

# VAYU

III/2023

## *Aerospace & Defence Review*



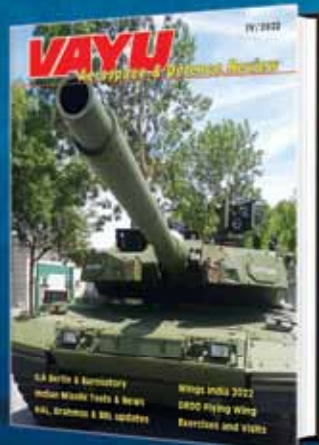
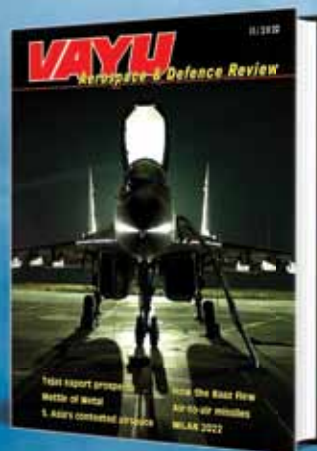
**IAF at Desert Flag VIII,  
Cope India, Orion 2023,  
Iniochos'23, Cobra Warrior**

**IAF Suryakirans/RAF Red Arrows  
Beyond "Gaming" in training  
India's Arjun MBT: a genesis**

# VAYU

**Aerospace & Defence Review**

**49<sup>th</sup> year of Vayu**



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Cover: IAF Mirage 2000 at Exercise Cobra Warrior, UK. Photo by Alex van Noije (Twitter @ANoije)

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Printed at Aegean Offset Printers

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# VAYU Aerospace & Defence Review

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## 18 Vikrant's Rotary Sentinel: Ka-31AEW



On 28 March 2023 the maiden night landing of helicopters onboard INS Vikrant included Kamov Ka-31 Airborne Early Warning (AEW) helicopter of INAS 339.

## 19 P8I simulator complex inaugurated



Defence Secretary Giridhar Aramane inaugurated the state-of-the-art P8I simulator named as 'Ashok Roy Training Simulator Complex' (ARTSC) on 25 April 2023 at INS Rajali.

## 33 Cobra Warrior 2023-1



The exercise Cobra Warrior is conducted two times per year and is the largest aerial exercise in the United Kingdom. The exercise was facilitated by the No 92 Squadron of the Royal Air Force, which is based at RAF Waddington.

## 40 IAF at Exercise Iniachos-23



The Indian Air Force (IAF) participated in Exercise Iniachos-23, a multi-national air exercise hosted by the Hellenic Air Force. The exercise was conducted at the Andravida Air Base in Greece from 24 April 2023 to 4 May 2023.

## 42 IAF and Exercise Orion 2023



An Indian Air Force contingent participated in Exercise Orion at Mont-de-Marsan, an Air Force base of the French Air and Space Force (FASF) on 10 April 2023.

## 44 IAF and Exercise Cope India 2023



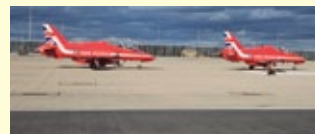
Exercise Cope India 23, a bilateral Air Exercise between the Indian Air Force (IAF) and the United States Air Force (USAF) was held at Air Force Stations Arjan Singh (Panagarh), Kalaikunda and Agra.

## 50 IAF Suryakiran's



Mayyank Kaul writes on the Suryakiran Aerobatic Team which is a renowned aerobatic display team of the Indian Air Force, captivating audiences with their breath-taking aerial manoeuvres.

## 53 Red Arrows at RAF Waddington



Vayu had the pleasure of visiting the famous Red Arrows Aerobatic Team (of the RAF) at Waddington. Having seen the team displaying and aweing one and all around the world including at airshows and ofcourse having performed in Indian many years ago, it was a full circle by team Vayu visiting them at their new homebase at RAF Waddington.

## 64 Arjun: The journey of India's MBT



Sankalan Chattopadhyay writes this article as a humble tribute to Lt Gen Ajai Singh, who gave almost everything to make India's indigenous main battle tank programme a success.

## Regular features :

Opinion, Viewpoint, Aviation & Defence in India, World Aviation & Defence News, Ancient Aviator Anecdotes, Vayu 25 Years Back, Tale Spin.

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## Admiral Arun Prakash says.... Opportunities in Crisis

Capitals worldwide, regardless of their distance from Kyiv, are feeling the reverberations of the war in Ukraine, which has impacted not only global political and financial systems but also common people everywhere. Ukraine is a key contributor of grain, edible oil and fertilisers to the world's supply chains and Russia is a major exporter of natural gas and crude oil. Shortages of these items are leading to falling stock markets, rising prices, public discontent and even political upheaval.

Vladimir Putin's full-scale invasion of Ukraine reminds us that realism remains the bedrock of inter-state relations and that "might" is still "right". His reckless nuclear sabre rattling has not only brought us perilously close to the brink of World War III but also resulted in widespread collateral damage. Economic sanctions may not have killed globalisation but as countries seek alternate sources of food, energy, commodities and arms, polarisation and realignments are underway.

The *casus belli* of this conflict can be discussed endlessly but it has two essential facets. First, is Putin's argument that a Ukrainian nation does not exist, because "it is an inalienable part of Russia's history, culture and spiritual space." Such revanchist claims are made by hegemonic states to camouflage their quest for dominance and are echoed in China's "Nine-dash line" in the South China Sea, its occupation of India's Aksai Chin and blatant claims on Arunachal Pradesh.

On the other hand, Putin accuses the US and Europe of bad faith, citing the assurance given to a worried Gorbachev that NATO would advance "not an inch eastward". This solemn undertaking was allegedly violated when NATO enlisted, in the next decade, 10 former Warsaw Pact members. With Finland as the latest entrant, NATO is now, 31-strong and Russia feels truly cornered.

Notwithstanding this, there was as little justification for Russia's aggression on a sovereign neighbour as there is for the West to egregiously fuel the ongoing conflict by a sustained supply of weaponry to Ukraine. This conflict has posed a dilemma for New Delhi, which remains engaged with Russia and China in the BRICS format as well as

in the Shanghai Cooperation Organisation (SCO), while also partnering with the US in the Quad and Malabar groupings. To add complexity, India simultaneously holds presidencies of the G20 and SCO. Astute statesmanship will be required if India is to eke advantage from this "tightrope walk" while maintaining "strategic autonomy".

Russia, in the wake of its bungled invasion, was badly in need of friends when China came to its rescue. With Xi Jinping now firmly in Putin's corner, China will not countenance a Russian setback. The consequent relegation of Moscow to a "junior partner" gives Beijing great leverage and fetters Russia's capacity to pursue independent relations with other states, especially India. Given the rapid decline of Russia's capability/reliability as a defence supplier and our parlous security environment, India's decision-makers should worry. The recent Poonch ambush shows that despite multiple ongoing domestic crises, the Pakistan army-ISI combine remains undeterred and persists with cross-border terrorism. Of equal concern should be the stonewalling of Raksha Mantri Rajnath Singh's demarche about the "violation of existing agreements" by his Chinese counterpart, Li Shangfu.

For New Delhi to stand firm against this dual-threat it needs to undertake a re-appraisal of its policies and accord priority to "power-balancing" as well as "technology acquisition" on its diplomatic agenda.

The Quad and Malabar groupings, whose membership includes Japan and Australia, are a manifestation of the convergence of US and Indian strategic interests. Although these forums appear to be serving a useful military-diplomatic purpose, their overall impact has been underwhelming. While China's frequent intimidatory messages to Quad nations indicate that it sees this grouping as a potential impediment to its hegemonic grand plan, the Quad members — barring the US — have shown nervousness and trepidation in their responses. Quad meetings go to great lengths to emphasise that the grouping has no security implications and is not an "Asian NATO". It is time for India

to motivate its Quad partners to evolve a meaningful charter and agenda and to invest the grouping with substance — and teeth.

In this context two new US initiatives deserve mention. In September 2021, Australia, the UK and US announced the formation of a trilateral security pact, AUKUS. Under it, the US and Britain apart from sharing many advanced technologies with Australia would also assist it in acquiring a nuclear attack submarine (or SSN) force. Apart from basing the US and UK's SSNs in Australia, Project SSN-AUKUS envisages training Australian crew in nuclear operations, sale of 3 Virginia-class SSNs and delivery of the first UK-built SSN to Australia in the late 2030s.

SSN-AUKUS brings into stark relief the complete absence of any similar offer of training, military technology or hardware, by the US to India. This is despite warm bilateral ties, a "strategic partnership", the "historic and path-breaking" Indo-US civil nuclear deal and a host of defence-related agreements. Perhaps it was to address this stasis in Indo-US relations that an Initiative on Critical and Emerging Technologies (iCET) was announced in May 2022 by Joe Biden. It remains to be seen if iCET results in significant sales or transfer of technology to India or ends up as an addition to the "alphabet soup" of Indo-US agreements.

India, a nuclear-weapon state and space power, also fields the world's fourth-largest military. And yet, the lackadaisical performance of its military-industrial complex has rendered it abjectly import-dependent for weaponry. While "atmanirbharta" is a laudable quest, technology has long gestation periods and we should draw useful lessons from China. In a single-minded campaign since the 1960s, China has employed reverse engineering, coercion, and even blatant theft to acquire military technology from the USSR and the West.

It is time for India to adopt a "whole of government" approach so that trade, commerce, and diplomacy can be synergised, to leverage the acquisition of military technology that will make us truly atmanirbhar in the long run. 🦋

**Lt Gen Kamal Davar says...**

## India and the new geopolitical churnings

**H**istorically speaking, there usually remains an uneasy consistency in the geopolitical world order as the strategic interests of nations are not given easy alterability. Nevertheless, the traumatic geopolitical churning witnessed by the world in the last three years has no parallels since the end of World War II in 1945. Even by conservative standards, the overall impact on the world—political, economic, social and diplomatic—has been unmistakably tectonic. As all nations, including the major powers, endeavour to absorb the cataclysmic effects of the events of the last three years, the early months of 2023 also display a susceptibility for this adverse impact continuing in relations between nations and severe economic and health challenges remaining to the fore threatening the overall worsening of the established global order. It brooks no elaboration to state that the current and likely continuing geopolitical differences in the world community will drive geo-economic warfare and vastly augment the risk of multi-domain conflicts. By any standards, the future in geopolitical churns across the globe remains steeped in uncertainty!

### Recent traumatic events and geopolitical churnings

The end of 2019 witnessed a global catastrophe with the outbreak of Covid19 pandemic also known as the coronavirus pandemic. Originating from the Chinese city of Wuhan, it could not be contained there and quickly spread to other Asian nations and in a few months from early 2020, virtually engulfed the entire globe. Reportedly, till date, this virus has affected 676 million cases causing over 6.88 million deaths. According to the WHO, this virus still exists in many parts of the globe in some form or the other. This Black Swan event affected the global economy, politics, health, ecology and environment besides adversely affecting many other aspects of life as never before. The globe is still reeling under the adverse impact of this virus.

