lot of dedicated efforts on the part of our R&D team and also the fact that we have continuously invested in improving our skillsets, assembly and testing infrastructure. The fact that we are the only private industry in India that has the kind of infrastructure that compares to the public sector industry highlights the importance we have associated in building top class products. It is the dedicated effort of our HR and our high end facilities that have ensured we have been able to meet critical product deliveries.

The hard work and the expertise we have gained on RF and Microwave technology is not easy to replicate, and for sure it is not possible to create an equivalent in a short span of time. This we believe is the most important strength for Astra Microwave and we look forward to serving the Indian defence and space programmes in the future.

Courtesy: AMPL

BEML at Aero India 2023

Showcasing its capabilities in Defence and Aerospace Sectors

BEML is showcasing some of its prime products during Aero India 2023, the biennial mega Aero exhibition, being held at Yellahanka Airbase, Bangalore. With the theme of 'Atmanirbharata'; BEML is displaying its niche products such as Variants of Unmanned aerial vehicles (UAV) and structure of space vehicle along with critical components in the aero-space sector and Miniature Models of its defence equipment.

BEML's focus at the Show is to showcase its capability, promote Aerospace and Defence products and to interact with potential customers and also to explore collaborations. BEML would be signing MoUs, to enter into collaborations with major players in the Defence and Aerospace Business. BEML would also be using the opportunity to network with MSMEs and Start-ups to maximise its efforts of localisation/indigenisation.

BEML is also displaying the 25 kg class Tactical UAV being developed indigenously in collaboration with Indian Institute of Technology, Kanpur. The UAV is intended to carry versatile payloads of 3.0 kg, such as day and night cameras. It can take off and land in short runways, fly continuously for 8 hours and has 50 kms radio range.

BEML Limited, the leading multi-technology, multi-product company, is engaged in the design, development and manufacturing of a wide range of products for core sectors of economy such as Defence, Mining, Power, Infrastructure and Urban Transportation. Presently over 87% of total business is won against tough competition mainly from MNCs, while above 68% of the business comes from in-house R&D developed products. BEML Limited has exported its products to over 68 countries.

Some displays of BEML from Aero India 2021

Milrem Robotics to deliver 14 THeMIS UGVs

European robotics and autonomous systems developer, Milrem Robotics, and the German defence company Krauss-Maffei Wegmann (KMW) have signed a contract to deliver 14 THeMIS unmanned ground vehicles (UGV) to Ukraine.

Patria's XA-180 armoured vehicles MLU

Patria has completed the XA-180 armoured personnel vehicle Mid-Life-Upgrade project as the last vehicles have now been delivered to the Finnish Army. The agreement of Mid-Life-Upgrade (MLU) of XA-180 armoured personnel carriers was signed by Patria and the Finnish Defence Forces in 2013.

Centauro II for Brazilian Army

The Brazilian Army, through the Comando Logistico (COLOG)/Diretoria de Material (DMat), has chosen the Centauro II 120 mm system made by Società Consortile Iveco–Oto Melara (CIO) as top of the list within the procurement process named Viatura Blindada de Cavalaria Média Sobre Rodas (VBC Cav - MSR 8x8).

Croatia Airlines for six A220s

Croatia Airlines, Croatia's national flag carrier based in Zagreb, has signed a firm order for six A220-300 aircraft. Croatia Airlines plans to lease an additional nine A220s, taking its total commitment for the type to 15.

Rolls-Royce and easyJet in H2 tests

Rolls-Royce and easyJet confirmed they have set a new aviation milestone with the world's first run of a modern aero engine on hydrogen. The ground test was conducted on an early concept demonstrator using green hydrogen created by wind and tidal power. It marks a major step towards proving that hydrogen could be a zero carbon aviation fuel of the future and is a key proof point in the decarbonisation strategies of both Rolls-Royce and easyJet.

Finland for AIM 9X and JSOWs

Finland has requested to buy forty AIM 9X Block II tactical missiles; four AIM 9X Block II tactical guidance units; and forty-eight AGM-154 Joint Stand Off Weapons (JSOW). Also

included are Dummy Air Training Missiles (DATM); Captive Air Training Missile etc. The total estimated cost is $323.3 million.

Rega orders 12 H145s

The Swiss Air-Rescue Service Rega has ordered a second batch of 12 five-bladed H145 helicopters to be operated from its mountain bases. They will replace the current fleet of AW109SP helicopters. This new order follows an initial contract for nine H145s, announced in March 2022. By 2026, Rega will operate an all-Airbus fleet consisting of 21 five-bladed H145s.

Bell V-280 Valor is new US Army FLRAA

Textron announced that Bell Textron Inc has been awarded the development contract for the US Army's Future Long-Range Assault Aircraft (FLRAA) programme. The award is based on Bell's V-280 Valor tiltrotor that was developed and tested as part of the Joint Multi-Role Technology Demonstrator (JMR TD) programme

that began in 2013. The V-280 progressed through design, manufacturing, and more than three years of rigorous flight testing that provided extensive data validating the technical and operational advantages of the aircraft for the long-range assault mission.

Poland for M1A1 Abrams MBTs

Poland has requested to buy 116 M1A1 Abrams Main Battle Tanks; twelve M88A2 HERCULES Combat Recovery Vehicles; eight M1110 Joint Assault Bridges; six M577A3 Command Vehicles; twenty-six M1152A1 High Mobility Multi-purpose Wheeled Vehicles (HMMWV); twenty-six M1279A1 Joint Light Tactical Vehicles (JLTV); one hundred sixteen M2 .50 caliber machine guns; two hundred thirty-two M240 7.62mm machine guns, etc.

ZeroAvia in hydrogen-electric test flights

The UK's Civil Aviation Authority (CAA) has granted a permit to fly for ZeroAvia's Dornier 228 aircraft, which has been retrofitted with its prototype hydrogen-electric powertrain. ZeroAvia secured the permit to fly following an extensive ground testing campaign and a rigorous review of the full development programme.

It means that ZeroAvia can now begin the first test flights of its 600kW hydrogen-electric powertrain. The 19-seat twin-engine aircraft has been retrofitted in an engineering testbed configuration to incorporate ZeroAvia's hydrogen-electric engine powering the propellor on its left wing, operating alongside a single Honeywell TPE-331 stock engine on the right for appropriate redundancy to allow the safe testing of the novel propulsion technology.

IAI unveils Point Blank

IAI has unveiled its Point Blank electro-optically guided missile that can be carried in a soldier's backpack. The system answers the battlefield requirement to provide tactical units ranging in size from small tactical teams to battalion level, with an independent and organic capability to increase their lethality. Point Blank allows these units to attack a variety of targets in real time with great precision and high lethality, without the need for support. The missile is hand-launched, operated by a single soldier, and can take off from and land vertically back to, the soldier's hand.

Sikorsky delivers 5000th Hawk

Sikorsky has delivered its 5000th "Hawk" variant helicopter, a US Army UH-60M Black Hawk. The iconic aircraft will continue to support medium-lift requirements for the US military and international operators for decades into the future.

Hensoldt SIGINT pod for Eurodrone

Hensoldt is developing sensor equipment that can be integrated into a pod to give the recently commissioned Eurodrone a signals intelligence (SIGINT) capability. The sensor technology for reconnaissance of radio and radar signals is based on a combination of the latest technologies in digitisation, electronic beam steering

and metallic 3D printing, some of which Hensoldt has already developed in its Kalaetron product family.

LM in laser lab demonstration

Lockheed Martin achieved first light from the Directed Energy Interceptor for Maneuver Short-Range Air Defence System (DEIMOS) system, which verifies that the laser's optical performance parameters align with the system design parameters. Lockheed Martin's 50 kW-class DEIMOS system is a ruggedised, tactical laser weapon system that can be integrated into the Stryker combat vehicle to deliver robust directed energy capability to the US Army's challenging maneuver-short range air defence (M-SHORAD) mission.

Elbit's doors for Boeing 777 Freighter

Elbit Systems announced that its wholly-owned subsidiary Elbit Systems-Cyclone Ltd was awarded a contract for the supply of aero-structure assemblies to Boeing. The contract includes production and supply of the largest Main Deck Cargo Door (MDCD) for the Boeing 777 Freighter and 777-8 Freighter.

Resumption of Rafale deliveries to France

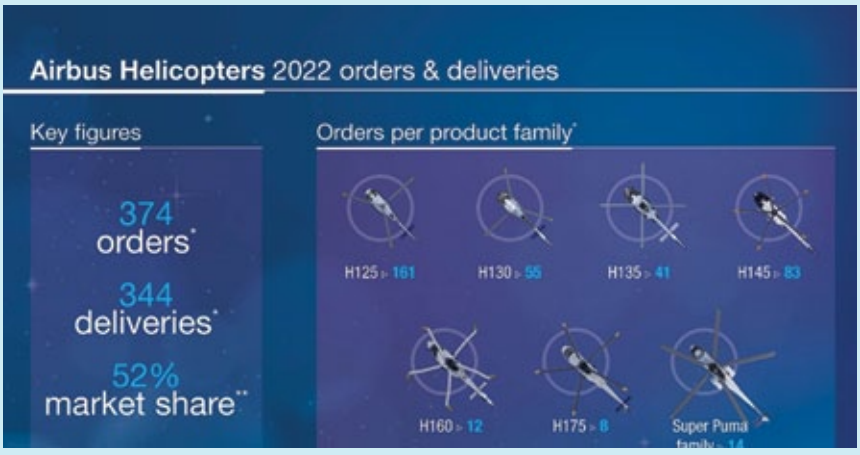
On 29 December 2022, Dassault Aviation's Mérignac plant delivered Rafale B359 (F3R standard) to the Direction Générale de l'Armement (French defence procurement agency).

This event marked resumption of Rafale deliveries to France after an interruption of four years. The Rafale B359 is for the French Air and Space Force. It is part of the "tranche 4" order for 60 aircraft awarded in 2009. In accordance with the various Military Programming Acts, deliveries to France were interrupted for budgetary reasons and the Rafale production line was then dedicated to export orders.

A further 27 Rafale are still to be delivered for tranche 4, plus 12 Rafale ordered by France in 2021 to make up for the 12 aircraft sold to Greece. Tranche 5 should be awarded in 2023. "In the current strategic context, the Dassault Aviation group is particularly proud to be a partner in equipping and supporting the French air force, as it has done for more than a century".

Airbus Helicopters performed steadily in 2022

In 2022, Airbus Helicopters logged 374 gross orders (net: 362), highlighting the ongoing market recovery with 216 light single engine helicopters sold. Deliveries increased from 338 in 2021 to 344 in 2022, contributing to Airbus Helicopters' preliminary 52% share of the civil and parapublic market. Significant support and services contracts were signed for both the civil and military range. Highlights include an NHIndustries contract with NAHEMA for the French and German NH90s, a follow-on contract with the US Army for more than 480 UH-72A and UH-72B Lakota helicopters.



Breaking Storm!

Richard Gardner reports from London

The news that negotiations between the European 6th Generation Tempest fighter team and Japan were at an advanced stage emerged during the 2022 Farnborough International air show in July but subsequently these talks have now moved on significantly and on 9 December the governments of UK, Japan and Italy issued a joint statement announcing the Global Combat Air Programme (GCAP). This elevates the trilateral partnership through what is described as "an ambitious endeavour to develop a next generation fighter aircraft by 2035". Perhaps the most important new aspect emerging from the formalisation of the joint agreement is the confirmation that Japan's next-generation F-X programme is to be merged into the UK-led Tempest initiative, which has already co-opted Italy, both nations looking towards an eventual replacement for their fleets of Typhoon combat aircraft. All three are also F-35 customers, and the GCAP is seen as a future complement to it in the late 2030s, but opening up longer-term opportunities to develop new technologies and safeguard sovereign defence capabilities - and eventually seek to exploit new export potential. This is first and foremost an exercise in defence resilience. All concerned wish to continue to work closely with the USA across the broad spectrum of shared defence interests, but at the same time have recognised that becoming too reliant on adopting US equipment severely restricts their freedom of action when it comes to developing and integrating future weapons and other advanced systems.

British Prime Minister Rishi Sunak expressed his enthusiasm for the agreement saying, "We need to stay at the cutting edge of advancements in defence technology, outpacing and out-manoeuvring those who seek to do us harm. The international partnership we have announced today with Italy and Japan aims to do just that, underlining that the security of the Euro-Atlantic and Indo-Pacific regions are indivisible." He was visiting RAF Coningsby, a major Typhoon base, when he made his announcement adding, "The next-generation of combat aircraft we design will protect us and our allies around the world by harnessing the strength of our world-beating defence industry, creating jobs while saving lives."