February 2022 witnessed the uncalled-for and unjust invasion of neighbouring Ukraine by mighty Russia—a war



which, surprisingly, carries on without any let-up and its duration, trajectory and unpredictability of its consequences confounds nations and most security analysts all over. That opinions, across the globe, to justify or condemn the Russian actions in Ukraine remain hopelessly divided and rigid will be stating the obvious. After the end of the Cold War in the early 90s, the global geopolitical and geo-economic divide, consequent to the ongoing Russo-Ukraine War, has never been so harshly polarised. Russia, gravely apprehensive of an ever-increasing membership NATO creeping towards its western borders, had mounted a surprise offensive into Ukraine in February 2022. Ukraine's dogged resistance to it surprised military analysts all over despite millions of ordinary Ukrainians getting displaced with their age-old homes and hearths being devastated beyond repair. The plight of the ordinary Ukrainian is beyond imagination.

However, this avoidable confrontation coupled with the economic after-effects of the pandemic has led to rising and virtually intolerable economic costs on the basic necessities of life, grave inflation and thus political instability across some nations in varying degrees. Where the interdependent world should undertake risk mitigation with cooperation, unfortunately, the reverse is true owing to the Ukraine War. As Russia, after initial military hiccups, has gradually commenced gaining ground primarily in the bordering eastern portions of Ukraine, it

has been predictably presented by the West, especially the US and European Union with nearly 14,081 sanctions of various types! Before this war, Iran was the most sanctioned country with 3616 sanctions.

The US and most NATO nations continue to support Ukraine with some financial and military equipment needs and the war continues unabated with no end in sight. Amazingly, the UN and, equally, leading global powers have displayed an uncanny inability to prevent the resurgence of this conflict. It's indeed a great pity that food, energy, global financial institutions and supply chains have been weaponised as never before.

The events of the last few years have also witnessed the phenomenal rise of China in many areas of global significance.

China has continued with its past record of brandishing unbridled assertiveness in the region and attempts at global hegemony to equal, if not immediately surpass the USA. It has not taken the responsibility whatsoever for the COVID-19 virus it had unleashed or failed to contain in an unsuspecting world. It continues with its aggressive posture and 'salami slicing' tactics in India's Eastern Ladakh and also now a fresh display of aggressive behaviour in the Tawang region of Arunachal Pradesh. Its domination of the international sea-lanes in the South China and East China seas, and its reclaiming island chains close to Japan, Philippines and Vietnam continues with abandon. Importantly, the world with

bated breath awaits its more than likely military trespass into neighbouring Taiwan taking a cue from its earlier mentor Russia's invasion of Ukraine. China, however, may await the main opposition party in Taiwan, Kuomintang (KMT) to come back into power next year and assist China in its reunification plans with Taiwan in a peaceful manner. The KMT is considered close to China.

China, especially after its supremo Xi's unprecedented third term extension in Oct 2022, appears to be getting hyperactive in the pursuit of its regional and global ambitions. China is endeavouring to present to the world a multipolar other than a US-dominated unipolar strategic alternative. Though many of its debt-trap activities involving many smaller nations, its genocidal activities in its East Xinjiang province and the display of its unbridled ambitions in the region have also given it a bad name. However, China has indeed scored a major diplomatic victory over the US by brokering a surprise deal between the erstwhile adversaries, Saudi Arabia and Iran to the surprise of many! China is seriously endeavouring to shore up its relations with nations of West Asia which also appear to surmise the lack of adequate US attention to it as hitherto. China's growing impetus in its relations with the Middle East will also contribute to addressing China's gigantic energy needs.

China is also helping Russia tide over some of the ill effects of US sanctions and has also grandiosely issued a 12-point peace plan to end the Ukrainian conflict. Its propaganda agencies are on an over-drive to present China as an exponent and global leader of peaceful intentions! Nevertheless, it is pertinent to note what President Xi had spoken recently in the National People's Congress stating that he will endeavour to "more quickly elevating the armed forces to world-class standards---and make it a great wall of steel." China's ambitions have willy-nilly also spurred other Asian nations to improve their defence preparedness. Japan has doubled its defence spending and will be purchasing long-range weapons from the US while South Korea has espoused stability in the Taiwan Strait as critical to its security. Meanwhile, the Philippines has granted new basing rights to the US armed forces. Additionally, AUKUS and the QUAD are also gearing up their cooperation and interoperability in the Indo-Pacific region. India

too has, accordingly, a vital role to play in this newly evolving joint strategy to counter China's myriad ambitions in this region.

### Implications and options for India

By all standards, India has a unique standing in today's world. As one of the world's leading markets for imports—both defence and non-defence materials and goods—India for purely commercial reasons can never be ignored by any power or combination of the world. Importantly, for decades, India does carry some moral authority with itself with its foreign policy based on the Nehruvian concept of non-alignment now aptly called 'strategic autonomy' which has been long respected by the 'third world' now referred to as the 'global south'. Importantly, India's adherence to democratic ideals and overall secular orientation gives it a tremendous ethical position in today's hatred and sectarian-driven world—that it must remain faithful to its roots if India strives for the much heralded 'Vishwa Guru' symbol is sine-qua-non. Nevertheless, India has its task cut out for making it as PM Narendra Modi envisioned "The India Moment".



For India, 2023 is indeed a year of great promise with the nation presiding over the much-coveted G-20 and even the Shanghai Cooperation Organisation (SCO) groupings. India can truly rise to be a beacon of hope for the Global South and also strive for making the world more peaceful and harmonious.

As regards combating any resurgence of the COVID-19 or any of its variants, India, after a sluggish start, has done well to manufacture and even assist many nations across the world in the supply of vaccines to neutralise the deadly virus. This area must continue to remain a priority for the nation and wherever we can assist the poorer nations to fight this malady we should do so.

As regards China is concerned, India will have to be more than wary of China's unending efforts to keep India boxed into the South Asian region. China sees India

as its major competitor in Asia, also now getting closer to the US and thus will keep up the pressure on India militarily by off-and-on efforts at encroaching on Indian territory. Its recent action at renaming 13 places in India's Arunachal Pradesh (which it calls Southern Tibet) is fraught with Chinese malafide intentions. Simultaneously, it will keep mouthing peaceful plaudits to fox the Indians. India must never let down its guard against the wily Chinese and ensure adequate military preparedness to thwart Chinese intentions towards us. India must also remain on guard as regards China trying to wean away Russia from its traditional friendship with India. No matter how close India-US cooperation may ensue, Russia remains a strategic partner for India and defence cooperation and energy relationships with it must be continued quantitatively and qualitatively. As regards the Indo-Pacific strategic region, India must play a greater role both economically and militarily. The China threat, both on our land borders and in the larger Indo-Pacific region, has to be factored in with the seriousness it deserves.

India, especially, now chairing the G-20 is concerned, must play a much greater role in trying to bring about peace in the Ukraine War. As PM Narendra Modi had opined to Russian President Vladimir Putin last year that "this is not an era of war", India must redouble its efforts to seek an amicable and just solution to the Ukrainian crisis, however difficult it may appear now.

### Conclusion

With the presidency of the G-20 and SCO this year and India going out of its way to make both organisations achieve something substantial, 2023 can be truly India's pivotal year. But for the government, as it reaches out to the Global South and also to the US and Russia, the current times, notwithstanding the many geopolitical churning taking place across the globe, 2023 is India's year of reckoning. In an interdependent world, India must manage both its internal pressures and external challenges with vision, a sense of balance and determination. The coming years project immense promise for India in diverse fields of human endeavour. Let's capitalise on our innate strengths and an inclusive vision for all in our great nation and be a beacon for humanity. 🦋

(This article first appeared in dsalert.org)

## MoD contract with BrahMos worth Rs 1,700 crore



Ministry of Defence, on 30 March 2023, inked a contract with BrahMos Aerospace Private Limited (BAPL) for procurement of Next Generation Maritime Mobile Coastal Batteries (Long range) {NGMMCB (LR)} and BrahMos Missiles at an approximate cost of over Rs 1,700 crore under Buy (Indian) Category. The delivery of NGMMCBs is scheduled to commence from 2027. These systems will be equipped with supersonic BrahMos missiles and will significantly enhance multi-directional maritime strike capability of Indian Navy.

## Contracts for Akash and 12 WLR Swathi



Ministry of Defence, on 30 March 2023, signed contracts for procurement of improved Akash Weapon System and 12 Weapon Locating Radars, WLR Swathi (Plains) for the Indian Army at an overall cost of over Rs 9,100 crore. The contract for procurement of improved Akash Weapon System (AWS) for 3rd and 4th Regiments of Army Air Defence, comprising live missiles and launchers with upgrades, ground support equipment, vehicles and infrastructure was signed with Bharat Dynamics Limited, worth over Rs 8,160 crore.

The contract for WLR Swathi (Plains) was signed with Bharat Electronic Limited (BEL) at a cost of over Rs 990 crore. It is an indigenously designed WLR which is capable of locating guns, mortars and rockets firing own troops, thereby facilitating their destruction through counter bombardment by own firepower resources.

## Contracts for 11 OPVs and missile vessels

Ministry of Defence, on 30 March 2023, signed contracts with Indian shipyards for acquisition of 11 Next Generation Offshore Patrol Vessels and six Next Generation Missile Vessels at an overall cost of Rs 19,600 crore. The contract for acquisition of 11 Next Generation Offshore Patrol Vessels under Buy (Indian-IDDMM) category was signed with Goa Shipyard Ltd (GSL) and Garden Reach Shipbuilders and Engineers (GRSE), Kolkata at a total cost of Rs 9,781 crore. The contract for acquisition of six Next Generation Missile Vessels (NGMV) was signed with Cochin Shipyard Limited (CSL) at a cost of Rs 9,805 crore. The delivery of ships is scheduled to commence from March 2027. The NGMVs would be heavily armed war vessels incorporating stealth, high speed and offensive capability.

## Modernisation of naval aircraft yards



Ministry of Defence, on 31 March 2023, signed a contract with Ultra Dimensions Pvt. Ltd. (UDPL), Vishakhapatnam for modernisation of Naval Aircraft Yards (NAYs) at Goa and Kochi, at a cost of Rs 470 crore. The NAYs undertake servicing/repairs of naval aircraft, aero engines, rotatables and test equipment at Goa and Kochi.

## IAF PC-7 MK.II in 2L FH

To commemorate the completion of over two lakh flying hours in a decade of operations by the Pilatus PC-7 MK II, the CAS, Air Chief Marshal VR Chaudhari flew a sortie in the aircraft on 12 April 2023 at Air Force Academy, Dundigal.



## President visits R11

President Droupadi Murmu visited INS Vikrant and interacted with the officers and sailors on 16 March 2023. The President said that the “indigenously built modern aircraft carrier is a testimony to India’s march ahead towards an Atmanirbhar Bharat”.