While the US government and its aerospace sector have enjoyed a continuous close partnership with Japan in the procurement of fighter programmes over the years, involving manufacturing and assembling US designs, there are signs that there is a new understanding emerging in Washington that recognises that in countering Chinese expansionism in the Pacific it is necessary to embrace and support a wider global response. That involves looking beyond potentially threatened regional governments only looking at the supply of US aircraft and weapons. Meeting Japanese expectations for greater involvement in developing new advanced air systems is one such example. Japan wants a bigger role in the future composition of its air defence assets. On news of the new GCAP agreement there was a joint statement issued by the US Department of Defence and the Japanese Ministry of Defence which declared, "The United States supports Japan's security and defence cooperation with likeminded allies and partners, including with the UK and Italy, two close partners of both of our countries, on the development of its next fighter aircraft." It continued, "The US and Japan are bolstering our defence cooperation in a number of promising areas, particularly in advancing opportunities for joint research, development, testing and evaluation. Together we have begun important collaboration through a series of discussions on autonomous systems capabilities, which could complement Japan's next fighter programme among other platforms. In this context both sides have concurred to start concrete cooperation within the next year. Such efforts between the United States and Japan greatly strengthen the US-Japan Alliance and build on our cooperation with likeminded partners, further enabling joint responses to future threats in the Indo-Pacific region and beyond."

There can be little doubt that the GCAP programme will be well-placed to capture an emerging market in the 2040s for the post Typhoon/Rafale era alongside the F-35. However the story of the F-35 has been rather mixed. Apart from a huge price tag per copy, support for and integration of new weapons and upgraded systems has been distracted by strict US controls, adding to delays and rising costs. The stealthy nature of the F-35 has also added new maintenance issues for customers. Over-complexity and high costs associated with the F-35 have helped those in Europe, and now Japan, pushing for a follow on combat air programme that allows more freedom in development and operation, as well as in-service support and an ability to adapt easily to allow new modes of operation. This will be expected to include hypersonic attack weapons, mixed combat alongside unmanned aircraft, and a high degree of autonomous operation. Completely unmanned operation might be a later development as an option. Adopting radically new approaches to rapid prototyping and fast-tracking development to achieve an entry into service in 2035, together with largely automated assembly procedures using the latest manufacturing technologies, with model-based systems engineering and open architectures, will be at the core of the GCAP initiative.

Getting all this ambitious package together at an affordable shared cost that will deliver an outstanding end product will be a big challenge. At present the only potential Western rival project is the Dassault-led FCAS, and that is now lagging behind the Tempest, though both aim to get a development demonstrator into the air by the middle of this decade. The US is well into developing its Next Generation Air Dominance (NGAD) fighter to replace the F-22 Raptor, but this is already sky-rocketing in cost and, just as with the F-22, is likely to be unaffordable, or undeliverable, for most otherwise potential export customers. Perhaps it should be remembered that even the "Most Favoured" US allies were not permitted to buy F-22s, so if GCAP can attract a sufficiently large launch commitment (and that might already be for at least 300 aircraft for the three current partners), then it could hit the next gen fighter sweet spot.

Alex Zino, Exec Vice President, Business Development and Future Programmes, at Rolls-Royce, stated, "We welcome the announcement and positive momentum we are building with our partners in Japan and Italy towards developing power and propulsion technology for the next generation fighter aircraft. In December 2021 we announced a target to jointly design, build and test an engine demonstrator. This work is progressing well and on track to deliver. This new announcement reinforces the strong and longstanding relationships we value with both Italy and Japan, and I look forward to us deepening that collaboration through this programme."

Mark Hamilton, MD Electronics UK, at Leonardo, stated, "The emergence of a single international programme, backed by three governments, represents a major point of maturity for our shared combat air vision and a strong vote of confidence in the readiness of industry to deliver the programme. At Leonardo we are privileged to be a core part of this endeavour. The future aircraft's integrated sensing, non-kinetic effects and integrated communications (ISANKE 7 ICS) will be at the heart of the system's capability, ensuring that our Armed Forces can effectively respond to the threats of the future and we look forward to working with our international colleagues to deliver this critical capability."

Chris Allam of MBDA UK added, "We will work with multi-national industrial partners to enable seamless integration, rapid evolution and effector networking to make any platform, any sensor, or effector, a reality."

Charles Woodburn, Chief Executive at BAE Systems stated, "The agreement with Japan and Italy is fundamental to meeting the goals set out in the UK Combat Air Strategy and is set to create and sustain thousands of high value jobs and benefit hundreds of companies across the UK, contributing to long-term economic prosperity and safeguarding sovereign combat air capability for generations to come."

Going beyond routine

This new, formal, multi-national agreement goes well beyond a routine project launch announcement as it signals the start of the potentially biggest all-new advanced Western fighter programme since the launch of the F-35 over 20 years ago. It would appear to have sufficient initial tri-service backing to enable the already ground-breaking progress to increase in momentum over this decade so the target ISD of 2035 is realistic and doable. All the key launch partner companies are at the top of their class in terms of experience and capability to deliver and with appropriate political support at the highest levels it should go a long way to providing much-needed additional global competition in the high-end military air sector – and the West's leading adversaries should now be taking note of what will be facing them in the Asia-Pacific as well as in Europe. China's desire for Air Dominance is not going to be challenged by the USA alone.

Europe's Future Combat Air System FCAS

On behalf of the governments of France, Germany and Spain, the French General Directorate for Armament (DGA) has awarded to Dassault Aviation, Airbus, Indra, EUMET and their industrial partners the contract for the Demonstrator Phase 1B of the Future Combat Air System (FCAS). This landmark contract, amounting to € 3.2 billion, will cover work on the FCAS demonstrator and its components for about three and a half years.

Dassault Aviation, Airbus, Indra and EUMET welcome this major step forward that reflects the determination of France, Germany and Spain to develop a powerful, innovative and fully European weapon system to meet the operational needs of the countries' armed forces.

This contract notification comes on the heels of the signature of the industrial agreements supporting the demonstrator Phase 1B by Airbus, Dassault Aviation Indra and EUMET as prime contractors of the programme and by their industrial partners from the three nations. Discussions held over the last months have enabled the creation of a solid basis for cooperation between industry and the three governments. This continues the successful Phase 1A demonstrators' related R&T work and development activities, which enabled the identification of key technologies and the launch of the demonstrators' developments. Paving the way for the development phase of the programme, this demonstration phase 1B will allow continuation of flying demonstrators and required cutting-edge technologies development and maturation as well as project architectures consolidation, with in-flight demonstrations targeted in the next phases by 2028-2029.

The programme is made up of a set of systems: New Generation Fighters teaming with Remote Carriers and connected through a Combat Cloud. In order to meet the ambitions and challenges of such a programme, an adapted and efficient industrial organisation has been set-up and built around technological pillars. Each pillar is under the leadership of an industrial champion acting as prime, working in close cooperation with its main partners and leveraging each nation's aeronautical industrial ecosystems.

In addition to their prime role per pillar, Airbus, Dassault Aviation and Indra act as national coordinators to ensure the overall coherence of the demonstrators and the overall programme's steering and work consolidation.

The industrial governance of the Phase 1B is organised per domain as follows:

- NGWS Consistency, Demonstrations and Consolidation with Airbus, Dassault Aviation and Indra Sistemas as co-contracting partners.
- New Generation Fighter (NGF), with Dassault Aviation for France as prime contractor, and Airbus as main partner for Germany and Spain.
- New Generation Fighter Engine with the 50/50 Joint-Venture EUMET - between Safran Aircraft Engines for France and MTU Aero Engines for Germany - as prime contractor and ITP for Spain as main partner.
- Unmanned systems, Remote Carrier (RC) with Airbus for Germany as prime contractor, MBDA for France and Satnus for Spain as main partners.
- Combat Cloud (CC) with Airbus for Germany as prime contractor, Thales for France and Indra Sistemas for Spain as main partners.
- Simulation with Airbus, Dassault Aviation and Indra Sistemas as co-contracting partners.
- Sensors with Indra Sistemas as prime for Spain, and Thales for France and FCMS for Germany as main partners.
- Enhanced Low Observability (stealth) with Airbus as prime contractor for Spain, Dassault Aviation for France and Airbus for Germany as main partners.
- Common Working Environment with Airbus, Dassault Aviation, Indra Sistemas and EUMET as co-contracting partners.

The industrial partners thank the three nations for their confidence and reiterate their firm commitment and total mobilisation to make this programme the armed wing of Europe's strategic autonomy thanks to the reinforcement of the operational, technological and industrial sovereignty of its defence.

Courtesy: Dassault and Airbus

Northrop Grumman and USAF unveil the B-21 Raider

On 2 December 2022, Northrop Grumman Corporation and the US Air Force unveiled the B-21 Raider to the world. The B-21 joins the nuclear triad as a visible and flexible deterrent designed for the US Air Force to meet its most complex missions.

"The Northrop Grumman team develops and delivers technology that advances science, looks into the future and brings it to the here and now," stated Kathy Warden, chair, chief executive officer and president, Northrop Grumman. "The B-21 Raider defines a new era in technology and strengthens America's role of delivering peace through deterrence."

The B-21 Raider forms the backbone of the future for US air power, leading a powerful family of systems that deliver a new era of capability and flexibility through advanced integration of data, sensors and weapons. Its sixth-generation capabilities include stealth, information advantage and open architecture.

"The B-21 Raider is a testament to America's enduring advantages in ingenuity and innovation. And it's proof of the Department's long-term commitment to building advanced capabilities that will fortify America's ability to deter aggression, today and into the future. Now, strengthening and sustaining US deterrence is at the heart of our National Defence Strategy," stated Secretary of Defence Lloyd

J. Austin III. "This bomber was built on a foundation of strong, bipartisan support in Congress. And because of that support, we will soon fly this aircraft, test it and then move into production."

The B-21 is capable of networking across the battlespace to multiple systems, and into all domains. Supported by a digital ecosystem throughout its lifecycle, the B-21 can quickly evolve through rapid technology upgrades that provide new capabilities to outpace future threats.

"With the B-21, the US Air Force will be able to deter or defeat threats anywhere in the world," stated Tom Jones, corporate vice president and president, Northrop Grumman Aeronautics Systems. "The B-21 exemplifies how Northrop Grumman is leading the industry in digital transformation and digital engineering, ultimately delivering more value to our customers."

The B-21 Raider is named in honour of the Doolittle Raids of World War II when 80 men, led by Lt. Col. James "Jimmy" Doolittle, and 16 B-25 Mitchell medium bombers set off on a mission that changed the course of World War II. The designation B-21 recognises the Raider as the first bomber of the 21st century.

The specific B-21 unveiled is one of six under production. Each is considered a test aircraft, but each is being built on the same production line, using the same tools, processes and technicians who will build production aircraft. This approach has enabled production engineers and technicians to capture lessons learned and apply them directly to follow-on aircraft, driving home a focus on repeatability, producibility and quality. The timing for first flight will be data and event, not date driven.

For comparison: The B-2 (top) and B-21 (bottom)

While the precise date when the B-21 will enter service is unknown, basing decisions have been made. Ellsworth AFB, South Dakota will become the first Main Operating Base and formal training unit for the B-21. Whiteman AFB, Missouri, and Dyess AFB, Texas, are the preferred locations for the remaining home bases. Each will receive aircraft as they become available.

Text and images: NGC/USAF

Mi-35 during a live exercise (photo via Cyprus Air Force)

Cyprus Air Force – one main mission, plus more

The Cyprus Air Force operate no less than 11 of the mighty Mi-35 Hind helicopters plus four SA.342 Gazelles. To understand why 75% of the complete fleet of this relatively small air arm consists of dedicated anti-tank gunships, we need to take a quick look at the recent history of the island.

Without taking sides, one can say Cyprus has known a turbulent history. Before and after the country gained independence from the British Empire in 1960 there were multiple periods of violence. In 1974 a coup by Greek colonels lead to another period of violence, with the Turkish armed forces invading and occupying the Northern part of the island. Since then the island has been divided in two parts, with a UN Buffer Zone in between. Turkish military presence in the Northern part is still very heavy today, including allegedly over 300 heavy battle tanks (M48 Pattons and recently also the more modern Leopard). Therefore it is no wonder the Cypriote armed forces invest heavily in anti-tank assets, including Mi-35s and SA.342s.

The current organisation dates back to 1995 when the Cyprus Air Force Command was formed from the National Guard. The 55 Sminarchia Machis or Combat Group report directly to the Air Force Command and is responsible for all flying assets. There are three squadrons with helicopters and UAVs, plus an air defence and a support squadron. Nowadays all are based at Andreas Papandreou airbase, which is the Northern part of the international airport of Paphos.