## Ka-31AEW on R11



Maiden landing of helicopters by night onboard INS Vikrant was achieved on 28 March 2023 by Kamov 31 AEW helicopter Team of Pilots and Air Tech Officer from INAS 339 led by Test Pilot of Naval Flight Test Sqn undertook trials successfully thereby proving night ops from R11 Vikrant.

## BDL tests Amogha-III



Barat Dynamics Ltd, on 28 March 2023, carried out successful field firing of its 3rd generation fire and forget man portable anti tank guided missile, Amogha-III. All the mission objectives were achieved.

## DRDO and IN test BMD interceptor



Defence Research and Development Organisation (DRDO) and Indian Navy successfully conducted a maiden flight trial of sea-based endo-atmospheric interceptor missile off the coast of Odisha in the Bay of Bengal on 21 April 2023. The purpose of the trial was to engage and neutralise a hostile ballistic missile threat thereby elevating India into the elite club of Nations having Naval BMD capability.

## DRDO and IN test ADC-150 from IL-38SD

Defence Research & Development Organisation (DRDO) and Indian Navy conducted the successful maiden test trial of ‘ADC-150’ from IL 38SD aircraft on 27 April 2023. ‘ADC-150’ is an indigenously designed and developed Air Droppable Container with 150 kg payload capacity. The trial was conducted to enhance the naval operational logistics capabilities by providing quick response to meet the requirement of critical engineering stores to ships (under distress), which are deployed more than 2,000 kms from the coast. It reduces the requirement of ships to come close to the coast to collect spares and stores.

## DRDO and VS based UASS

Centre of Fire, Explosive and Environment Safety (CFEES), a Delhi-based laboratory of Defence Research and Development Organisation (DRDO) has designed and developed a vertical shaft based underground ammunition storage (UASS) facility. It enables

upward vertical dissipation of blast effects considerably reducing the blast effect on surrounding utilities. The design validation trial of this underground ammunition storage structure was successfully conducted on 30 April 2023. The instrumented blast trial was carried out in presence of the Armed Forces by detonating 5,000 kgs of TNT in one of the chambers of the underground facility.

## President's Standards awarded



General Manoj Pande, the Chief of Army Staff presented the prestigious 'President's Standards' or 'Nishan' to four Armoured Regiments of the Indian Army, namely 49 Armoured Regiment, 51 Armoured Regiment, 53 Armoured Regiment and 54 Armoured Regiment during an impressive Standards Presentation Parade held at Suratgarh Military Station in Rajasthan on 25 March 2023.

## UK CDS in India

The United Kingdom's Chief of the Defence Staff (CDS), Admiral Sir Tony Radakin, took part in a series of high-level meetings in India recently, continuing momentum in building strategic ties between the two countries. The CDS began his three-day visit by paying homage to the fallen soldiers at the National War Memorial on 17 April, ahead of his first meeting with his Indian counterpart, General Anil Chauhan. The two Chiefs reviewed progress on various pillars of the UK-India defence partnership and exchanged views to further expand ties in all the domains.



## FPV and LCA ship for Maldives



On the second day of his 3-day visit to the Maldives, Raksha Mantri Rajnath Singh handed over a Fast Patrol Vessel and a Landing Craft Assault ship to the Maldives National Defence Forces (MNDF) on 2 May 2023. The Fast Patrol Vessel, capable of coastal and offshore surveillance at high speeds, was commissioned as MNDF Coast Guard ship Huravee. President of Maldives Mr Ibrahim Mohamed Solih and Defence Minister Ms Mariya Ahmed Didi were present on the occasion.

## IAF's 44 Sqn celebrates Diamond Jubilee

44 Squadron of the Indian Air Force celebrated its Diamond Jubilee this year at Chandigarh. "The rich and glorious history of the Sqn is a kaleidoscope of military history and military diplomacy of modern-day India and filled with tales of fortitude, courage, daring, devotion and professionalism which encapsulates all that IAF stands for", in a statement issued.

The Squadron was raised on 6 April 1961 and equipped with the An-12 aircraft. It operated the An-12 till 1985. In March 1985, it brought the Il-76 aircraft into India, which was formally inducted into IAF on 16 June 1985. The aircraft continues to in service today. The Diamond Jubilee celebrations due in 2021 had to be postponed due to COVID 19 pandemic. Since its raising, No. 44 Sqn has been at the forefront of the airlift activities undertaken by IAF.



## CDS attends IAF Commanders' Conference



The CDS, General Anil Chauhan attended the IAF Commanders' Conference (AFCC) at Air Headquarters (Vayu Bhavan) on 20 April 2023, where he was briefed about the operational readiness of the IAF. Later, speaking to the IAF Commanders present in the Conference, the CDS highlighted the need to chart a clear path towards fleet sustenance, while simultaneously taking steps towards increasing indigenisation. He also discussed the contours of enhancing integration amongst the three services and the benefits that would accrue from the same. Views of various government organs and academia are sought during the Conference which is also addressed by the Chiefs of the Army and Naval Staff.

## NASA and ISRO's NISAR

National Aeronautics and Space Administration (NASA) and the Indian Space Research Organisation (ISRO) have jointly manufactured an earth science satellite named, NISAR (NASA-ISRO Synthetic Aperture Radar). The mission objectives of the satellite are Design, Develop and launch Dual Frequency (L and S band) Radar Imaging Satellite and to Explore newer applications areas using L & S Band microwave data especially in surface deformation studies, terrestrial biomass structure, natural resource mapping and monitoring and studies related to dynamics of ice-sheets, glaciers, forests, oil slick etc.

## Astra Microwave receives order

Astra Microwave Products Limited has received an order from the Indian Met Department for supply of 3 C-band Dual Polarised SSPA based Doppler Weather Radars in a competitive



bid. "We have successfully supplied 10 X-band DWRs and continue our leadership position in indigenous DWRs".

## Imphal, Project 15B, in maiden sea trials

Imphal, Indian Navy's third indigenous stealth destroyer of the Project 15B class, planned to be commissioned later this year,



undertook her maiden sea sortie recently. The ship incorporates several niche technologies and high indigenous content and is designed in-house by the Navy's Warship Design Bureau and constructed by Mazagon Dock Ltd. Imphal will have the unique distinction of being the largest and most advanced destroyer to be ever named after a city from the North-East. Imphal would thus be a befitting symbol of the growing importance and contribution of the North-Eastern region and the state of Manipur towards national security and development.

## Keel laying at L&T



Keel laying ceremony of the two ships of Multi Purpose Vessel (MPV) Project (Yard 18001 – Samarthak and Yard 18002 – Utkarsh) was held at L&T Shipyard, Kattupalli, on 20 March 2023. The ceremony was presided by VAdm Sandeep Naithani, Chief of Materiel, in the presence of VAdm Kiran Deshmukh, CWP&A, Ashok Khetan, Head Shipbuilding Business, L&T and other senior officials from Indian Navy and L&T.

## Launch of 'Androth'

'Androth', the second of 8 x ASW Shallow Water Craft (SWC) Project, being built by GRSE for Indian Navy was launched on 21 March 23 at GRSE, Kolkata. The ship made her first contact with water of Hooghly River at 1430 hrs at the launch ceremony presided over by VAdm Dinesh K Tripathi, FOC-IN-C (West). 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 in-service Abhay class ASW Corvettes of Indian Navy and are designed to undertake anti-submarine operations in coastal waters,



Low Intensity Maritime Operations (LIMO) and Mine Laying operations including subsurface surveillance in littoral waters. The ASW SWC ships are 77.6 m long, have a displacement of 900 tons with a maximum speed of 25 knots.

## Garuda Aerospace and drone sector



Garuda Aerospace has teamed up with over 120 Make In India companies to achieve complete indigenisation of the drone industry. Garuda Aerospace will collaborate with its partners through joint ventures, technology transfers, supplier arrangements and investments to help local manufacturers meet the growing demand for Made In India drones. The company aims to make India a global drone hub by 2030.

## 11th meet between Indian and Korea Coast Guards

A seven-member delegation of the South Korea Coast Guard conducted a high level meeting with Indian Coast Guard in



New Delhi on 25 April 2023. The delegation of South Korean Coast Guard was led by Commissioner General KIM Jong Wook, while Indian Coast Guard team was headed by ADG Rakesh Pal, Officiating Director General, Indian Coast Guard. Both sides discussed measures at further enhancing the mutual cooperation including capacity building and other issues of mutual interest.

## Avolon delivers 15 Airbus A320neo's to Vistara



Avolon, the international aircraft leasing company, announced that it had completed the delivery of 15 A320neo aircraft to Vistara, a joint venture of Tata Group and Singapore Airlines.

## GE Aerospace's GENx power Vistara with SAF

GE Aerospace's GENx aircraft engines powered the industry's first wide-body aircraft on a long-haul route using Sustainable Aviation Fuel (SAF) to India recently. Vistara, India's full-service carrier and a joint venture of Tata Sons and Singapore Airlines, operated the Boeing 787-9 Dreamliner ferry flight from Charleston, South Carolina, in the United States, to New Delhi, India, used a blend of 30% SAF with conventional jet fuel.



The GENx engine is a high-thrust jet engine developed for the 787 Dreamliner and 747-8 airplane. Compared to its predecessor the CF6, the GENx engine is up to 15% more fuel efficient with up to 15% fewer CO<sub>2</sub> emissions.

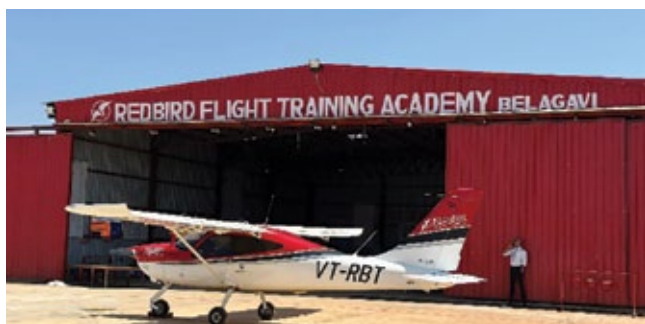
## Airbus and TASL for cargo doors



Airbus has awarded a contract to Tata Advanced Systems Ltd (TASL) to manufacture cargo and bulk cargo doors of the A320neo aircraft family. The contract is a significant step towards increasing Airbus' competitiveness in the single-aisle aircraft market and supporting the ramp-up of the A320 programme. TASL will produce these doors at a new facility in Hyderabad using cutting-edge robotics and automation technology. Each shipset will include two cargo doors and one bulk cargo door. The contract was signed by Olivier Cauquil, SVP Aerostructure Procurement, Airbus, and Masood Hussaini, VP & HO Aerostructure & Aero-Engines, Tata Advanced Systems Ltd, at Hyderabad on 29 March 2023.

## Redbird inaugurates fifth flight academy

Redbird Flight Training Academy, the biggest flying school in India and Asia Pacific, has inaugurated its fifth flying base at Belagavi, Karnataka. Redbird will equip aspiring and existing pilots



with hands-on training in the new academy. With the existing fleet of 40 aircraft, expanding to 60 aircraft this year, Redbird consists of modern technology glass-cockpit aircraft, including Tecnam P2008JC, Tecnam P2006T, Tecnam P Mentor and Cessna 172.

## AIRO Group MoU with BLADE India

Fly Blade (India) Private Limited (BLADE India), a joint venture between Hunch Ventures and Blade Air Mobility, Inc, and Jaunt Air Mobility LLC, a subsidiary of AIRO Group Holdings, Inc (AIRO), announced recently that they had signed a memorandum of understanding (MoU) aimed at launching electric vertical take-off and landing (eVTOL) aircraft operations in India and the subcontinent region by 2027. The MoU includes BLADE India's intended acquisition of 150 Jaunt Journey aircraft, with an option to order another 100 aircraft to meet the projected demand over the next decade.



## APPOINTMENTS

### Vice Admiral Sanjay Jasjit Singh is VCNS

Vice Admiral Sanjay Jasjit Singh assumed the appointment of the Vice Chief of Naval Staff on 1 April 2023. VAdm Sanjay Jasjit Singh is a graduate of the National Defence Academy, Pune, and was commissioned in 1986 in the Executive Branch of the Indian Navy. In his career spanning 37 years, he has served on most class of ships of the Indian Navy and has held a range of command, training and staff appointments, including Assistant Chief of Naval Staff (CSNCO), Flag Officer Sea Training, Flag Officer Commanding Western Fleet, Commandant Naval War College, and Controller Personnel Services. Prior to taking over as the Vice Chief of Naval Staff, he was Deputy Chief of Integrated Defence Staff (Operations).



### Vice Adm Atul Anand is DGNO, IN

Vice Admiral Atul Anand assumed charge as the Director General Naval Operations on 1 April 2023. He was commissioned on 1 January 1988 into the Executive Branch of the Indian Navy. He is an alumnus of the National Defence Academy (71st Course, Delta Squadron) the Defence Services Command and Staff College, Mirpur (Bangladesh) and the National Defence College, New Delhi. He has also attended the prestigious Advance Security Cooperation Course at the Asia Pacific Centre for Security Studies, Hawaii, USA. A recipient of the Ati Vishisht Seva Medal and Vishisht Seva Medal, he has held several key appointments in his naval career including the command of torpedo recovery vessel IN TRV A72, missile boat INS Chatak, corvette INS Khukri and the destroyer INS Mumbai.



### Vice Admiral Suraj Berry is Chief of Personnel, IN

VAdm Suraj Berry assumed charge as Chief of Personnel on 1 April 2023. The Flag Officer was commissioned on 1 January 1987 and is a specialist in Gunnery and Missile Warfare. His

sea commands include that of the missile vessel INS Nirbhik, missile corvette INS Karmuk, stealth frigate INS Talwar, and the aircraft carrier INS Vikramaditya of which he was the commissioning Commanding Officer, having been associated with the Project for nearly four years. His Staff and Operational appointments include those as the Flag Lieutenant to FOC-in-C Western Naval Command, Operations Officer of the Mobile Missile Costal Battery, Fleet Gunnery Officer of the Western Fleet, Defence Advisor to the Indian High Commissioner in Sri Lanka and Maldives, Director at the Directorate of Staff Requirements, Naval Assistant to the Chief of the Naval Staff and Principal Director Strategy, Concepts and Transformation at the Naval Headquarters.



## Vice Admiral K. Swaminathan is CPS, IN

Vice Admiral Krishna Swaminathan assumed charge as Controller of Personnel Services on 17 April 23. The Flag Officer was commissioned into the Indian Navy on 1 July 1987 and he is a specialist in Communication and Electronic Warfare. He is an alumnus of the National Defence Academy, Khadakwasla; the Joint Services Command and Staff College, Shrivenham, United Kingdom; the College of Naval Warfare, Karanja; and the United States Naval War College, Newport, Rhode Island, USA.



## Air Marshal N. Tiwari is AOC-in-C, SWAC

Air Marshal Narmdeshwar Tiwari took over as Air Officer Commanding-in-Chief (AOC-in-C), South Western Air Command (SWAC) at Gandhinagar on 1 May 2023. He succeeds Air Marshal Vikram Singh, who superannuated on 30 Apr 2023. Air Marshal Narmdeshwar Tiwari was commissioned in the Fighter Stream on 7 June 1986. He is an alumnus of the National Defence Academy and passed out as the President Gold Medalist. He has flown over 3600 hours on various types of aircraft.



## Air Marshal S. Balakrishnan takes over as CINCAN

Air Marshal Saju Balakrishnan took over as the 17th Commander-in-Chief of the Andaman and Nicobar Command (CINCAN) on 1 May 2023. The Andaman and Nicobar Command (ANC) is the only Joint-services Command in India and serves as a model for the country's planned theatreisation of Army, Navy, and Air Force capabilities. Air Marshal Saju Balakrishnan is a distinguished alumnus of the National Defence Academy Khadakwasla, having been commissioned into the fighter stream of the Indian Air Force (IAF) in 1986. With over 3200 accident-free fighter flying hours on various variants of MIG-21 and Kiran aircraft, he is an accomplished fighter combat leader.



## Air Marshal B. Manikantan is AOC-in-C, SAC

Air Marshal Balakrishnan Manikantan took over as Air Officer Commanding-in-Chief (AOC-in-C) of Southern Air Command on 1 May 2023. An alumnus of Sainik School Kazhakootam and National Defence Academy, the Air Marshal was commissioned in the Indian Air Force on 7 June 1986. He has flown over 5400 hrs on various types of helicopters and fixed wing aircraft. He is a Helicopter Combat Leader and a Type Qualified Flying Instructor. The Air Marshal has done instructional tenures at National Defence Academy and at Tactics and Air Combat Development Establishment (TACDE).



# BEL achieves record turnover of Rs. 17,300 Crores



in the field of defence and allied fields in a big way. BEL continues to focus on Research & Development through in-house efforts and collaboration with DRDO, Academia and other Industry partners. Make in India initiatives, indigenisation, outsourcing to Indian private industry, procurement from MSMEs and GeM procurement continue to top our priority list. BEL will continue to explore new growth opportunities through export initiatives, diversification, capability enhancement, competitiveness and modernisation.” 🇮🇳

**B**harat Electronics Limited (BEL) has achieved a turnover of about Rs. 17300 Cr (Provisional & Unaudited), during the Financial Year 2022-23, against the previous year's turnover of Rs. 15,044 Cr registering a growth of 15%.

BEL's Order Book as on 1 April 2023, is around Rs. 60500 Cr. In the year 2022-23, BEL secured significant orders of around Rs.20200 Cr (excluding taxes). Some of the major orders acquired during the year were Himashakti, Medium Power Radar (Arudhra), Air Defence Control & Reporting System (Akashteer), Lynx U2 systems, EW Suite for MLH Upgrade, DR118 for Su-30, Weapon Locating Radar (WLR), SARANG ESM, etc.

Some of the major projects executed during FY 2022-23 were Long-Range Surface-to-Air Missile (LRSAM) systems, Akash Missile Systems, SATCOM

Network, Command & Control Systems, various Radars, Electronic Warfare Systems, Communication equipment, Coastal Surveillance System, Electro-optic Systems, Fire Control Systems, Home Land Security Systems, Smart City projects, etc.

BEL achieved export sales of around US\$ 46.5 million during FY 2022-23 against the previous year's export of US\$ 33.3 million registering a growth of 40%. Major products exported include Transmit & Receive (TR) Modules, Radar Warning Receiver (RWR), Control Cards, Link-II Systems, Compact Multi-Purpose Advanced Stabilisation System (CoMPASS), Low Band Receivers (LBREC), Medical Electronics, etc. BEL has acquired export orders worth US\$ 75.66 million during the year 2022-23.

Mr. Bhanu Prakash Srivastava, Chairman & Managing Director, BEL, stated, "BEL has been contributing to the Government's Atmanirbhar Bharat initiative

## MoD contract with BEL for 13 Lynx-U2 FFC

**M**inistry of Defence, on 30 March 2023, signed a contract with Bharat Electronics Limited, Bangalore for procurement of 13 Lynx-U2 Fire Control Systems for Indian Navy at a total cost of over Rs 1,700 crore under Buy Indian IDMM (Indigenously Designed Developed and Manufactured) category. The Lynx-U2 System is a Naval Gun Fire Control System designed and developed indigenously. It is capable of accurately tracking and engaging targets amidst sea clutter as well as air/surface targets.

# Indian defence exports reach all-time high

Through consistent policy initiatives of the Government and tremendous contribution of the defence industry, India has achieved a remarkable milestone in defence exports in Financial Year 2022-23” states the MoD report. The exports have reached an all-time high of approx. Rs 16,000 crore, almost Rs 3,000 crore more than the previous financial year. It a rise of over 10 times since 2016-17.

India is now exporting to over 85 countries. Indian industry has shown its

(Rs in crores)

Financial Year	Total Export Value
2016-17	1,521
2017-18	4,682
2018-19	10,745
2019-20	9,115
2020-21	8,434
2021-22	12,814
2022-23	15,920

exports will continue to grow exponentially,” he tweeted.

Today, India, which was known as an importer about eight years back, exports major platforms like Dornier-228, 155 mm Advanced Towed Artillery Guns (ATAGs), Brahmos missiles, Akash Missile System, radars, simulators, mine protected vehicles, armoured vehicles, Pinaka rockets and launchers, ammunitions, thermal imagers, body armours, besides systems, line replaceable units and parts and components of avionics and small arms. 🇮🇳



capability of design and development to the world, with 100 firms exporting defence products at present. The rising defence exports and participation of 104 countries at Aero India 2023 is proof of India’s growing defence manufacturing capabilities.

In a tweet, Prime Minister Mr. Narendra Modi described the achievement as a clear manifestation of India’s talent and the enthusiasm towards ‘Make in India’. “It also

shows the reforms in this sector over the last few years are delivering good results. Our Government will keep supporting efforts to make India a defence production hub,” he stated.

Raksha Mantri Mr. Rajnath Singh termed record defence exports as a remarkable achievement of the country. “Under the inspiring leadership of Prime Minister Narendra Modi, the defence



# President takes a sortie on a Su-30MKI

President Droupadi Murmu took a historic sortie in a Sukhoi-30MKI fighter at the Tezpur Air Force Station in Assam on 7 April 2023. President Murmu is the third President and second woman President to undertake such a sortie. Expressing her appreciation, President Droupadi Murmu wrote in the visitor's book, "I congratulate the Indian Air Force and the entire team of Air Force Station Tezpur for organising this sortie. It was an exhilarating experience for me to fly in the mighty Sukhoi-30MKI fighter aircraft of the Indian Air Force. It is a matter of pride that India's defence capabilities have expanded immensely to cover all the frontiers of land, air and sea."