SA.342 Gazelle doing a high speed pass

SA.342 Gazelle front view

449 squadron were added to the unit when their base Lakatamia closed.

The P in Mi-35P stands for 'Pushka', meaning cannon. This 30 mm fixed GSh-30K cannon is one of the main features of the Hind helicopter, which can also be armed with 9M120 Ataka V guided anti-tank missiles, unguided S-8 and S-24 rockets and 23 mm cannons in any combination under the stubwings. The landing gear of the Cypriote version is fixed, unlike most others, and therefor lighter. For self-defence the helicopters have a radar warning receiver, chaff, flares, an IR-jammer and of course armour. The other helicopter type in the squadron is the French built SA.342L1 Gazelle, which can be armed with 4 HOT-3 anti-tank rockets. This helicopter has armoured plates in the bottom and also around the engine.

450 ME/P (Mira (Antiarmatikon) Elikopteron or Attack Helicopter Squadron)

This is the oldest of the three current flying squadrons. It was founded in 2001 when 12 Mil Mi-35P helicopters were delivered by Russia (one has since crashed in 2006). The squadron number refers to the year 450 BC when a Greek general sailed to Cyprus to expel the Persians. After founding 450 ME/P also got the 2 PC-9s and single BN-2 that were in service at the time. In 2010 these moved to the newly founded 460 squadron and instead the SA.342 Gazelles of

Venerable B.206

B.206 helicopters starting up

Where the SA.342 is solely used for anti-tank warfare, the Mi-35 is used as multi-purpose helicopter. The squadron also provides combat support to ground forces, flies JTAC-missions and is used for Medical Evacuation (Medevac). Both types almost always operate together in pairs or groups of three or four. As Gazelle pilot Flt.Lt. Giorgos explains: "the Gazelle is small and therefor low observable. We are in the same squadron, so there is optimal knowledge and cooperation, we really operate as a team!" Despite the different roles the squadron has, training is mostly aimed at missions against a possible invasion from Turkey. As Giorgos says: "The UN are independent and only watch and report, if necessary we have to do the fighting".

Aerostar UAV in front of its shelter

The Mi-35s are nearing the end of their service with the Cyprus Air Force, the search for a replacement is currently ongoing. Amongst others the SA.342M and EC.665 Tigre have been rumoured to be candidates. However, as base commander Lt Col Michalis Michael, himself an active Mi-35 pilot, explains: "this is a political decision. The air force gives input regarding the required standards, and a competition follows." One of the desired capabilities is "to fly and fight during day and night". The Hinds have already been sold to Serbia, but at the moment they are still fulfilling their duty. This summer an order for 6 Airbus H.145M helicopters has been placed, including an option for another 6. Whether these will be the replacement helicopters for the Mi-24s is currently not known yet.

460 MED (Mira Erevnas Diasosis or Search and Rescue Squadron)

This squadron was established in 2010, when the Cypriot government took the exclusive responsibility for search and rescue in its region. First next to the two remaining Bell B.206 also the two PC-9 and single BN-2 aircraft were used, but these were quickly replaced by three Agusta-Westland AW.139 helicopters. Obviously search and rescue (SAR) is the main task of the squadron. Within the unit they say 'life takes you to unexpected places, but 460 brings you home'. Other tasks are transport, parachute dropping and aerial photography and since 2014 also firefighting. For this last task, added because of the long fire season in Cyprus (May-November), a special training was followed with the Cyprus Police Aviation Unit who also operate the AW.139 amongst others.

AW.139 taxiing out

The AW.139 is mostly tasked with the operational tasks while the B.206 is used for all others. The work load on the B.206 is kept as low as possible though, because of their age and the fact no replacement is planned yet. Despite their age, they are very reliable and easy to maintain. Both the AW.139 of the Cyprus Police Aviation Unit and the AW.139 of 460 squadron alternate a 24/7 readiness state, which is coordinated by the Joint Rescue Coordination Center (JRCC) in Larnaca. For this the AW.139 amongst others has a double hoist, a strong search light and is NVG-capable. It has no self-defence systems, and because of the weight armour is only carried when deemed necessary.

470 MMEA (Moíra Mi Epaldroménon Aeroskafón or Unmanned Aircraft Squadron)

The newest squadron is 470 MMEA, which operates the Israeli built Aerostar UAV since 2019. Four of these unmanned aircraft have been delivered and the operators are all former helicopter pilots. Different types of cameras are used, and information is available in real time if needed for both helicopters and ground stations.

Operational tasks are intelligence, surveillance, reconnaissance (ISR) and tactical air support. Next to these missions the unit carries out social missions including fire surveillance and search and rescue. For this the Aerostar can fly to up to 250 km from the ground station and stay in the air for over 12 hours.

Training and maintenance

All pilot training is done in Greece, where cadets learn to fly on the Tecnam P-2000 followed by the T-6 Texan II and then the T-2 Buckeye. After some two years they get their wings and return to Cyprus where based on the operational needs they go to either 450 or 460 squadron for their first helicopter flying. For some 6 months they fly either the SA.342 or the B.206 after which they are combat ready. Again depending on the needs they keep flying these helicopters or transfer to respectively the Mi-35 or the AW.139. Currently the Cyprus Air Force has some 85 pilots. When 460 squadron was formed, specific SAR training was done by FB Heliservices, with a lot of emphasis on night operations. Nowadays this training is done inhouse.

Currently all maintenance is being done in Cyprus. In the past the AW.139s went to the Agusta facility in Belgium for 4 years and 1200 hrs maintenance, and a new contract for this is expected to be signed soon with Agusta or another party. There is also support from Russia and France when needed. Most helicopters are in a very effective three tone desert camouflage, only the AW.139s are currently receiving a dedicated SAR c/s.

Exercises

All three squadrons participate in national and international exercises, notably Inichios in Greece and Scorpion in Israel. Furthermore every year some four live-gunnery exercises are held in which the Mi-35 and SA.342 participate. And every time when other countries deploy in the area, the opportunity is seized to train together. Earlier this year the French aircraft carrier Charles De Gaulle visited Cyprus, during a deployment to the eastern Mediterranean, and multiple missions were flown together.

All in all it is clear the Cyprus Air Force are ready to play a vital role in the event of any potential war or military invasion from neighbouring Turkey. However one can only hope training for this is all that's ever needed, while in the meantime they can serve the people from Cyprus with all their secondary tasks.

Text and photos: Patrick Dirksen & Frank Mink of Tristar Aviation

Mi-24 baking in the sun

Dutch Dauphins and Do's to disappear
Coast Guard in transition

After years of preparation The Netherlands aerial Coast Guard services is currently replacing its fixed wing aircraft as well as its rotary assets, coincidentally come together late 2022. The Dornier-228 patrol aircraft is being replaced by Dash-8 aircraft and Leonardo AW-189 helicopters have taken over the SAR duties from the AS-365 Dauphin. We take a look at the operations of the Dutch Coast Guard over the past years, towards the introduction of the new aircraft and helicopters.

Do-228

The Coast Guard started using the Do-228-112 in 1992, when a single specie was operated to monitor the Dutch territorial waters of The North Sea. The aircraft, with its preferred top mounted wings, provided the onboard observers an unobstructed view at the sea ways during their patrol missions. It was no surprise that this ideal-for-its-purpose aircraft was replaced in 2007 by the same type of aircraft.

Some years earlier, the Coast Guard unit noticed an increased demand for patrol flights, as the Dutch defence had decided to terminate their navy sea patrol operations after the "cold-war" period and the P-3C Orions were sold. As an unforeseen consequence a capacity gap in coastal monitor patrol flights became clear, resulting in the replacement of the first and single CG operated Dornier by two other Do-228-112 aircraft. These two aircraft remained in service until late 2022. The Coast Guard main tasks include tracing and identifying origin of sea pollution, observing ships' sailing behaviour, law enforcement, monitoring and filing sea traffic and supporting Search and Rescue (SAR) operations. The Dorniers were based at Schiphol-East, part of Schiphol-Amsterdam International Airport and, although civil registered, managed by Dutch Defence. The maintenance for both Do's was carried out by Jet Support, a local civil company. The aircraft crew was composed out of pilots from the air force and the other cabin based functions were executed by military or governmental specialists, like the Dutch Koninklijke Marachaussee (Royal Military Police) and customs. The Do-228's were equipped with navigation, communication and marine tracking and tracing devices and included furthermore photo and video means. Next to the North Sea oriented tasks of the Dutch Dorniers, the aircraft occasionally participated in international missions. Lt Mike Hofman, Staff officer of the Royal Military Police, mentioned their participation in periodical deployments on behalf of European Union (EU) FRONTEX missions over the past years. A sample for such a mission was operation Sophia out of Sicily, Italy, where several EU members contributed to maritime patrol missions over the central south region of The Mediterranean.

While the Dorniers approached the age of 30 and getting closer to their economical

end of life, a project group was installed under the supervision of the Defence Material Organisation (DMO), responsible for Dutch military acquisitions, to prepare the replacement of the patrol aircraft. The gathering of all needed requirements, specifications and preferred operational organisation for the new aerial patrol platform, resulted in a tender with a main focus for an outsourced activity. Late 2020 the outcome of the tenders revealed the awarding of a contract to the ISR Support Europe BV consortium, a partnership between Jet Support (same as for current Do-228 maintenance) and PAL Aerospace from Canada. PAL Aerospace already executed other similar maritime surveillance operations for clients In Canada, The Dutch Caribbean and the United Arab Emirates. The new contract for The Netherlands included modification and delivery of two fully missionised Bombardier Dash 8 aircraft, to provide cockpit crew and taking care of crew training on all systems and support the operation of the leased aircraft for an initial ten year period with an option to extend for two additional one year terms. Like before, the cabin crew with its observers and system operators, remained a composition out of Dutch military and other governmental services. Although no detailed specifications of the equipment has been released, the switch to Dash 8 operations saw several benefits against the older patrol platform. Certainly the up to 6 hour flight time of the Dash 8 provided more flexibility to the Coast Guard operations and the inclusion of a surface radar improved the sea traffic data availability significantly. More modern equipment onboard furthermore improves the detection of drowned persons and sea pollution.

For that reason Aerospatiale Dauphine helicopters were on permanent alert at 2 locations to react on emergency situations at sea and conduct Search and Rescue (SAR) tasks. Operated by "Noordzee Helikopters Nederland" (NHN), subsidiary of the Belgian "NHV" group, these helicopters executed their tasks under the responsibility of the Dutch Coast Guard.

In August 2021 the Coast Guard announced that the Dutch helicopter SAR operations would be transferred to Bristow Helicopters Ltd per November 2022, as an outcome of a public tender. The contract with NHN, which ran the operations since 2015, expired by term and therefore be closed. During their SAR operational days, the bright yellow NHN AS-365N Dauphines were a common sight in the

For the pilot training, which started already late 2021, a smart plan was needed as the regular patrol operations had to continue as normal. A smaller, more theoretical, training of the system operators had to await completion of the full course, until the aircraft were delivered. With a slight delay, the first modified Dash-8 arrived at Schiphol airport last year September and the second a month later. The aircraft will change their current registration from Canadian to Dutch, once training is completed and the aircraft are contractually accepted.

Dauphin

The Dutch Coast Guard contracts also a Search and Rescue (SAR) service for its national waters, as well as for the international seaways over the North Sea.

coastal areas. Primary SAR station was Naval Air Station De Kooij, located in the North of the Netherlands and also home base of the Dutch naval 860 squadron with their NH-90 helicopters in support of nearby navy port Den Helder. From this station NHN operated also a small fleet of helicopters including AW-139 for ferry flights of oil industry employees to and from oil platforms at the North Sea.

The second base of NHN was located at Pistoolhaven, part of main port Rotterdam. Next to the SAR tasks, the NHV also conducted commercial flights from here to bring pilots to merchant vessels needed for assistance when the ships enter the harbour.

Both stations had each 2 AS-365N helicopters on base, of which one was continuously on a 24/7 alert. The Dutch Coast Guard requires SAR helicopters to be airborne within 20 minutes after an emergency call. A second helicopter on both stations was a security back-up and intended for use in cases of larger incidents. The majority of Dutch SAR helicopter missions are in support of ship and for search and rescue of persons. SAR mission figures over 2019, representing also more recent years, show 108 cases of SAR support and 40 medical evacuations from various types of vessels. Former NHV base manager and pilot Remco Siemerink of SAR station Den Helder explained that the normal SAR helicopter crew consisted out of 4; a pilot, a co-pilot, a rescue swimmer and a hoist operator. He further mentioned the lead role of his station, "at Den Helder we had an additional flight nurse who joined the crew for medical related emergencies. The flight nurse determined the need for a medical evacuation when early medical treatment in a hospital was required."