The President was also briefed on the operational capabilities of the aircraft and the Indian Air Force (IAF). She expressed satisfaction on the operational preparedness of the IAF. The President flew for about 30 mins covering Brahmaputra and Tezpur valley. The aircraft was flown by Gp Capt Naveen Kumar, CO of 106 Squadron. The aircraft flew at a height of about two kms above sea level and at a speed of about 800 kms per hour. 🇮🇳



All images: Saurav Chordia (Twitter @SauravChordia1)

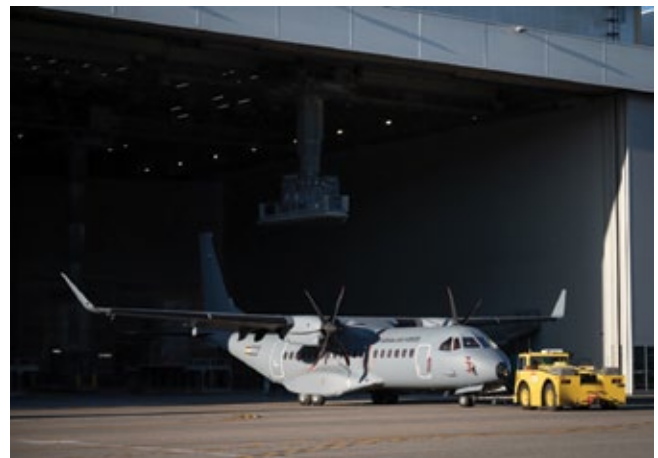
# Countdown to India's receiving its Airbus C-295



*The first C-295 for India-- engine run and roll out early April 2023*



*The plastic and wrapping coming off mid-April 2023*



*Being towed out for some sunshine!*



*And there she is looking all ready and pretty end-April 2023! Now for the testing schedules etc.*



Early May 2023, training of IAF pilots commenced on the C295MW at Airbus International Training Centre Seville, Spain.

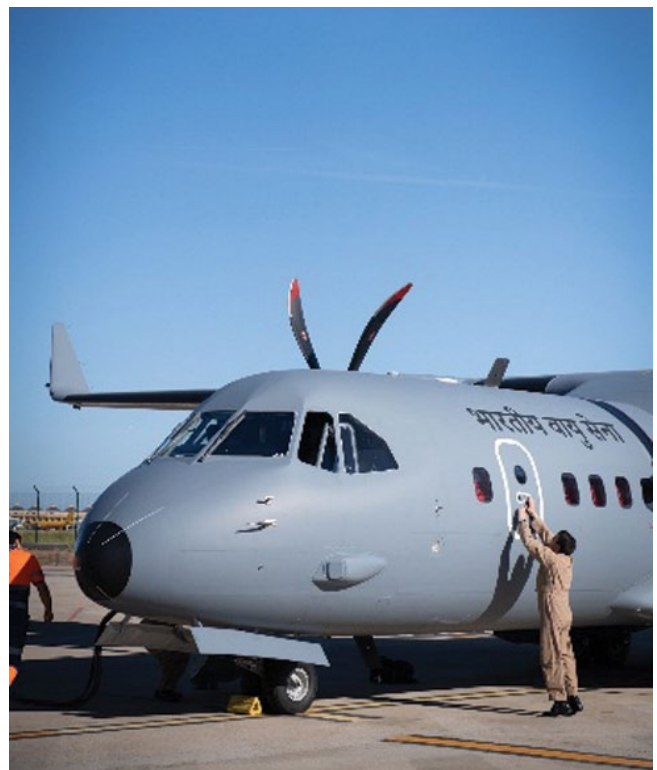
## First C295 completes maiden flight

The first C295 for India successfully completed its maiden flight, marking a significant milestone towards its delivery by the second half of 2023. The tactical aircraft took off from Seville, Spain, on 5 May at 11:45 am local time (GMT+1) and landed at 14:45 pm after three hours of flight. The global C295 programme comprises a total of 280 orders from 39 operators, making it an unmatched aircraft in its weight and mission class. ✈️



## Ground-breaking ceremony of C-295 simulator

Ushering in a new era, ground-breaking ceremony of C-295 aircraft simulator was performed at Air Force Station Agra by Airbus representatives on 31 March 2023. Senior functionaries of the Station were present at the event.



# Vikrant's Rotary Sentinel: Ka-31AEW

On 28 March 2023 the maiden night landing of helicopters onboard INS Vikrant included Kamov Ka-31 Airborne Early Warning (AEW) helicopter of INAS 339 'Falcons' flown by Test Pilot of Naval Flight Test Squadron from INS Hansa. Incidentally, the Indian Navy (IN) ordered four Ka-31 AEW helicopters in 1999 and a further five in 2001. The first batch entered service with the IN in April 2003, while the second batch was delivered in 2005. Another five entered service in 2013. INAS 339 'Falcons' squadron operate the type, with a fleet of 14 helicopters based at INS Hansa in Goa. Further acquisitions have been temporarily put on hold.

Optimised for AEW operations from major surface combatants of any size, Kamov JSC, based in Moscow, began development of the Ka-31 AEW naval helicopter in 1980 and the first flight took place in 1987. Powered by Klimov TV3-117VMAR turboshaft engines (rated at 1,633-kW each), the main mission of the helicopter is long-range detection of threats, including airborne threats such as fixed-wing aircraft and helicopters. Surveillance, target tracking and transmission of the target data to the command posts is carried out onboard the helicopter, thereby increasing the combat efficiency of associated naval units regarding interception of aerial threats plus Over-The-Horizon (OTH) strikes at hostile units. The airframe of the Kamov Ka-31, based on the proven and highly successful Kamov Ka-27, has co-axially mounted contra-rotating main propellers. The original AEW version was Kamov Ka-29TB/Ka-29RLD (Radiolokatsionnogo Dozora). The distinctive antenna of the AEW radar either rotates while operational, or remains folded and stowed under the fuselage. The Ka-31 has a maximum take-off weight of 12,200 kg. The operating altitude is up to 3,500 m. The helicopter flies on patrol at 100 km/h and the operational range with the antennas in the stowed position is 600 km. The mission duration is two hours 30 minutes. A proposal to extend the endurance of the helicopters is being considered by Air-to-Air Refuelling (AAR).



The flight deck of the Ka-31 helicopter is wider than that of the Ka-27 and accommodates the pilot and the navigator in an armour protected cockpit. The navigation suite includes a Kronstadt Kabris 12 channel Global Positioning System (GPS), digital terrain mapping, ground-proximity warning and obstacle approach warning. In IN service, the aircraft received Abris GPS system featuring a 12 channel receiver and option to employ Differential GPS references, designed by the Kronstadt itself.

The AEW radar, E-801M Oko ('Eye'), was developed by the Nizhny Novgorod Radio Engineering Institute. The 6-m<sup>2</sup> radar antenna is stowed flat against the underside of the fuselage until deployed. The navigator

switches on the radar system and the antenna extends, turning through 90° from the horizontal to the vertical plane. The landing gear retracts in order to prevent interference with the radar. In operation the antenna rotates at 6-rpm. Once the navigator has switched the radar system to operational mode, the system works autonomously without operator control. The navigator monitors the target observation on a display. The radar has 360° azimuthal coverage.

The surveillance range against a fighter aircraft size target is up to 150-km. The surveillance range against a surface ship is typically 100 km to 200 km. The radar is capable of simultaneously tracking 40 targets. Target tracking data is transferred to the command post through datalink. Power for the radar and antenna is provided by an auxiliary power unit, type TA-8Ka, installed above the rear section of the engine bay. When the radar surveillance phase of the mission is completed the antenna is retracted to the storage position. The antenna is fitted with explosive bolts enabling it to be jettisoned quickly in an emergency, such as in preparation for a forced landing. 🦋

**Sayan Majumdar**

(Photos of IN Ka-31AEWs for reference only)



## P8I simulator complex inaugurated at INS Rajali, Arakkonam



**D**efence Secretary, Giridhar Aramane, in the presence of VAdm Biswajit Dasgupta, Flag Officer Commanding in Chief, Eastern Naval Command and VAdm Sanjay Jasjit Singh, Vice Chief of Naval Staff, inaugurated the state-of-the-art P8I simulator named as 'Ashok Roy Training Simulator Complex' (ARTSC) on 25 April 2023 at INS Rajali, Arakkonam. The ARTSC will allow reduction of on aircraft training, thereby ensuring higher availability of aircraft for operational missions. This facility will aid the aircrew in practising all operational missions and complex military scenarios and it will provide the men and women in the Indian Navy, the requisite training required to operate one of the most advanced aircraft – the P8I. The training simulator complex is named 'Ashok Roy Training Simulator Complex' to commemorate the distinguished service and the supreme sacrifice made by Late Lt Cdr Ashok Roy during the gallant action in 1971 Indo Pak war.

The Boeing P8I aircraft inducted in the Indian Navy in 2013 have flown over 40,000 hrs. Designed for Long Range Maritime Reconnaissance (LRMR), Anti-Submarine Warfare (ASW), Anti Surface Warfare (ASuW) and Intelligence, Surveillance and Reconnaissance (ISR) missions, the aircraft plays a crucial role as eyes of the Indian Navy, in the vast expanse of IOR, whilst undertaking critical maritime operations. These aircraft thus, provide the nation requisite Maritime Domain Awareness, in our Area of Interest. To ensure that men and women operating these advanced aircraft are adequately trained to undertake various operational missions, Indian Navy signed a turnkey project with Boeing in 2018 to build a simulator complex with on-site AMC of 10 years. The project, only the fourth of its kind in the world along with US, UK and Australia, is the first in Asia.

The complex houses a state-of-the-art simulator for training requirements of P8I aircrew and technical team aimed towards safe operation and maintenance of the aircraft. The facility will significantly contribute towards improving training standards and reduction of training requirement on actual aircraft, thereby ensuring higher availability of aircraft for operational missions. The aircrew can practice emergencies such as Engine Failure/Fire, Rapid Decompression, Reject Take Off since these can be easily simulated for honing flying skills, but cannot be practiced in actual flying missions. The simulator also provides a first-hand experience to the technical team to practice routine and special maintenance procedures with 3D software solutions, including armament loading/unloading, as the facility is equipped with a to-scale model of aircraft wing and mock ups of missile and torpedo. The introduction of such a simulator is a transformative and progressive step towards quality training, which will significantly aid in enhancing the crew expertise towards 'on-task' mission effectiveness.

The airfield at Arakkonam was constructed for use by the Allies during World War II in early 1942. First reported air operations from the field took place when No. 2 Squadron of the Royal Indian Air Force, flying Westland Lysander aircraft undertook support flights for the British Indian Army between May-Sep 1942. During this period, 7 Rajput regiment was also stationed here, equipped with a Battery of 3.7 inch heavy anti air guns providing protection to the airfield. The airfield abandoned after war, lay unused until 1980s, when Indian Navy rehabilitated and commissioned the airfield as INS Rajali on 11 March 1992, by President of India

R Venkataraman. The location and length of over 4000 m of runway optimally suited Indian Navy's maritime surveillance and reconnaissance requirements. The air base has since become one of the largest and most advanced air stations in the country. The upgraded airbase is now home to a long-range maritime reconnaissance and anti-submarine warfare squadron, INAS 312 and Helicopter Training School, INAS 561, apart from operating HALE RPAs.

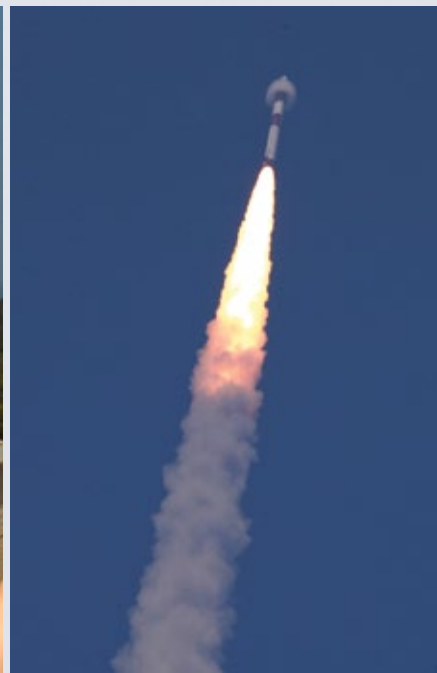
The training simulator complex is named 'Ashok Roy Training Simulator Complex' (ARTSC) to honour the dedication to Service and the supreme sacrifice made by Late Lt Cdr Ashok Roy, Vir Chakra (VrC), Nausena Medal (NM) during the gallant action in the 1971 Indo Pak war. The officer was in command of a detachment of two anti-submarine and reconnaissance aircraft of the Indian Navy during the war. On 10 December 1971, an enemy surface force was reported at sea attempting to attack an Indian harbour. It was essential to locate the enemy force before an attack on own shores. An Alize aircraft under the command of Lt Cdr Ashok Roy was launched to search the enemy force. During this operation, Lt Cdr Ashok Roy's aircraft was spotted by an enemy jet. Despite having a chance to retreat, he decided to continue his search for enemy force. In the ensuing battle between the two aircraft, the Alize was lost at sea. He was awarded 'Vir Chakra' posthumously for his service to the nation during the 1971 war.

The inauguration of the ARTSC on 25 April 23 by Giridhar Aramane, Defence Secretary, was also attended by the Managing Director, Boeing Defence India RAdm Surendra Ahuja (Retd) and the family members of Late Lt Cdr Ashok Roy, VrC, NM. 🇮🇳



# ISRO news

ISRO's PSLV-C55 mission was successfully launched on 22 April from SDSC-SHAR, Sriharikota. This was a dedicated commercial mission through NSIL with TeLEOS-2 as primary satellite and Lumelite-4 as a co-passenger satellite. The satellites weighed about 741 kg and 16 kg, respectively and both belonged to Singapore. 🚀



## ISRO's Gaganyaan mission

A budget of Rs. 9023 Crore has been allocated towards achieving the objectives of Gaganyaan mission. The scope of Gaganyaan programme is to demonstrate human spaceflight capability to Low Earth Orbit and safe return. ISRO is developing indigenous technologies for Human rated launch vehicle, Habitable Crew Module, Life Support System, Crew Escape System, Ground Station Network, Crew Training and Recovery. These technologies are crucial to meet the objectives of Gaganyaan mission and to take up any further interplanetary missions.

# ISRO conducts RLV LEX mission



**I**SRRO successfully conducted the Reusable Launch Vehicle Autonomous Landing Mission (RLV LEX). The test was conducted at the Aeronautical Test Range (ATR), Chitradurga, Karnataka in the early hours on 2 April 2023.

The RLV took off at 7:10 am IST by a Chinook Helicopter of the Indian Air Force as an underslung load and flew to a height of 4.5 km (above MSL). Once the predetermined pillbox parameters were attained, based on the RLV's Mission Management Computer command, the RLV was released in mid-air, at a down range of 4.6 km. Release conditions included 10 parameters covering position, velocity, altitude and body rates, etc. The release of RLV was autonomous. RLV then performed approach and landing maneuvers using the Integrated Navigation, Guidance and control system and completed an autonomous landing on the ATR air strip at 7:40 AM IST. With that, ISRO successfully achieved the autonomous landing of a space vehicle.

The autonomous landing was carried out under the exact conditions of a Space Re-entry vehicle's landing—high speed, unmanned, precise landing from the same return path—as if the vehicle arrives from space. Landing parameters such as Ground relative velocity, the sink rate of Landing Gears, and precise body rates, as might be experienced by an orbital re-entry space vehicle in its return path, were achieved. The RLV LEX demanded several state-of-the-art technologies including accurate navigation hardware and software, Pseudolite system, Ka-band Radar Altimeter, NavIC receiver, indigenous Landing Gear, Aerofoil honeycomb fins and brake parachute system.

In a first in the world, a winged body has been carried to an altitude of 4.5 km by

a helicopter and released for carrying out an autonomous landing on a runway. RLV is essentially a space plane with a low lift to drag ratio requiring an approach at high glide angles that necessitated a landing at high velocities of 350 kmph. LEX utilised several indigenous systems. Localised navigation systems based on pseudolite systems, instrumentation, and sensor systems, etc. were developed by ISRO. Digital Elevation Model (DEM) of the landing site with a Ka-band Radar Altimeter provided accurate altitude information. Extensive wind



tunnel tests and CFD simulations enabled aerodynamic characterisation of RLV prior to the flight. Adaptation of contemporary technologies developed for RLV LEX turns other operational launch vehicles of ISRO more cost-effective.

ISRO had demonstrated the re-entry of its winged vehicle RLV-TD in the HEX mission in May 2016. The re-entry of a hypersonic sub-orbital vehicle marked a major accomplishment in developing Reusable Launch Vehicles. In HEX, the vehicle landed on a hypothetical runway over the Bay of Bengal. Precise landing on a runway was an aspect not included in the HEX mission. The LEX mission achieved the final approach phase that coincided with the re-entry return flight path exhibiting an autonomous, high speed

(350 kmph) landing. The LEX began with an Integrated Navigation test in 2019 and followed multiple Engineering Model Trials and Captive Phase tests in subsequent years.

Along with ISRO, IAF, CEMILAC, ADE and ADRDE contributed to this test. The IAF team hand in hand with the Project team and multiple sorties were conducted to perfect the achievement of release conditions. Dr. S Unnikrishnan Nair, Director, VSSC, and Mr. Shyam Mohan N, Programme Director, ATSP guided the teams. Dr. Jayakumar M, Project Director, RLV was the Mission Director, and Mr. Muthupandian J, Associate Project Director, RLV was the Vehicle Director for the mission. Mr. Ramakrishna, Director, ISTRAC was present on the occasion. Chairman, ISRO/Secretary, DOS Mr. S Somanath witnessed the test and congratulated the team.

With LEX, the dream of an Indian Reusable Launch Vehicle arrives one step closer to reality. 🦋



# HAL's third LCA line inaugurated

## 100th Su-30MKI ROH handed over to IAF



The Defence Secretary, Mr. Giridhar Aramane inaugurated the third LCA production line and also handed over 100th Sukhoi-30 MKI ROH aircraft to Air Vice Marshal Sarin, Assistant Chief of Air Staff (Eng A), Indian Air Force in a programme at HAL's Nashik Division on 7 April 2023. The Signal Out Certificate (SOC) of the 100th ROH aircraft was handed over by Mr Saket Chaturvedi, CEO (MiG Complex) to Air Vice Marshal Sarin, VSM in the presence of HAL CMD, Mr. C.B. Ananthakrishnan and other senior officials.

systems, come out with new concepts, new platforms for future growth," he added. He also urged HAL to take up new initiatives to aggressively compete in the defence market and look into new areas like unmanned vehicles as the country is in need of these advanced systems. He emphasised on Initiatives, Innovation and Excellence and focus on performance. He visited the LCA Assembly Complex, Su-30 ROH Flight Hangar and Final Assembly Hangar.

Mr. C.B. Ananthakrishnan, CMD, HAL stated, "The new production line

will enable the Company to enhance LCA MK1A production capacity from 16 to 24 aircraft per year. HAL's Nashik Division has achieved peak overhaul capacity of 20 Su-30 aircraft per year despite having supply chain issues in current geopolitical situations." HAL has already set up two LCA manufacturing facilities in Bengaluru.

HAL's Nashik Division set up Su-30MKI Repair and Overhaul (ROH) facility in 2014, the first of its kind anywhere in the world to meet the operational requirements of the IAF. Having gained experience from manufacturing MiG-series and Su-30MKI aircraft and subsequent overhaul of MiG-series aircraft, HAL successfully mastered the technology with valuable support from the IAF, regulatory bodies and private industries. Several HAL sister Divisions are involved in the ROH activities. HAL plans to reduce the dependency on OEM by indigenising majority of components required for ROH within the next 3-5 years. 🦋



The Defence Secretary lauded HAL's efforts in taking up the challenge of setting up an ROH facility for Su-30MKI and also establishing a new production line for LCA manufacturing. He remarked that HAL had been fulfilling the needs of the country's security. He stated, "The Government has come out with several 'Aatmanirbhar Bharat' policies, and that puts HAL in a very important position. HAL will be producing more in the coming years. Build more



# HAL registers highest ever revenue of Rs. 26,500 Crores



HAL registered highest-ever revenue from operations of around Rs. 26,500 Crores (provisional and unaudited) for the Financial Year 2022-23 as against Rs. 24,620 for the previous financial year. The Company recorded a revenue growth of 8% during the year as compared to the previous year, 2021-22.

“Despite the challenges of supply chain disruptions due to geo-political situations, the Company could achieve the targeted growth in the top line. This was possible with the increased thrust on indigenisation and with the available inventory,” stated Mr. C B Ananthakrishnan, CMD, HAL.

He further added that the order book of the Company stood at around Rs. 82,000 Crores at the end of March 2023 after liquidation of the supplies during 2022-23. During the year fresh contracts of around Rs.26,000 Crores were received which includes manufacturing contracts for 70 HTT-40, 6 Do-228 aircraft and PSLV launch vehicles. In addition, on the ROH front fresh order to the tune of Rs.16,600 Crores was received during the year.

The cash flow of the Company has improved substantially with payments of around Rs. 25,000 Crores received from the various defence customers during FY 2022-23.

During the year, the income tax refund of Rs.1,798 Crores including interest of Rs. 542 Crores has been received consequent to the favorable decision of the ITAT. This will clear all the old outstanding tax litigation with the Income tax Department. 🦋



## LCA trainer in first flight



As a major milestone in the LCA Tejas Programme, the first ever series production standard LCA Trainer (LT 5201) manufactured by HAL took to the skies for its maiden flight on 4 April 2023 from HAL airport and landed after completing a successful sortie of around 35 minutes.