Contract and future

Last November the SAR helicopter service transferred to Bristow for a term of 10 years and the NHN Dauphins consequently terminated their tasks for the Dutch Coast Guard. The transfer finally closed a turbulent period in which the Coast Guard prepared for the new contracting term. Since 2015, the years of NHN operations, the Dutch Coast Guard and its responsible minister experienced public allegations that the Dauphins were thought to be inadequate towards the SAR demands. Nevertheless it was proven that the contract with NHN was fulfilling the tender demands. In 2021 the contracting process suffered again from some unforeseen developments. Due to the fact that some tender awarding elements were disputed by NHN, a court decision was requested to re-view the correctness of the process, the interpretation of described specifications and the awarding criteria. Early August 2021, with a delay of approximately 4 months, a judge could confirm that the tender awarding was made correct and therefore could be granted to Bristow. The court decision also revealed that NHN had done a total bid of about € 169 million, while Bristow could make a bid of about € 158 million and obtained position number one. Two other tender participants were not disclosed.

The offer of Bristow included the use of 2 operational Leonardo AW-189 helicopters and 1 for back-up duties and became operational last November. In general the AW-189 can be seen as a proven Coast Guard/SAR helicopter concept and fulfilling the Dutch tender rescue capacity demand specification of 16 persons. The standard AW-189 SAR crew will have 2 pilots, a rescue swimmer, a hoist operator and can be added with a flight nurse when the emergency dispatch is medical related. Next to the SAR operations the helicopter can also transfer a mobile firemen team from the "Maritime Incident Response Group" (MIRG) in case of a fire incident on board of a vessel at The North Sea. The primary station for Bristow remains NAS Den Helder and their secondary base is located at Airport Midden Zeeland (ICAO EHMZ).

Photos and text: Peter ten Berg

Defending the Eastern Flank

Photo: NATO Air Command

With the return of seven CF-18 Hornets of the Royal Canadian Air Force (RCAF) to Bagotville, QC early December 2022, Air Task Force-Romania ended after four months securing the Romanian skies and training with other NATO allies.

Enhanced Air Policing

Operation Reassurance is Canada's contribution to NATO assurance and deterrence measures, which demonstrates Canada's ability and willingness to react rapidly to international crises and to work side by side with its NATO Allies to reinforce the alliance's collective security. Air Task Force–Romania (ATF-R) is the name of the Air component of this mission. "After four months here at Mihail Kogalniceanu Air Base we have had the opportunity to work alongside our Romanian colleagues and several Allies conducting interoperability training enhancing NATO's collective assurance and deterrence on the southeastern flank," stated ATF-R detachment commander, Lieutenant Colonel Stephen Latwaitis, a CF-18 pilot with 2400 jet flying hours under this belt. "We were on stand-by to launch quick reaction alert sorties when directed by the Combined Air Operations Centre (CAOC) at Torrejón in Spain, and controlled by the Control and Reporting Centre (CRC) in Bucharest. For this we had liaison officers embedded in the CRC that worked daily with their Romanian counterparts".

Since 2014, the enhanced Air Policing mission has assured Allied populations of NATO's enduring commitment to collective deterrence and defence. It demonstrates the Alliance is capable and willing to sustain a strong and robust posture along the entire Eastern flank of Europe.

SEVEN

Canadian fighter detachments have been a regular sight in the skies above the city of Constanța on the shores of the Black Sea. LCol Latwaitis, "Since 2014 with the beginning of NATO's enhanced Air Policing in Romania, Canada has consistently supported this mission and showcased the strong transatlantic bond within the Alliance and our commitment to collective security." This is the seventh time the Royal Canadian Air Force (RCAF) have deployed an ATF to Romania on Operation Reassurance. The first time was in 2014 at a base in Northwestern Romania but with an absence in 2015 and 2016 the detachment moved to the current Mihail Kogalniceanu Air Base in 2017 and has called 'MK' home ever since with a yearly Task Force. "This is our seventh time in Romania, meaning the bonds between our two forces run deep. While every ATF mission since 2014 has

Photo: Bob Smith

been an enriching experience, this year is understandably different in that the threat is even more palpable. We are proud to work with and stand by our Romanian counterparts who value our contribution to their Air Policing activities at a time of growing tensions over Russia's invasion of Ukraine," stated Major-General Iain Huddleston, Commander 1 Canadian Air Division Joint Force Air Component in a statement.

Preparation

With the invasion of the Russian military into Ukraine last February the preparations and mind set were different than other years. From that 24 February NATO went to a high alert status and although this was a planned deployment for the RCAF the question was now what the footprint would look like for the Canadian detachment. "The lead unit for this ATF was 425 Tactical Fighter Squadron called 'Alouette' (English: Skylark) based out of 3 Wing at Bagotville. The majority of the aircraft and personnel for this mission, which comprised 175 people, were drawn from this unit but all in all people from sixteen different units from nearly every Wing across Canada were represented in this ATF. During our preparations for our deployment earlier this year we looked at the Canadian ATF of 2021 and modelled our Task Force on their best practices. We took their model and came to MK in May to get a lay of the land and see how the mission was doing at that time with the Royal Air Force (RAF) which were the ATF at that point with their Eurofighters. The conclusion was to augment the mission with an extra 20 personnel as we prepared to be on alert longer then we normally would be and it was more of a 'in case we had to', we wanted to be prepared," stated LCol Latwaitis.

Mission and training

The Canadians brought initially eight CF-18s eventually reducing it to seven. Depending on requirements from NATO four to six jets were available for the Air Policing mission leaving the rest of the jets available for training with NATO Allies. LCol Latwaitis elaborates, "Besides the alert mission our Hornets supported numerous operational sorties, training events and exercises. Initially our exercise calendar was relatively blank and we didn't know what to expect with all the focus on the events in Ukraine. But with so many forces deployed to the Eastern flank the question was how are you going to keep everybody (pilots, maintainers etc.) as sharp as they needed to be? So quite a few exercises came up in which we could participate. For example, we worked with the United Stated Navy carrier strike group during Neptune Strike, participated in Olympic Cooperation over Greece and our primary (scheduled) exercise was Thracian Viper over Bulgaria. During this Bulgarian-led exercise we worked with Bulgarian Su-25 and MiG-29 aircraft as


Photo: Stephen Morrison


Photo: Yissachar Ruas

well as SA-6 and SA-8 ground-to-air missile systems next to Greek and Romanian F-16s. It was interesting to work with and in other scenarios against the Bulgarian aircraft types and missile systems."

Rewarding

Because of the location of MK Air Base the Canadian Hornets represented the most forward deployed NATO fighter air detachment in proximity to Ukraine certainly to the Kherson area. "Being so close to why we were here for made us conscious of the importance of our presence. I believe our people performed exceptionally well under that pressure, certainly when we were on alert and when we performed the mission. Our Hornets are 40 years old and our maintainers did a phenomenal job as we have flown about 500 missions (training and alert) representing nearly 900 flying hours. It makes me proud to see what our maintenance has done being 4000 miles away from our support base being able to put up such high serviceability rates. Also the fact that we, next to our core unit of 425 TFS, had a team made up with personnel from sixteen other units from across Canada which all came with their own experiences and inputs but seamlessly integrated so our fighter force was as capable as it could be" stated LCol Latwaitis.

Home

Early December 2022 the Italian Air Force with their Eurofighters took over the role of the Canadians who in turn said good bye to MK Air Base. With a short stopover in Scotland the Hornets and personnel returned home safely. "With the return home after an intense four month period everybody can look back at an interesting time in which we learned a lot again." stated LCol Latwaitis. "Everybody stepped up. With our mission and numerous exercises it took a lot of coordination and consistent effort almost every day to make sure that the missions were flown safely and effectively. I am proud we made that possible together".

At this point Canada is not planning to participate in an Air Policing mission in 2023. It seems that the city of Constanca has do without the Canadians at least for a year but when called upon Canada will be ready!

Article by Remco Stalenhoef and Patrick Smitshoek


Photo: Stephen Morrison

Au revoir Alouette III

French navy helicopter retires after 60 years

Nowadays manufacturers often do their best to promote their hardware in describing its achievements and milestones in order to obtain interest for new potential clients. A sample of an airframe which was accountable to do this almost on its own, can hardly be named better as the Alouette III.

With a first flight in 1959 the French helicopter producer Sud Aviation (later also named Aérospatiale and currently Airbus Industries) introduced the SA-316 "Alouette III", the slightly bigger brother of the Alouette II. The helicopter was powered by a single Turboméca Artouste IIIB Turboshaft engine, which changed around 1969 to the more powerful and fuel efficient Turboméca Astazou XIVB. In parallel with the entry of the new engine, which provided the Alouette III the unique high whistling sound, the helicopter type identification was re-designated into SA-319. Although the number of, certainly military, operators is declining these days, the helicopter can still be seen flying all over the world. By 1979, when the production of the popular helicopter came to an end, almost 1500 Alouette III's had been produced. Additionally another 500 pieces had been built under license by HAL in India, where it received the local name "Chetak" and by IAR in Romania. The success of the helicopter probably had a variety of reasons. Its smaller to medium size frame and an oval all-around glass cockpit, provided the pilot an excellent view for agile manoeuvrability even in narrow areas. The helicopter, with a cockpit crew of 2, could offer up to 5 additional seats in its cabin or quickly be changed into other configurations, like medical evacuation containing several stretchers. With an external positioned engine, the Alouette III was not only efficient in available cabin space, but made the helicopter also easy accessible for maintenance. Of course, the early adaption of the Alouette III into the French military aviation and their activities in international mission, could not be a better platform to demonstrate the reliable performances of the not too expensive helicopter.

France

All branches of the French military aviation have been operating the Alouette III, where it was, after 32 years in 2004, taken out of air force service while the French army retired the helicopter back in 2013. For the French Aéronavale (naval aviation), the end to the SA-319 Alouette III operations came only recently, when a ceremony took place at Base Aéronavale (naval air base) Lanvéoc-Poulmic at the west coast of France on 9 December 2022. Normally the retirement in the French navy would have been years earlier, however earlier delays in the upgrading programme of the NH-90 "Caiman" and the expected entry of the new H-160 Guépard (together becoming the 2 future basic naval helicopters) in 2026, forced the naval command to prolongate the career of the Alouette III. The NH-90 helicopters appeared to be suffering from unexpected corrosion sensitivity after its military introduction, resulting in a poor service availability rate of about 35%. Due to the complexity of the problem likely in combination with the large number of

last 5 SA-319 Alouette III's in French military service. Group 34F "Ecole Spécialisation Hélicoptères Embarqués/ ESHE (Specialisation School Embarked Helicopters), took care of specialised crew training for ship based flight operations, meaning take-offs and landings and furthermore included liaison flights, naval forces support and Search and Rescue (SAR) activities. A former task of the Alouette III's in 34F service, which was already transferred before to other helicopters and units, included Anti-Submarine Warfare (ASW) when armed with 2 Mk-46 torpedos. Next to the operations out of its the French home base, 34F is also responsible for a permanent

stakeholders in this multi-national NH-90 project, a common shared solution approach seemed to take more time, causing delay in favour of extended Alouette III operations.

Aéronavale

The aéronavale Alouette III retirement ceremony at Lanvéoc-Poulmic took place under presence of the commander of the French Naval Staf, Admiral Pierre Vandier, who addressed a speech to the current last operators of the Alouette III, as well as to invited former users of the iconic helicopter during its 60 years of operations in French navy service.

Close to the retirement ceremony in December, the Lanvéoc-Poulmic based unit, Flottille 34 (34F) had the

Badge Flottille 35F

helicopter detachment in French Polynesia. The aéronavale Alouette III's were at both sides of the fuselage applied with dayglow inflatable floats, in case of the event of an emergency landing at sea, giving the navy helicopters a different appearance against the SA-319's that were in service with the army and air force.

Pedro

The operational assignments of 34F were reason that the Alouette III's were often detached to French navy vessels which included frigates and amphibious assault ships or helicopter carriers of the Mistral class. The summer of 2022 saw the last 2 ship based detachments onboard the Frigate "Prairial" (F731) and the Command and Supply ship "Somme" (A631).

Badge Flottille 34F

Another important task for the navy SA-319's was onboard the French aircraft carrier Charles de Gaulle. The flight operations from the nuclear powered aircraft carrier, also registered as R91, were always under surveillance of an airborne Alouette acting in the "Pedro" service. With a crew of 3, a pilot, a hoist operator and a rescue swimmer, the helicopter was flying low level in close proximity of the ship to react immediately to any sudden occurring mishap of an aircraft during catapulted take-offs or arrested landings at the ships flight deck. The French named this rescue service after the first known successful recovery, of an US fighter pilot who crashed during the war in Vietnam, executed by a helicopter flying under callsign Pedro. During the Pedro service of the SA-319 next to the

Charles de Gaulle sailing at sea, the rescue swimmer is already dressed in special protective swim gear and fully equipped to jump immediately into the water when needed. The hoist operator interacts with the rescue swimmer and can deploy additional means out of the helicopter like inflatable rafts, hoisting baskets etc upon demand of the swimmer.