# Maiden Passing Out Parade of Agniveers 01/22 batch

A total of 2585 Agniveers (incl 272 women) of the Indian Navy passed out from the portals of INS Chilka, at Odhisa, in a first of its kind ceremonial, post sunset Passing Out Parade, held on 28 March 2023 under the aegis of Southern Naval Command. The parade was reviewed by Adm R Hari Kumar, Chief of the Naval Staff, in the presence of VAdm MA Hampiholi, the Flag Officer Commanding-

in -Chief, Southern Naval Command, Member of Parliament PT Usha, eminent sports personality Mithali Raj and eminent naval veterans.

The passing out parade marks, not only the successful culmination of 16 weeks of their ab-initio rigorous naval training, but also the start of a new voyage in the Indian Navy, where men and women will work together to make the Indian Navy a

Combat Ready, Credible, Cohesive and Future Proof force. During his address, the CNS urged the passing out trainees to hone their skills further and develop a strong foundation of knowledge, willingness to learn and commitment to excel in their respective careers that lay ahead. He also urged them to uphold Navy's core values of Duty, Honour and Courage, in pursuit of Nation building. 🇮🇳



# GE Aerospace: India's Trusted Partner in Aerospace and Defence

**G**E Aerospace has been a steadfast supporter of India's efforts to achieve defence self-sufficiency for the past three decades. To assist India's development, GE has maintained a sustained presence in India by constructing world-class manufacturing and engineering facilities. We take great pride in having supplied the Tejas, an indigenous Light Combat Aircraft from India, with its engines. Along with providing the programme with engines, GE Aerospace partnered with Hindustan Aeronautics Limited (HAL) to assist Tejas development, enhancing India's capacity to create cutting-edge combat aircraft. Additionally, GE and the Indian Air Force are working together to construct Tejas programme engine repair facilities in India. GE and HAL operate together to assemble and deliver GE LM2500 gas turbines, which are used to power the frigates and indigenous aircraft carrier of the Indian Navy. Over 1000 engineers work in one of GE Aerospace's major engineering facilities in Bangalore, which is dedicated to the development of new technology for aero-engine design and lifecycle support. GE Aerospace has built in India all the ingredients required to grow a full scale aero-engine industry, from design through production to lifetime support.

GE Aerospace proactively pursues a comprehensive plan geared to expand our current operations in India into a full aero-engine industry and strongly supports India's Make in India initiative. This plan is created to assist the Indian armed forces throughout the lifecycle of an aero-engine. The engineering, manufacturing, aftermarket services, and advanced manufacturing technologies are some of the components of this sector. Over the next ten years, GE wants to be a dedicated partner in making Make in India a reality. With capabilities built upon a strong, truly sustainable commercial engine component manufacturing basis, GE's own manufacturing facilities in Pune and our expanding Indian supplier chain focused on Tata (Tata Advanced Systems) are well positioned to enter the military engine manufacturing market. This capability is now based in India and contributes millions



*GE's marine LM2500*

of dollars' worth of aero-engine components annually to GE's global supply chain. Given the fact that only GE now possesses this competence in India, GE can expand there to achieve the government's Make in India ambitions.

GE Aerospace's comprehensive 'Make in India' strategy will help India achieve its aspirations for Aatmanirbar Bharat. GE's strategy is neither an idea nor a promise. It is a far more advanced reality that is happening today. GE turns 'Make in India' into 'Made in India'. Some key highlights of GE's commitment towards Aatmanirbar Bharat include GE's rapidly expanding supply chain in India. Our supply chain in India is based on a partnership with Tata Advanced Systems Limited. Each year, Tata supplies millions of dollars' worth of innovative components for GE's industry-leading LEAP engines. Tata's capabilities and capabilities continue to expand as it has demonstrated a clear ability to compete and win in the global marketplace.

GE is developing a robust network of medium and small business suppliers (MSMEs) in India as well. This growing network provides a lengthening list of essential components and services to ensure a fully indigenous manufacturing infrastructure. HAL is licensed to assemble, inspect, test and depot overhaul GE LM2500 engines in India. HAL supplies LM2500 marine engines to shipyards and the Indian

Navy. GE and HAL are partnering to produce forgings used as raw material for engine components, a first for India.

GE has also partnered with the Indian Air Force to establish Tejas engine maintenance capabilities in India including a depot within the Indian Air Force. GE offers best in class life cycle cost as similar engines power multiple platforms. At GE skill development is given vital importance, sponsoring advance training for manufacturing machinists and employing them in the GE Indian supplier network. GE partners with Indian Universities and Institutions in developing aero-engine related technologies such as our Indian Institute of Technology Madras partnership for combustion modelling and our Indian Institute of Technology Roorkee partnership for cold spray technology. 🦋



*Article by Youngje Kim, Vice President – APAC Region, Military Systems Operation – GE Aerospace*

# Rolls-Royce: 'The right collaboration can accelerate India's defence programmes and build strategic capability'



Indigenisation in defence is critical for achieving self-reliance and developing capabilities within the country. India has already taken several steps towards the creation of a domestic defence manufacturing ecosystem with the support of the private sector and global partners.

The evolution of its indigenisation policy towards co-development and co-production in partnership with global companies has also provided the much-needed impetus to the growth of the local defence industry. With geopolitical and economic crises affecting world stability, a robust and self-reliant defence ecosystem will help develop India's strategic capability, boost manufacturing and exports as well as contribute to economic and security resilience.

While efforts in this direction have been significant, India can accelerate its progression towards critical technology development and ownership through programmes that will lead to the creation of technological capabilities within the country. This will ensure long-term benefits and opportunities for further customisation and exports.

The Indian government's goal of achieving true self-reliance will actually be realised through end-to-end capability creation and ownership of intellectual property (IP). Here, a mutually rewarding partnership with a willing ally could prove beneficial.

The United Kingdom is one such country that is ready to go one step

further, enabling not only technology transfer but the co-creation of capabilities in-country. The UK industries, with the support of the UK government, have a proven history of partnerships with other nations that have resulted in successful programmes. These include the EJ200 (developed with Germany, Spain and Italy) and the ongoing next-generation Global Combat Air Programme (being developed in collaboration with Italy and Japan), wherein Rolls-Royce has played a critical role in the success of the collaboration. With a proven legacy of technology development collaborations and demonstrated technical know-how, the UK can complement India's own technical and resource strengths and capabilities for joint development. As the two countries have pledged their commitment to greater cooperation in defence and security, it is an opportune time to build on the relationship.

Rolls-Royce is well-positioned to support such a collaboration with its ecosystem of strategic local partnerships, strong supply chain, rich talent pool, digital solutions and service delivery capabilities in India. We have been serving the Indian armed forces for nine decades and are committed to strengthening this relationship. Rolls-Royce's India presence is backed by over 100 years' experience in engine design, development and manufacturing, particularly in the complex, gas turbine-based aero-engine segment. All these factors make us a potentially game-changing partner for India's combat engine programme. We are

offering a co-development model that leads to IP ownership in India, naturally followed by co-production and co-manufacturing opportunities. Such co-development will result in the creation of capability in-country to indigenise defence technologies.

India's defence industry is at a transformational tipping point. Aimed at rapid indigenisation, the government's efforts have been directed towards revamping the manufacturing ecosystem with a focus on technological innovation, enhancing capacity and building a robust supply chain to meet both domestic and international demand. At this point, a strategic collaboration that results in both technology and capability creation would accelerate India's goal of becoming a leading global defence hub. 🦋



Article by Alex Zino, Rolls-Royce

# VAYU Interview with Alain Garcia, VP, India Business Development, Boeing Defense, Space & Security and Global Services

**VAYU :** *With a strong focus from the Indian government on building an Aatmanirbhar Bharat strategy for aerospace and defence, how does the Super Hornet Block III support this vision?*

Boeing plans to further strengthen its Make in India initiatives, building on a successful track record of contributing to India's indigenous aerospace and defence ecosystem. As part of this effort, Boeing anticipates \$3.6 billion in economic impact to the Indian aerospace and defence industry over the next 10 years, with the F/A-18 Super Hornet as India's next carrier-based fighter. The economic impact would be over and above Boeing's current offset obligations and plans in the country. The strategy includes five key pillars:

**Supply Chain Development and Manufacturing:** The new plan builds on Boeing's sourcing of \$1 billion annually from 300+ suppliers on parts, assemblies and services from Indian suppliers. Boeing has added several new Micro, Small and Medium Enterprises (MSMEs) suppliers in support of our commitment to Aatmanirbhar Bharat, and they account for over 25 percent of our suppliers in India. The plan also envisages potential for additional manufacturing opportunities, including the F/A-18's Outer Wing and Nose Barrel component manufacturing and assembly. Additionally, Boeing is reviewing several hundred other machined assemblies that could be placed with Indian suppliers.

**Engineering and Technology Transfer:** Boeing envisions working closely with industry and the US and Indian governments to share technology and transfer work of the F/A-18 fighter jets in India, based on interest and business case. Boeing will also leverage investments made in the Boeing India Engineering & Technology Center (BIETC) and its talented pool of 4,500+ engineers and innovators in Bengaluru and Chennai to drive growth and innovation, and advance work in materials, manufacturing technologies and methods, and the "Digital World." As a part



of "Digital World," new manufacturing processes have been established, and Boeing has unlocked the potential of the Full-Size Determinant Assembly (FSDA) approach for its customers. With the F/A-18, Boeing will continue to explore opportunities to bring FSDA-related advanced technologies to the Indian defence industry.

**Support and training:** Boeing will collaborate with the Ministry of Defence and Indian industry to develop long-term and self-reliant sustainment solutions for the Super Hornet fleet to deliver increased aircraft availability and mission readiness. This will be done by leveraging the existing industry ecosystem across key support areas such as On and Off Aircraft Maintenance, Sustaining Engineering, Fleet Operations Support, and Training, and by leveraging the local Maintenance Repair & Overhaul (MRO) capabilities that Boeing Defence India is building.

**Investments:** Boeing India employs over 5,000 employees directly, and over 13,000 are employed through over 300 suppliers in India. Boeing's joint venture with Tata - Tata Boeing Aerospace Limited - manufactures aerostructures for Apache attack helicopters for global customers out of Hyderabad. This campus will be the largest Boeing-owned facility of its kind outside the US.

**Impact by Hornet Industry Team:** The diversity and strength of the Hornet Industry Team, comprising of General Electric, Northrop Grumman and

Raytheon, has the potential to deliver significant benefits to Indian industry. These industry leaders have proven their commitment to India by collaborating with Indian entities and delivering on Aatmanirbhar Bharat objectives. The F/A-18 will enhance collaboration with Indian industry by facilitating knowledge transfer and promoting autonomy in operating and maintaining India's fleet of F/A-18 aircraft. Further, this knowledge transfer may also provide opportunities for India to support F/A-18 fleets around the world through manufacturing and sustainment.