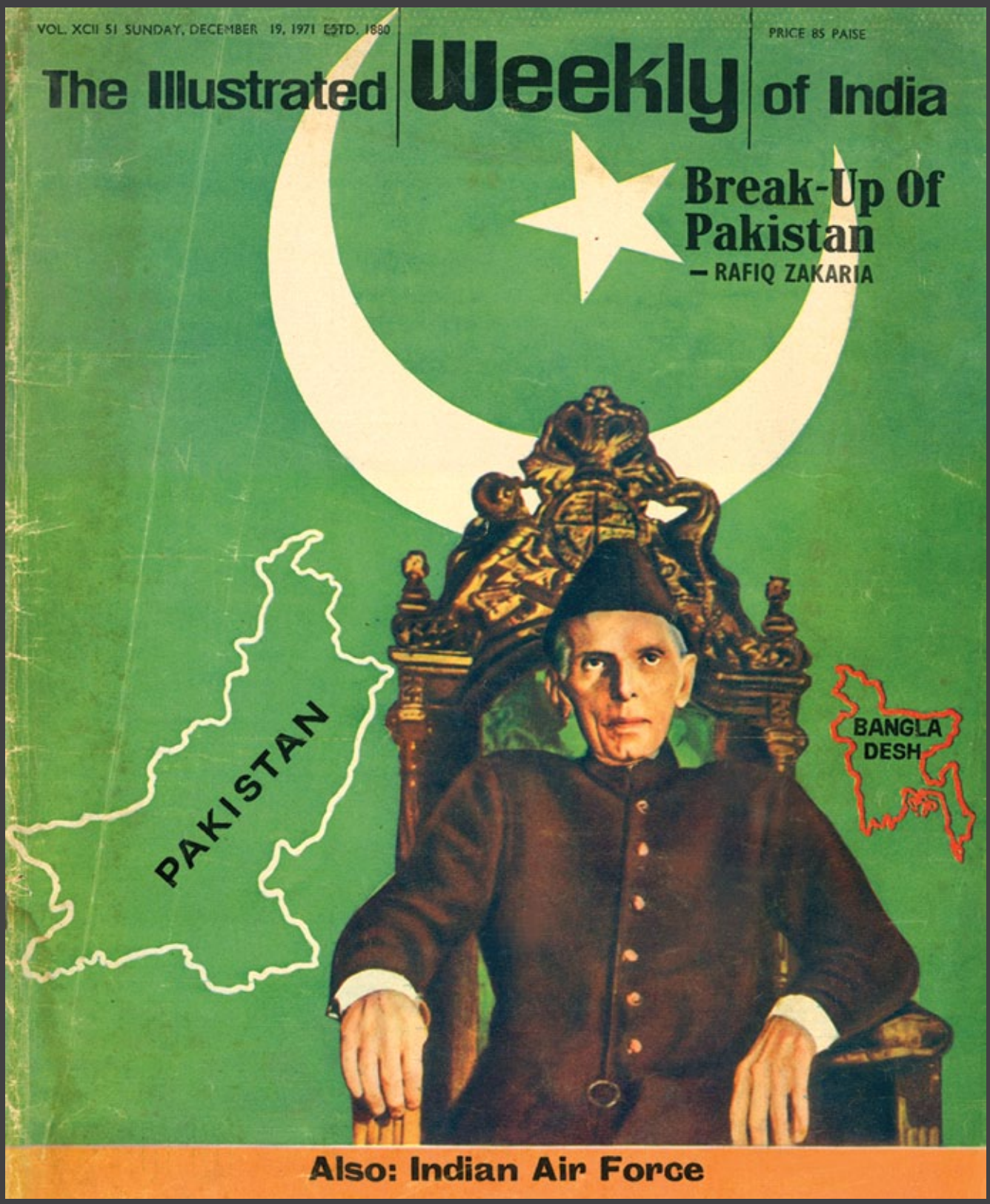
With several flight sequences on a normal day onboard the Charles de Gaulle, the Alouette's had a busy daily schedule together with their liaison flight activities between the ships of the carrier strike group. Other navy units who provided the aircraft carrier Pedro tasks earlier, were Escadrille (squadron) 20S, 22S, 23S and Flottille 35F. Over the last years, the operational number of Alouette III's, of which the French Aéronavale acquired a total of 37, reduced considerably resulting that in July 2022 the last SA-319 to undergo depot level maintenance at the "AIA" facilities at Lanveoc, France, was re-delivered for its final navy service.

As a consequence of the declining operational Alouette III's, the Pedro assignments onboard the Charles de Gaulle, had already been gradually taken over by the AS-365N3 Dauphin operated by Flottille 35F some years earlier. The Dauphins shall continue the onboard Charles de Gaulle SAR activities until the deliveries of its successor, the H-160 Guépard, expected to start in 2026.

Text and photos by Peter ten Berg

From the Vayu Aerospace & Defence Review archives

Scanned pages from The Illustrated Weekly of India, 19 December 1971
(original magazine in full at our office safely saved if anyone is interested in going through it!)



THE MiG-21, a Russian-built single seater, is an all-weather interceptor. It has a maximum speed of 1,320 m.p.h., a tactical radius of 375 miles and an initial climb of 30,000 ft per minute. It is armed with one 30-mm. cannon and two Atoll air-to-air missiles or two pods, each containing nineteen 55-mm. rockets. In late 1967, HAL at Nasik obtained a licence to produce 450 machines. At present India is believed to have 120 MiG-21 planes.

HE HEADS OUR AIR FORCE. Air Chief Marshal P. C. Lal, who took over command on July 15, 1969, is considered to be one of the country's most experienced combat experts.

The Indian Air Force

by Wing Commander MOHAN SINGH (Retd)

In 38 years, the Indian Air Force has developed from a force of 16 to 90,000 men. It has 625 serviceable planes—fighters, bombers, transport and reconnaissance.

THE IAF came into being on April 1, 1933. It had five officers and eleven hawai sepoys. Until the war years, its expansion was not marked. But the high performance of Indian pilots during World War II was acknowledged by the British and they elevated it to the Royal Indian Air Force.

During the war, Indian pilots won 22 DFCs. Wing Commander "Jumbo" Majumdar won a DFC bar. In 1944 the No. 1 Squadron of the RIAF in the Arakan and Imphal campaigns acquitted itself so brilliantly that it got to be known as the "eyes and ears" of the 14th Army.

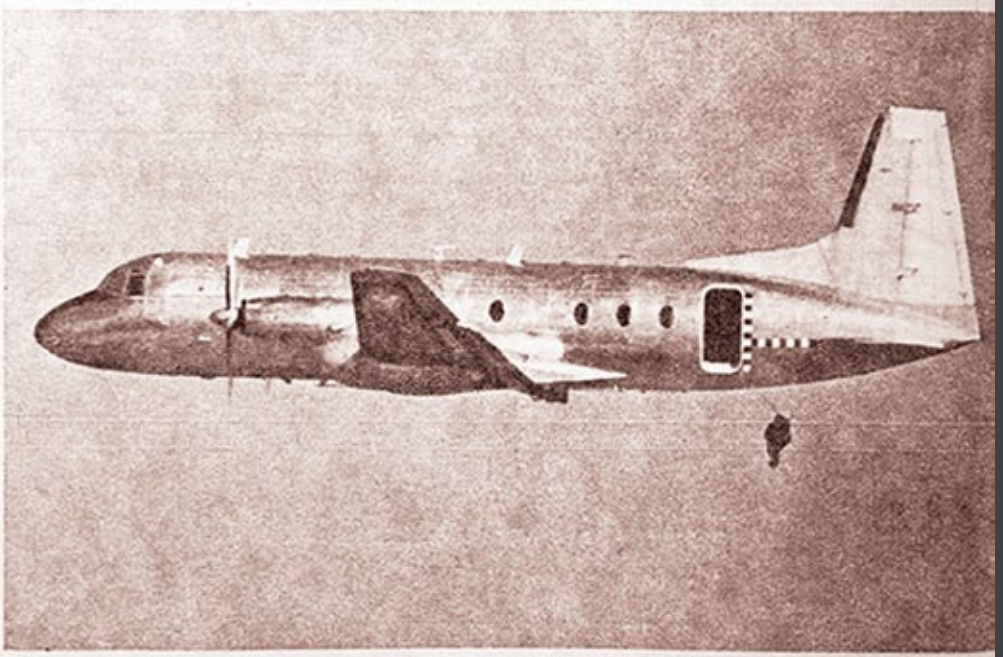
Split Into Two Wings

On August 15, 1947, the RIAF split into two national air wings: India and Pakistan. Two of the nine Squadrons went to Pakistan. In the next six months, both forces were occupied in the evacuation of refugees from West Pakistan to India and *vice versa*.

The dust of Partition had not settled when Pakistan made a bid for Kashmir. It was the alacrity of the RIAF, the Indian Airlines and other private commercial lines —which airlifted Indian troops to Srinagar in time—that enabled the Indian forces to halt the Pak offensive. **On January 26, 1950, the prefix "Royal" was dropped. On April 1, 1954, the first Indian Air Chief, Air Marshal Subroto Mukherjee, took over command from Air Marshal Gibbs.**

In 1948 the IAF armada comprised Liberators (reconditioned at HAL) and Dakotas. Till then it had Harts, Lysanders and Hurricanes. **India was the first Asian nation to go in for jets when she bought the Vampires.**

They were followed by the Toofanis, Mysteres, Canberra bombers, Hunters, Gnats and the Russian-built MiG-21s and Sukhoi-7s.



THE FIRST LIVE PARADROP from an Indian-built HS-748 aircraft, executed by Squadron Leader M. Vania on February 16, 1971. India has two para brigades. Their main task in a conflict is to drop inside enemy territory—so as to carry out subversive exercises. Paratroops can also reinforce battalions isolated in battle by disrupted communications. India's crack fighting team is known as Para-Commandos.

In 1950 HAL, Bangalore, began production of the Gnat under a licence from Britain. It has also begun to manufacture the indigenous HF-24 (Marut) jet and the HJT-16 (Kiran) trainers that have now replaced the wooden Harvard. At Nasik HAL has signed a contract to manufacture an advanced version of the MiG-21. For the transport squadrons, the Dakotas were replaced by C-119 Fairchild Packets, Caribous and AN-12 heavy transport aircraft. HAL once again took a leading role and has undertaken to produce the HS-748 Avros at Kanpur. It is now planning to build a military freighter version of the same plane.

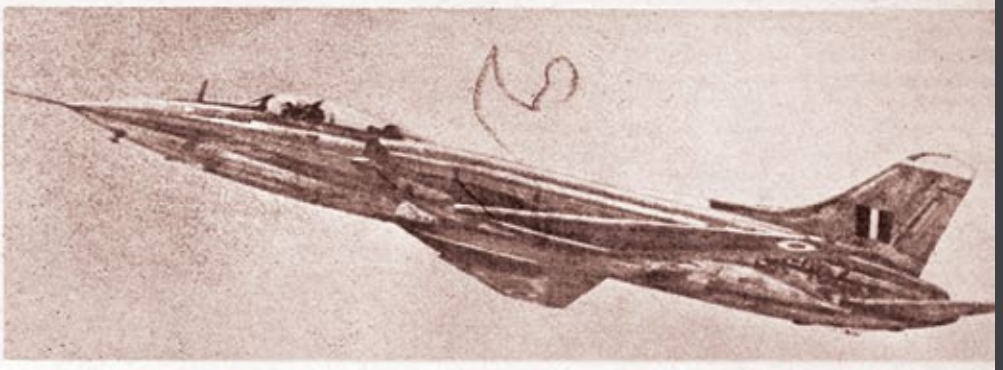
In 1954 the helicopter wing of the Air Force went in for S.55 and S.62 helicopters. They were followed by the Bell models. But all these helicopters did not have a sufficient climbing capacity and, with the tension increasing on the mountain fronts and our consequent military deployments there, the IAF realised the need for machines that could take on the Himalayas. For that Russian-made Mi-4s and French Alouette IIIB helicopters were purchased. They can attain heights of 19,000 ft. The production of another light 'copter, the SA-315, with French collaboration is being planned. The IAF transport planes land at Leh, the highest airfield in the world.

From the slow-moving, almost fossilised Wapiti of 1933 to the Mach-2 speed of the MiG-21 has been pretty good going for 38 years. The IAF has now a strength of 45 squadrons and is believed to possess 870 serviceable combat aircraft.

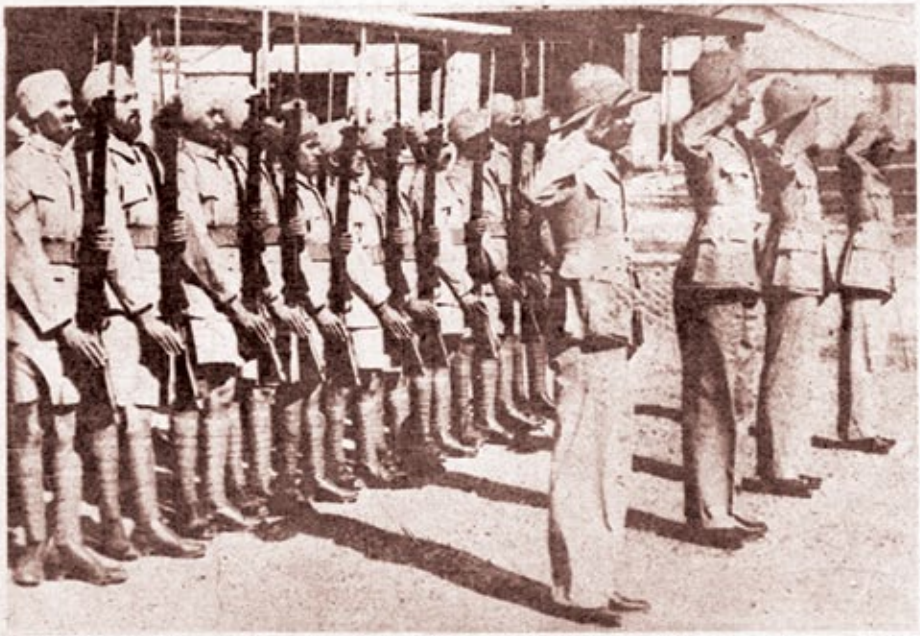
Until 1965, when the IAF had its first real taste of air battle, it was running mercy missions for the Government during floods, draughts and earthquakes.

The IAF has also made its mark in several international crises.

THE WAPITI (BRITISH) BIPLANE. It could reach 90 miles per hour. Today the Russian-made MiG-21s can almost touch Mach-2 speeds (1,500 m.p.h.). India has 120 MiG-21 interceptors, 140 Sukhoi-7 fighter-bombers, 150 Gnat interceptors and 80 Hawker Hunter aircraft.



THE INDIAN-BUILT HF-24 INTERCEPTOR-RECONNAISSANCE PLANE which is designed and manufactured at HAL, Bangalore. India and UAR collaborated to build the HF-24-E-300 (the E-300 turbo jet is made in the UAR) in 1968. The MK-2 version of the HF-24 is coming out now. The plane has a speed of 630 m.p.h., a combat radius of 420 miles and a ceiling of 52,000 ft. It carries four 30-mm. Aden Cannons and an internal missile launcher with four vertical rows of spin-stabilised rockets, plus four air-to-air missiles. It also carries four 1,000-lb. bombs and sixteen 60-lb. high-velocity aircraft rockets. The bomb bay may be supplanted by a second seat.



ON APRIL 1, 1933, was formed the first contingent of the Indian Air Force. It comprised 5 officers and 11 hawai sepoys. They flew Wapiti aeroplanes and other biplanes. Today the IAF commands the services of 90,000 officers and men and 625 combat aircraft—from trainers to bombers, helicopters to supersonic fighters. In comparison Pakistan has 270 combat planes and 15,000 men.

During the 1960 Congo uprising, Fairchild Packet (transport) pilots and crew were sent out to man UN aircraft. A Canberra squadron was despatched to support UN forces against the dissident Katanga Government. In early 1971, planes and pilots were sent to Ceylon to help its Government curb a rebellion.

As the IAF grew, it channelised into different wings—transport, fighter, bomber and helicopter. To cope with the tremendous expansion, the rank of Chief of Air Staff was elevated to Air Chief Marshal in January 1965.

This elevation had been more than earned by the IAF during the 22-day war. On September 1, 1965, the Air Force recorded 28 sorties in 75 minutes. Inside two minutes from "scramble", they were able to have 28 planes in the air from one airstrip.

On September 3, 1965, the IAF got its war colours. Squadron Leader Trevor Keeler in his Gnat downed the highly eulogised American-built Pak F-86 Sabre over the Chhamb sector.

In those days the IAF employed helicopters to strafe and bomb intruding raiders in Kashmir. **At the time of ceasefire, the**

—Continued

IAF had accounted for 73 Pakistan aircraft and 120 tanks. To prove they had not lost their touch, Gnat interceptors caught four trespassing Sabres 30 miles north-east of Calcutta on November 22, 1971, engaged them and downed three without suffering any damage themselves. In the current battle, India (as we go to press) has downed 72 Pak planes, including 5 Mirage IIIs, 5 F-104 Starfighters and over 25 F-86 Sabre jets.

But you don't get that way unless you have been "rogered" good and solid. IAF training never ends. From the moment a cadet passes his Pilot Aptitude (PAPT) Test (he is allowed only one chance), he undergoes 18 months of flying training at the Air Force Flying College in Jodhpur, then

THE RUSSIAN-BUILT FIGHTER-BOMBER SUKHOI-7. It has a speed of 1,056 m.p.h. and an initial climb of 30,000 ft per minute and is specially geared for ground attack. It has two 30-mm. cannon, two 1,000-lb. bombs and two pods with nineteen 55-mm. rockets or 2 air-to-surface missiles.

AIR MARSHAL ELMHIRST, the first of our seven Air Chiefs. The three British Chiefs laid the foundation of IAF. Air Marshal Elmhirst strove to reorganise the post-partition Air Command.

AIR MARSHAL IVELAW CHAPMAN. He was legendary for strapping into any aircraft and taking off for any station without warning—in order to see things for himself.

AIR MARSHAL GIBBS, the last of our British Chiefs. He handed over command to Air Marshal Mukherjee on April 1, 1954. Air Marshal Gibbs was responsible for initiating the helicopter wing.

AIR MARSHAL MUKHERJEE, the first Indian Chief of Air Staff. Strongly against "red tape", he was well known for bypassing irrelevant paperwork. "Subroto" to friends, he was very popular.

GETTING TO THE TOP. The IAF helicopter wing has been doing tremendously good work across the Himalayan range. The French-built Alouette is usually reserved for evacuation of casualties. It can climb to 19,000 ft and has a speed of 100 m.p.h. The IAF also has the smaller Russian Mi-4s and the older S-55 and S-62 helicopters. Our total 'copter strength is about 130. And India holds the world record (22,500 ft)—in an Alouette piloted by K. K. Saini.

AIR MARSHAL "ASPY" ENGINEER, who took over from Air Marshal Mukherjee, has the distinction of being the first man to fly solo between India and England at the age of 17. He won the Aga Khan Prize for the feat.

AIR CHIEF MARSHAL ARJAN SINGH. He was upgraded one rank on January 15, 1965, after the Indo-Pak war. He has flown over 70 different aircraft. He is at present India's Ambassador to Switzerland.

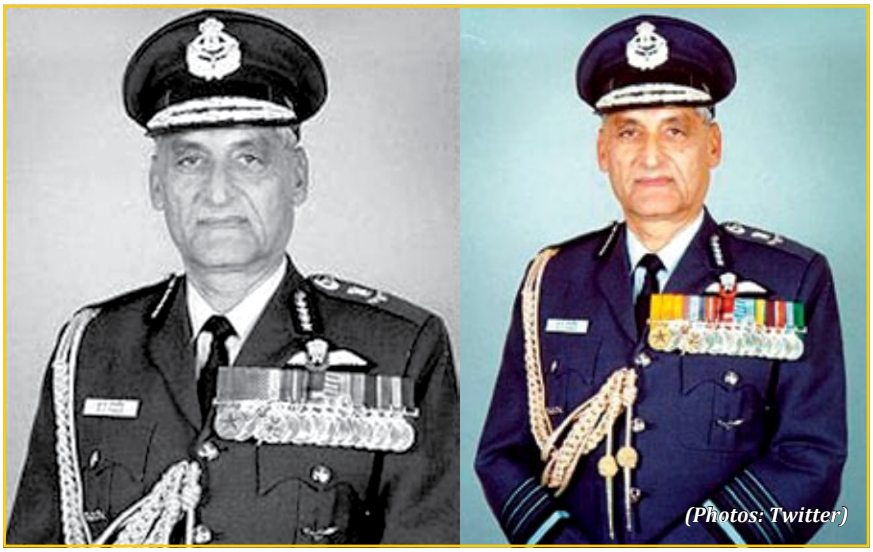
at Bidar (in Mysore), after which the Transport fliers go to Hakimpet and the fighters are coached at Begumpet. Both institutions come under the Hyderabad Command. An Air Force Academy is almost ready on a 5,600-acre plot of land, at Dundigeal, 30 miles from Hyderabad. Being built in stages, it is expected to be completed by 1974. Training to air and ground crew will be imparted here.

With rapid innovations coming in almost every day, a pilot has to be on the ball all the while. To come down to earth for a moment, it won't be fair on the Air Force to forget the important but less glamorous band of non-fliers who maintain, service and look after the planes. Without them no plane would be safe, nor would any pilot be ready to fly.

From the first force of 15, the IAF strength is now 90,000 officers and men. Until there is a military de-escalation on the border, the IAF will have to go on building its strength in men and planes.

Air Marshal (R) Harish Masand says...

I learnt more than flying from them: AY TIPNIS



(Photos: Twitter)

Very late in my service career, after almost 30 years of service, I really met Air Marshal Anil Yashwant Tipnis, better known in the Air Force as "Tippy". At that time, though he was already the Vice Chief, it was not known that he would soon become the Chief since the two year extension of service had not been announced till then. Signifying this delay in our meeting, the first thing Tippy Sir asked me, when he was the Chief and I was in a spot of trouble, was how it was that our paths had never crossed earlier. I had responded with the simple statement that he had been mainly in the Western stream, as the Air Attache in France and as the Commander of the Mirage base at Gwalior while I had mainly been on the Russian stream with Su-7s, MiG-21s and finally the MiG-29 and the Su-30. Moreover, he was significantly senior to me and we had hardly ever met socially. We did briefly cross paths when he was a Wing Commander and JD Air Defence in Air HQ however, and I was on my way to Gorakhpur as a relatively junior Squadron Leader to be Flight Commander of 1 Squadron there after doing Staff Course at Wellington in early January 1983 but I doubt he would remember that brief meeting. We had met purely by chance in the corridors of Air HQ and after wishing him, I had felt compelled to ask how a person like me, who was essentially a MiG-21M (Type 96) guy, was being posted as senior Flight Commander in a MiG-21FL (Type 77) squadron. Added to that was the fact that I had limited experience even on the MiG-21 since I had spent most of my initial career on Hunters, Su-7s and as an instructor in the Air Force Academy- and while I was grateful for the opportunity, I also wanted to understand how I had earned it.

As a symbol of the great influence he had on my life and future in the Air Force, instead of giving me an answer, he just smiled and asked me to come home and have a drink with him that evening. I promptly landed up at his house at the given time, and over a brief visit and a couple of drinks, he just smiled again at my questions and simply asked me to trust Air HQ in selecting the right man for the job. Quite frankly, I had never filled up the column on choice of posting in my reports earlier and even after Staff College, though one was generally given a choice posting after staff college, so that made a lot of sense to me and stayed with me throughout my career. Thereafter, I never really came across Tippy Sir until he was the Vice Chief.

Of course, I kept hearing of him in the interim on the service grapevine, particularly about his professional achievements with having topped the PAI and FCL courses earlier. I knew that he had also faced serious adversity in his personal life as fate had dealt him a rough hand with the premature loss of his wife. I also heard some good snippets about his Mirage project team leader days in France. Later, when I commanded 28 Squadron, The First Supersonics, and converted it on the MiG-29s from 1987, I read about him being a young Flying Officer when he was specially chosen and inducted into the Squadron in the first lot of young pilots in the early days in 1963-64. Our Squadron was the only MiG-21 squadron at that time, and he had flown MiG-21s in the 1965 War. When the Mirage-2000s came for trials against the MiG-29s in Poona in March-April 1988, Tippy Sir was the AOC of Gwalior, the Mirage base, but he didn't visit Poona then and I am not certain what he heard about these trials from "Pudding" Ahluwalia. (For details, please see "Rivals from the Same Team" in a previous VAYU Issue III/1989). Immediately after these trials in mid-April 1988, we celebrated the Silver Jubilee of the Squadron in Poona, which had been delayed due to these exercises that we were involved in. Unfortunately, once again Tippy Sir could not make it and I missed hosting him then.

Two things happened when he was the Vice Chief and I met him after taking over command of Poona in January 1997. Soon after the induction of the Su-30 in June 1997, I got a call from Tippy Sir telling me that one of his wild, but dear, NDA course mates, Rear Admiral Purushottam Sharma, was already on the road to Poona with his wife and dogs, having sold his house in NOIDA and having despatched the truck with his households in a jiffy without even having picked up a place in Poona. Tippy Sir asked me if I could look after him and his stuff till he found a house in Poona. Needless to say, my answer to this was a 'yes' without any reservations. The very next day, the

Air Chief Marshal Anil Tipnis (Retd) and Molina Tipnis (Photo: corporatecitizen.in)

Admiral arrived in the afternoon after two days on the road and was accommodated in the VIP Cottage. I dropped in on the Admiral, and his charming wife Kavita, at tea time after games, intending it to be a short courtesy call to enquire about their road trip and if they needed anything to be more comfortable. Instead of tea, the Admiral asked me if I would be willing to share a drink with him to take away the weariness of the long drive. After that, it goes without any further elaboration that Kavita and "Phydo" (as he was known in the Navy as a carrier pilot) became great friends and mentors to my wife, Malini, and me and we spent a lot of social time together. In due course, Admiral Sharma also picked up a cottage right outside the Air Force area in Viman Nagar since he still loved watching aircraft and flying, like most pilots, and was a regular invitee whenever we put up a show in the base. Perhaps, this had an impact in my first face-to-face interaction with the Vice Chief in Air HQ in November 1997.

In the intervening period from June to November 1997, while I went to Air HQ a couple of times to brief them on the Su-30 issues, I didn't really meet Tippy Sir but dealt only with the ACAS (Ops), then AVM Mike McMahon and the CAS/DCAS for reasons I couldn't understand then. In November 1997, Tippy Sir called me over to Air HQ to discuss the open skies policy and opening up the base more to civilian traffic and private carriers based there. I believe a politician by the name of Madhu Dandavate had approached him based on the inputs given to him by Mr Cyrus Poonawalla, of SII fame now, and some other industrialists of Poona who had their private corporate aircraft based there. I had already been approached by Cyrus and others on keeping the airfield open to these private aircraft all night, or at least past midnight. Poona those days was manned only for one and a half shifts, that too on TBM levels, and was open to civilian traffic only till 8 pm though we did accommodate an odd aircraft returning late, generally from Bombay, as also scheduled flights which had been delayed for some reason, on a case-to-case basis. What I admired about Tippy Sir that day, on 25 November 1997, was that despite the political pressure on him, he listened to my reasoning patiently and finally agreed with my views and recommendations on the subject. I remember the date vividly due to a special reason which is not important for this narrative. When we had finished the discussion and I was about to leave, Tippy Sir said with a smile, "I believe you are enjoying yourself in Poona" hinting that he knew about my aerobatic displays. I then suspected that Admiral Sharma or someone else may have mentioned these to him. When I said "Yes Sir", he nodded and said, "Just be careful, son". I assured him that I would continue to be extremely careful, and

that nothing would go wrong before leaving his office. This meeting showed me two things. Firstly, that Tippy Sir had an open mind and was willing to listen to different views from his subordinates before arriving at a decision, an important quality in senior commanders. Secondly, that he was willing to trust his subordinates and did not have a zero-error mindset.

Later, he visited us at the end of September 1998 when, being a keen pilot, he also flew both the maritime Jaguar and the newly inducted Su-30K that we had on the base. During this visit, I observed how friendly and easy-going he was with the men, even at the lowest rank/level which encouraged them to speak freely and tell him their difficulties and problems. This was unlike many other senior officers who found it difficult to relate to the men on a more personal level. At the end of his visit, he was also very generous to have remarked in the visitors' book that, "AF Stn Pune is in good shape. Many improvements are visible and etc. Morale of the personnel seems to be high and everyone is proud of what what he is doing, etc". These remarks also showed that he did not hold back in his praise and encouragement when his subordinates did well; a much needed pat on the back for their hard work and efforts. I made sure that these remarks were made known to the men which bolstered their morale even more.

I mention these remarks because of the state of the morale in January 1997 when I took over command of the base in tragic circumstances after the fatal accident of the previous commander in a MiG-29 on base which naturally affected all the personnel and their families.

I had mentioned this to the then CinC, Air Marshal SR Deshpande and told him that I would have to do some things that may not be quite as per the book. Deshu Sir had just said, "do whatever you have to, that's why we sent you there but be careful". I, therefore, decided to fly in a manner that set an example and lead from the front to reinstill the confidence of the people in the aircraft by sending the message that if this "old man" could trust the MiG-29 that much, surely they had no cause for worry. Also, that each of us had to excel in the job entrusted to us no matter how menial it may seem. With God's grace, my low-level aerobatics once in a while, till almost my posting out in May 1999, went without an incident either from me or any of my subordinates. The squadrons did take a lead from this and both 6 and 28 squadrons kept winning the best squadron trophies between 1997-99 till I left. Even the men were inspired to excel in their jobs

with a smile, as also noticed by a number of visiting dignitaries. Our maintenance and all other support services, including Air Traffic Control, were also regularly praised. This was a team that I will always be proud of, despite an odd errant or disgruntled person which is par for the course in a large base like Poona.

Tippy Sir was quite obviously an advocate of open and transparent communications encouraging even the ranks to speak freely to senior officers/ commanders, as evident from his visits to Poona and his interaction with the men. I was already practicing a bit of this from my early days in the Air Force and generally kept an open office so that anyone could walk in and speak his mind freely. Through this open office, I used to get to know what

(Photo: Indianexpress.com)

was going on at lower levels in the base as also some good suggestions on issues that could otherwise become serious later, if neglected. Such meetings were also my sounding board for measures that I wanted to implement and how they would be taken by the men.

Tippy Sir became the Chief on 31 December 1998 and soon visited Poona in February 1999. During his visit, he, once again, commented favourably on the way the base was functioning. Since I was in the habit of keeping a copy of all important documents in my personal folder, I would just quote what he wrote in the visitors' book after this visit. "Very happy to have visited the Station and see at first hand the high morale and camaraderie that exists amongst all personnel. Good luck. Jai Hind." The important thing was that despite many shortages, the men were happy and smiling at work. Even Mrs Molina Tipnis was just as easy going and friendly in her approach while going around the station and Malini found it a delightful experience to be with her and take her around to show her everything. As it turned out, I had detailed a young, energetic, cheerful and promising lady officer, Flying officer Tarannum Misbah, who also functioned as my Assistant Adjutant and Officer in charge AFWWA, as the Liaison Officer to Mrs Tipnis and we soon lost her to the Chief's office. We did not really mind that since this move was better for Tarannum's career since she was like a daughter to us and many people even mistook her for our daughter, Ruheene. Even more significantly, Tippy Sir called and asked me whether they could take her away.

The inquiries against me, and I use the word 'against' very carefully because that is how the inquiries turned out later, were already ON when the Chief again came to Poona for a short visit in May 1999 for a function in town. These inquiries make a story of their own for a later time. Tippy Sir briefly made a mention of these and I had assured him that all the allegations in there were totally false and would soon be disproved. As for my flying, there was nothing to hide and I used to do this in front of everyone for the morale of the base, as he may have known. He left it at that. I did, however, mention to him that I was willing to continue as the AOC for another year since Ruheene was in her final year of school and needed to stay back till she completed the board examinations in March-April 2000. Soon thereafter though, my posting from Poona as Director Air Staff Inspections in Air HQ was changed to a less sensitive and less important post as Director Projects, perhaps due to these inquiries.

I reported to Air HQ in early June 1999 without Malini or Ruheene who had to reluctantly stay back in Poona. As it happened, within a couple of days of my reporting to Air HQ, Malini was detected with cancer and I had to rush back on casual leave for her surgery. On my return after a few days, I went to the Deputy Chief, my branch head, then Air Marshal Naqui, with an application requesting annual leave and furlough so that I could take care of Malini and Ruheene during the planned chemo and radiation therapy. Unfortunately, he instead emphasised that I was being considered for Srinagar to help out in the Kargil War that had just started but considering the remaining inquiry on flight safety funds, I first needed to go to SWAC, Gandhinagar and clear my name. He also advised me to go have a drink, think about it and come back to him the next morning with my decision. Well, I certainly had more than one drink that evening while planning alternate arrangements for Malini's care and acting on my PA's advice of leaving everything to the bigger man called God, whom I always invoked as my co-pilot.

That seemed to have worked since the next morning was a total surprise to me. The Deputy Chief had me in his office as soon as I reached Air HQ and, in a total turnabout, he told me that I should go ahead with my leave and furlough but, first, the Chief wanted to see me immediately. I went up one floor and was immediately ushered in to see the Chief. Tippy Sir asked me how Malini was and when I briefly told him about the diagnosis, he asked, "What is this I'm hearing? You want furlough to take care of her? Are you that rich that you can live on half-pay during her treatment?", or words to that effect. I told him that money was unimportant when the question was of Malini's treatment and I was fortunate enough to have some reserves. He immediately responded with that he would have me attached to Poona for the duration of her treatment. When I resisted this generous offer/order due to the fact that on attachment, I would be hounded again for the Inquiry, as also other duties, and would not be able to provide the care that my family needed, he immediately called the AOP, Air Marshal VK "Frisky" Verma over and told him to attach me to Advance HQ SWAC in Poona with the condition that I would not be asked to report for any work. I learned later from the Air Advisor, then

Air Commodore Ajit Bhavnani, that the previous evening they were returning from a visit to Bombay when the Chief asked him about Malini. Ajit told him what he knew of Malini's condition and added that he would check with me since I was reportedly back in Delhi to seek leave/furlough.

The humane side of Tippy Sir came immediately to the fore and he reportedly reacted pretty strongly to this by remarking whether we had come down to this level where someone with a serious problem had to be left to his own without any help from the organisation. He accordingly saw me first thing the next morning and his decisions were undoubtedly a major help to me in that difficult period. The concern for his subordinates was so very obvious from his actions. Actions that, in my opinion, motivate subordinates to do whatever is asked of them, and more, by such leaders, including laying down their lives on the line.

Tippy Sir's compassion and concern for his subordinates did not end there. After a month or so in Poona, the SOA of SWAC, Air Vice Marshal HP Singh, called me and requested me to attend the Inquiry which would now be shifted to Poona from Gandhinagar due to my inability to travel. I realised why this was being asked and done but still accepted, since I also wanted to clear up the mess and disprove the allegations against me. However, I clearly mentioned the condition that I would only be available from 0800 till 1330h on days that Malini was not required to be taken to hospital for any treatment. Accordingly, the Court assembled in a hurry but the very first day, I was kept till 1900h without even a lunch break. Obviously, I told the Presiding Officer, Air Vice Marshal CK Krishnatri, who knew me well but was obviously under

pressure from SWAC, that I would not come the next day if these kind of hours continued. Unfortunately, this repeated itself over the next few days till I put my foot down and both of us were summoned to Air HQ to the Chief again. After hearing both of us, Tippy Sir spoke to Krish Sir separately without me. Thereafter, I was not held beyond the specified time and could rush home in time to look after Malini's needs. That was his way of resolving issues. However, it must be said that my state at that time, both physical and mental, was taking a toll on Malini also and she even asked me to resign and leave the Air Force. I managed to convince her that I could not leave with a blemish against my name and reputation thus playing into the hands of the people who were just waiting for me to

break. I also told her that I could handle all such pressures as long as she stood by me and remained strong. That she bravely did over the next 13 years till she passed away, including the time when I was compelled to approach the court for justice in 2004.

By about November 1999, I returned to Air HQ having disproved the allegations against me in the Inquiry. During my cross-examination, the moment the accuser had no choice but to confess that he had levelled false allegations about finances against me, the Inquiry was closed thus confirming that it was actually a witch-hunt against me. By that time, Malini had also finished the planned treatment and was slowly recovering with her mother and sister to take care of her in turn. Here is when Admiral and Mrs Kavita Sharma came out with tremendous support for us in all possible ways. Around that time, the Inquiry on my low-level aerobatics had reached Air HQ and I was given "a minor rap on the knuckles" only because the CinC wanted some action, as I got to learn later, since both the VCAS and the Chief reportedly remarked that I was known for my flying. Reportedly, the consideration was that even Air HQ knew about such flying and the Command should have certainly known about it and should have put a stop to it right in the beginning, if they were against such flying.

Tippy Sir's sense of fair play came to the fore again soon since now it was time to consider my applications against the CinC and for protection of the confidential report on me for that period. While he was visibly happy that I had cleared my name, Tippy Sir asked me why I was in such trouble despite having a record that almost anyone would be envious of, adding whether I was "bucking" the CinC? He again gave me a patient hearing wherein I showed him all the documentation to prove that this was not the case and even these allegations against me were false, emphasising communications and honest advice that I gave just once for consideration of the commander(s). Tippy Sir, after two meetings on these issue, told me to go without saying anything but I got the impression that he would resolve these issues in his own way. Once again, his belief in fair play was evident since, concurrently, on the recommendations of the new DCAS, Air Marshal S Inamdar, he placed me in the important post of Director ASR from Projects in December 2000.

Unfortunately, soon afterwards in 2001, in the board for promotion to Air Vice Marshal in 2001, some new allegations were made against me about my time as a Squadron Leader in 1 Sqn almost two decades earlier and I was again called to his office. This time, I told Tippy Sir that

I was tired of such false allegations and offered that I would not even touch upon the legalities of such belated allegations at all but would request that my report for that period, when I was Flight Commander of 1 Sqn and had lifted it from a non-operational status to Operational in quick time, be checked. If there was even a hint of any remarks supporting such allegations, I would not even question why these were not communicated to me at that time but resign from the Air Force immediately. However, if there was no such remark in the report and the person concerned did not stop me from further promotions or report this alleged conduct, he had no business to be an Air Marshal and raise the issue almost 20 years later. Tippy Sir smiled as usual and took this argument in the spirit it was made and told me that he was clearing me for my promotion but if I ever let him down even after he had retired, he would be the first one to hang me. Well, all I need to say is that he has not hanged me yet.

In the winter vacations of 2000-01, our daughter Ruheene was visiting us from her college in Manipal and I got permission to bring her along for an informal event in Akash Mess. Soon after she was introduced to the Chief and when we were by ourselves, Ruheene remarked that we had a very handsome and charming Chief. Much later, after he had retired, I mentioned this to Tippy Sir and I thought I saw him clearly blush at the compliment; another indication of his humility and modesty. Sometimes, I remind him of this even after all these years of retirement and he reacts almost similarly trying to act nonchalant and gruff over this. Fortunately, by the grace of the almighty, the Air Chief Marshal and Mrs Tipnis continue to look good even now, as I saw in Gwalior recently, but are modest about it and take such compliments with the right touch of humility and grace.

In April 2001, Tippy Sir took me along to Brazil for his visit and I got to know both Molina Ma'am and him better at the informal level. Both of them were truly easy to be with and we had a good time even socially, apart from the educative professional engagements. It was my birthday the evening we landed in Rio de Janeiro and I offered to take them out for dinner along with our Indian Ambassador in Brazil who had come down from Brasilia to be with the Chief. It was an informal evening and his interaction with the Ambassador made me feel proud to be serving under such a fine officer and gentleman. With the Brazilian Air Chief and the Air Force personnel we met and flew with, as well as the President of Embraer, Tippy Sir obviously made a great impression and their respect towards him was obvious in all our interactions. One evening, I suggested that we go to the Brazilian barbecue place, called Churrascaria in Portuguese, that I knew about. Tippy Sir was feeling a little tired from the day-long official engagements and excused himself but Molina Ma'am took up the offer and their AA, Air Cmde "Bingo" Gokhale and I escorted her that evening. After a samba show and dinner, we all even visited the famous night flea market on Rio's beaches though it did get a little late. Next evening, Tippy Sir remarked that we obviously had a good time, as must have been conveyed to him by Molina Ma'am, so we would repeat it with him. We did just that that evening and had a wonderful time again. Truly remarkable people who know when to let their hair down and enjoy the moment without breeding any over-familiarity.

The author of this series: Air Marshal (R) Harish Masand seen here at Aero India 2009 at Yelahanka, Bangalore.

Once again, in 2004, when Tippy Sir had already retired and I was fighting my promotion case in the High Court, we met occasionally in Gurgaon at the golf course and they always made it a point to enquire about Malini's and my well-being. I do not really know what he thought about my going to court but they never let it come in between our conversation or the way they treated me. Later, when the Air Force decided to go in appeal to the Supreme Court, some rumours were planted and were circulating questioning my very loyalty to the Service and the nation. Tippy Sir asked me about it on the golf course one morning and I requested him for a little time in the evening when I could come over with the relevant documents to disprove whatever was being spread. He was gracious enough to give me a patient hearing again that evening which seemed to convince him that this was yet another canard against me. I did not pursue this further since I was already deep in court cases and did not have the time or the resources to start another defamation case against the people concerned.

All in all, I think I was a huge problem that arose in Tippy Sir's life, pretty late in his career too, and he would have been more than justified to decide to have nothing to do with me and all these complications. Instead, he chose to give me a patient hearing time after time and then do the right thing. For his sense of justice, fair play and strengthening the values of the Air Force, we would remain eternally grateful. Their humility and compassion is also remarkable. I only wish we had more leaders like him. Leaders like him are rare and come along once in a lifetime, and I am grateful and humbled to have crossed paths with Air Chief Marshal Tipnis in this one. In the end, I can only wish the Air Chief and Mrs Tipnis what they truly deserve; good health and every happiness in a long life.

25 Years Back

From Vayu Aerospace Review Issue I/1998

Mirage 2000s: In The Sub-continent

Reported in the (serious) Indian press on the eve of Mr Chirac's arrival in New Delhi, is the following: Though 18 months of sulks have been officially put behind, India is still sore over the proposed French sale of Mirage 2000 fighter aircraft to Pakistan, which had strained relations between the two countries.

Indo-Russian Defence Discussions

India and Russia began crucial discussions at New Delhi on 19 December 1997, pertaining to defence programmes and the joint development of defence hardware under their long term military-technical cooperation programme. This was extended by a decade to 2010 following Indian Defence Minister Mulayam Singh Yadav's visit to Russia in October.

'Tata Airline Must Conform To Norms'

In the first official comment from the Ministry of Civil Aviation, Ms Jayanti Natarajan, the Minister of State has stated that the Government "will clear Tata's Airline project to launch a domestic airline if the proposal conforms to the existing civil aviation policy."

AI Board Okays Aircraft Purchase

The Air India Board has focused its attention on the future growth of the airline, approving in-principle acquisition of additional aircraft and asked the management to submit detailed proposals within a specified time frame. The airline will carry out studies for purchase of three medium capacity/medium haul aircraft and one Boeing 747-400, costing around $400 million.

18th Boeing 737 For Jet Airways

An advanced generation Boeing 737-400 aircraft acquired by Jet Airways flew into Mumbai on 19 December 1997 under the command of Capt David Ezekiel, being the second aircraft out of the ten aircraft which Jet Airways will acquire from the Boeing Commercial Airplane Company. On these, the third aircraft is expected to join the fleet in April 1998 and the fourth in June 1998.

PAF Turns to Russia

The Pakistan Air Force, which has desperately been looking for new fighter aircraft to replace the obsolescent fighter-types in its inventory, has been keen on Russian-aircraft for sometime, particularly the MiG-29 and Su-27.

The US May Employ Indian Satellites in Future

A Memorandum of Understanding (MoU) signed by the Israeli Government, NASA and an American scientific body on December 17 to study the atmosphere may be a precursor to joint Indo-US scientific projects, especially those involving meteorological study as Indian satellites extensively study global weather patterns.

UAE Orders Mirage 2000-9

The United Arab Emirates (whose total population is less than 1.5 million) have ordered 30 Dassault Mirage 2000-9s, specifically developed for them to add to the already substantial numbers (33) of the Mirage 2000 supplied earlier, and which will also be upgraded to the 2000-9 standard.

Bangladesh To Acquire MiG-29s, More F-7Ms

On 28 December, Bangladesh Prime Minister Sheikh Hasina announced that her Air Force will acquire MiG-29 advanced fighters from Russia and CAC-7M fighters from China, as part of its military modernisation programme. Presently, the BAF has F-7Ms, some MiG-21s, A-5s and few F-6s (transferred from Pakistan).

An-74s to Iran

The first of 12 Antonov An-74T-200 turbofan tactical transport aircraft for the Islamic Republic of Iran Air force were recently delivered to Iran from the factory at Kharkov. The aircraft are of series 200 standard, and not series 100 as earlier assumed.

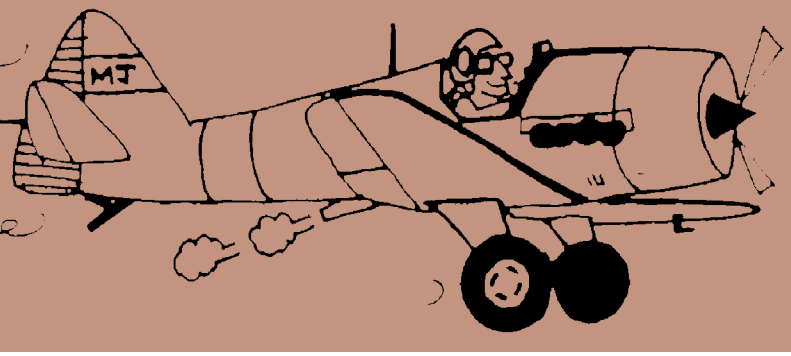
57 IAF Aircraft In R-Day Fly-past

The 26 January 1998 Republic Day parade at New Delhi featured the largest-ever fly-past by aircraft of the Indian Air Force in over a decade, with 57 IAF aircraft participating, comprising 43 fighters, including four of the recently-inducted Sukhoi Su-30s, one of which carried out "limited" aerobatics.

Syrian AF Maintenance

Syria's fleet of MiG-21s and Mi-8 helicopters are likely to be overhauled in India by HAL (Nasik Division) and the BRDs of the IAF respectively.

Ancient Aviator Anecdotes



The poem below was composed by Mrs Shirley Parker to mark the 90th birthday of her husband AVM Cecil Parker and read at a surprise party organised by their daughter Shalini and son Kevin on 22 November 2022

LEAVES FROM LOCHINVAR'S LOG BOOK

Now young Lochinvar he came south with a zest
To learn how to fly he said was his quest.
But going to church with intentions so good
He found young Maid Marion sans Robin Hood.
While learning to fly his aircraft caught fire
But bail out he did from a plight so dire.
Though injured while leaving the plane all aflame,
God opened his chute so down safely he came.
Then off to the north our hero he went,
Each day to the maiden a letter he sent.
With his eloquent prose he gained her permission
On a Valentine's Day he completed his mission.
In the years by and by the family did flourish,
As our hero with jet engines his passion did nourish,
Till the war clouds, so angry, over land they did spread,
Filling the poor maiden's heart with much dread.
The conflict it raged over land and the air,
While Lochninvar did his squadron prepare
For the call to the battle with sirens began,
Cometh the moment, cometh the man.
Peace reigned at last, the victory was won
He looks on with pride at a job so well done.
Award and praises on him they did shower
His record still stands tall of that darkest hour.
Fifty years later when the story is told,
The country paid honour for valour so bold.
But time flies by and memories fade,
The valiant few recall how history was made.
With the passing of time there are no backward looks,
Recounting events in his writings and books.
The ups and the downs and the calm and the storm
His life on the pages in anecdotal form.
No waiting as yet for the whistle to blow,
When life is at ebb and not with the flow
While defying all odds makes dreams come true,
If you fit his mould, this should work for you.
"For men may come and men may go
But when comes such another?"
(With apologies to Alfred Lord Tennyson)

Submarine lost and found in the desert?

In the shimmering heat of the Saudi desert, it could be dismissed as a mirage, but photographer Khaled Al Enazi has pictures to prove he really did spot a giant fish or submarine shaped rock emerging from the sands. The rock formation resembles an aquatic creature or submarine swimming through the golden sand, its dorsal fin-like structures also suggesting it could be a predator emerging from the depths to stalk its prey. (CNN)

Month of "The Last" for two 'Queen of the Skies'

December 2022 saw the end of two eras- two very different aircraft serving two very different and distinct markets. On 12 December 2022, the last Pilatus PC-6 (SN 1019) was delivered to an Indonesian customer and earlier in the same month, Boeing rolled out their final 747 from its widebody factory in Everett for delivery to Atlas Air marking close of a historic 54-year 'jumbo' production run.

Smile please!

In the current times of gloom, Airbus has a remedy: cute and beautifully painted Airbus aircraft for various customers on their way for delivery with nice happy faces. The world would be a happier place if one saw humanity roaming around with such faces—and would make the tedious wait at airports better for passengers.

Happy New Year to all!

Afterburner

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U.S. Marine Corps photo by Sgt. Luke Kuennen

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