**VAYU :** *What is the update on the six Apaches which the Indian Army had ordered?*

On 19 January, we completed the delivery of the first fuselage for the Indian Army's six AH-64 Apache attack helicopters from our JV facility Tata

Boeing Aerospace Limited (TBAL) in Hyderabad. Spread over 14,000 sq. m., this state-of-the-art facility with over 900 engineers and technicians, it demonstrates co-development of integrated systems in aerospace and defence in India. An example of Boeing's commitment towards Make in India and Aatmanirbhar Bharat. The TBAL facility manufactures aero-structures for Boeing's AH-64 Apache helicopter, including fuselages, secondary structures, and vertical spar boxes for customers worldwide, including for the US Army. As of January 2023, more than 190 fuselages have been delivered by TBAL. Recently, we added a new production line at TBAL to manufacture complex vertical fin structures for the 737 family of airplanes, a significant milestone for the joint venture.

**VAYU: Boeing's P-8I and C-17 platforms have been actively leveraged by the Indian defence forces. How does Boeing support the maintenance and upkeep of these platforms to support mission readiness of the armed forces?**

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. Notably, the Indian Navy was also the first international customer for the P-8 and today operates one of the largest non-US fleet. Since the induction of the P-8I in the Indian Navy, Boeing has been supporting the fleet to ensure high rates of mission readiness. The 12 P-8Is in the Indian Navy's arsenal significantly contribute to the Indian Navy's capacity to keep the vast areas of interest in the Indo-Pacific under surveillance – 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 was inducted. 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. 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.



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, and the trainings commenced in April 2022. The secondary centre at the Naval Institute of Aeronautical Technology, Kochi was also 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 (IN) so far. Three of them were in heavy maintenance checks concurrently, demonstrating a maturity and scale at par with developed global MRO hubs.

We support the Indian Air Force C-17 fleet under the Globemaster Integrated Support Programme (GISP) that maintains high mission capability rates by providing them access to an extensive support network



for parts availability and economies of scale. Boeing provides comprehensive C-17 Globemaster III training solutions for aircrews and loadmasters with advanced simulation, courseware and computer-based training. C-17 operators can practice the complete range of tasks required for tactical military airlift operations and humanitarian missions, along with mission rehearsal of all scenarios including emergency procedures. Boeing's in-country C-17 training center has completed thousands of training hours for aircrews and loadmasters.

**VAYU: The Indian Air Force (IAF) had reportedly earlier indicated a requirement for additional Chinooks, update us on how the discussions are progressing?**

Boeing stands ready to support the India Air Force for any additional Chinooks required, in addition to the 15 already delivered. The Indian Air Force is best suited to confirm their procurement plans. 🛩️





# Exercises and visits

## INS Sujata visits Port Maputo, Mozambique

INS Sujata, a ship based at Southern Naval Command, Kochi, visited Port Maputo, Mozambique as a part of Overseas Deployment from 19 to 21 March 2023. The ship was received by Captain Nitin Kapoor, DA Pretoria, Commandant NRN Siva Babu, Coast Guard Afloat Support Team and Captain Florentino Jose' Narciso from Mozambican Navy amidst the fanfare of Mozambican Navy Band and traditional dance performances at the jetty.



## Exercise Konkan 2023

Konkan 2023, the annual bilateral maritime exercise between the Indian Navy and the Royal Navy, was held from 20 to 22 March 2023 off the Konkan coast in the Arabian Sea. INS Trishul, a guided missile frigate, and HMS Lancaster, a Type 23 guided missile frigate, participated in this edition and undertook multiple maritime drills to enhance interoperability and imbibe best practices. The



exercises covered all domains of maritime operations, air, surface and sub-surface, and included gunnery shoots on surface inflatable target 'Killer Tomato', helicopter operations, anti-air and anti-submarine warfare drills, Visit Board Search and Seizure (VBSS), ship manoeuvres and exchange of personnel.

## Port visit of INS Sumedha at Algiers



INS Sumedha, presently deployed in the Mediterranean Sea, entered Algiers, Algeria on 26 March 2023 for an operational turn around. The ship was received at Port Algiers by officers of the Algerian Navy and officials from Embassy of India, Algiers. Indigenously built, INS Sumedha is a stealth offshore patrol vessel constructed at Goa Shipyard Ltd and is fitted with a state-of-the-art weapon and sensor package. She is routinely deployed for fleet support operations such as anti-piracy patrol, SAR, HADR, surveillance and escort missions. She can carry an Advanced Light Combat Helicopter onboard.

## ICG Regional Sarex, Kakinada

The Indian Coast Guard Region (East) conducted Regional Search and Rescue exercise from 28-29 March 2023 at Kakinada. The aim of the exercise was to conduct a real time exercise of maritime distress scenario within regional AoR and highlight the functioning of Search and Rescue organisation for a Mass Rescue Operation (MRO) and activating the state disaster contingency plan. The exercise involved all resource agencies with effective use of available resources towards M-SAR contingency efficiently and effectively for a timely response.



## India- Africa Exercise 'AFINDEX-23'

The 2<sup>nd</sup> edition of joint military exercise "The Africa-India Field Training Exercise (AFINDEX-2023)" culminated at Foreign Training Node, Aundh, Pune. AFINDEX-2023 was held from 16 to 29 March 2023. A total of 25 nations of the African continent with 124 participants and Indian troops from the Sikh, Maratha



and Mahar Regiments participated in the multinational exercise. The validation phase of the exercise was witnessed by General Manoj Pande, Chief of the Army Staff along all the African Chiefs and representatives who attended the Chiefs' Conclave.

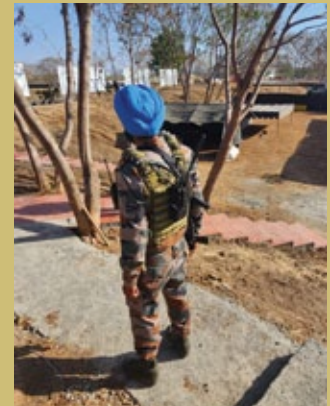
## Exicom Technologies at AFINDEX 2023

The second edition of the AFINDEX-2023 (Africa-India Field Training Exercise) was recently held at Foreign Training Node, Aundh, Pune. The joint exercise, with over 100 participants was focused on Humanitarian Mine Action and Peace Keeping Operations. The improvement of interoperability and operational readiness for UN peacekeeping missions depends on military engagement and cooperation among the participating member countries.

Exicom Technologies India was a part of the joint exercise conducted by the Indian Army on various tactical scenarios.

Exicom's radio technology was used to integrate various manned/unmanned entities like soldiers, drones, and UGVs on a centralised digital network.

Speaking about Exicom Technologies participation in the joint exercise, Mr. Raghav Agarwal stated that, "It was our honour to have gained Indian Army's trust over the years for them to let us be in charge of such a critical aspect of an operation that had the presence of both Indian and allied decision makers".



## India-Sri Lanka SLINEX-23

The 10th edition of IN-SLN bilateral maritime exercise SLINEX-23 was held at Colombo from 3-8 April 2023. The exercise was conducted in two phases: the Harbour Phase from 3-5 April 2023, followed by a Sea Phase from 6-8 April 2023. Indian Navy was represented by INS Kiltan, an indigenous Kamorta class ASW corvette and INS Savitri, an Offshore Patrol Vessel. The Sri Lanka Navy was represented by SLNS Gajabahu and SLNS Sagara. Maritime Patrol Aircraft, helicopters and Special Forces from both sides also participated in the exercise. The previous edition of SLINEX was conducted off Visakhapatnam from 7-12 March 2022.



## Joint Military Exercise 'Ex Kavach'

Andaman and Nicobar Command (ANC) conducted a large-scale Joint Military Exercise 'Ex Kavach' involving the assets of the Army, Navy, Air Force and Coast Guard. The exercise, which began on 23 February 2023, concluded on 7 April 2023. The exercise was aimed at fine-tuning joint warfare capabilities and Standard Operating Procedures (SOPs) and enhancing interoperability and operational synergy between the forces. Elements of the 'Shatrujeet Brigade' of the Army, Armed Forces Special Operations Division (AFSOD), Special Forces of the Navy and Amphibious troops of the ANC, participated in the multi-domain exercise involving amphibious



landing, air-landed operations, heliborne operations and rapid insertion of the Special Forces from mainland on a remote Island of the Andaman and Nicobar Islands.



## ASEAN India maritime exercise (AIME-2023)



Indian Naval Ships Satpura and Delhi with RAdm Gurcharan Singh, the Flag Officer Commanding Eastern Fleet embarked onboard arrived at Singapore on 1 May 2023 to participate in the Inaugural ASEAN India Maritime Exercise (AIME-2023) which was held from 2 to 8 May 2023. The Harbour Phase of the exercise was held at Changi Naval Base from 2 to 4 May 2023 and the Sea Phase was conducted from 7 to 8 May 2023 in the South China Sea. AIME 2023 provided an opportunity for Indian Navy and ASEAN navies to work together closely and conduct seamless operations in the maritime domain.

## Indo-UK joint military Exercise Ajeya Warrior-2023

The 7<sup>th</sup> edition of joint military exercise “Ajeya Warrior-23” between India and the United Kingdom was conducted at Salisbury Plains, United Kingdom from 27 April to 11 May 2023. Exercise Ajeya Warrior is a biennial training event with the United Kingdom which is conducted alternatively in the United Kingdom and India, the last edition was held at Chaubatia, Uttarakhand in October 2021.

Soldiers of the 2 Royal Gorkha Rifles from the United Kingdom and Indian Army soldiers from the Bihar Regiment participated in the exercise. The Indian Army contingent arrived at Brize Norton on 26 April 2023 by an Indian Air Force C-17 aircraft with indigenous weapons and equipment. The 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 company-level sub-conventional operations in urban and semi-urban environments under UN mandate, in addition to developing inter-operability, bonhomie, camaraderie, and friendship between the two armies.

The scope of this exercise involved a Command Post Exercise (CPX) at the Battalion level and Company level Field Training Exercise (FTX). During the exercise, participants engaged in a variety of missions testing their operational acumen in various simulated situations; showcasing and refining their tactical drills, and learning from each other’s operational experience. 🇮🇳





*Indian Air Force Mirage 2000s before a sortie*

# Cobra Warrior 2023-1

The exercise Cobra Warrior is conducted two times per year and is the largest aerial exercise in the United Kingdom. The exercise is facilitated by the no 92 Squadron of the Royal Air Force, which is based at RAF Waddington. The exercise is intended to train participants in tactical air warfare operations in large groups and at a high intensity. This edition of the exercise Cobra Warrior, also known as CW 2023-1, took place from 2 March until 24 March 2023. More than 70 aircraft and helicopters took part in the exercise and were guided by command personnel from RAF Waddington, Lincolnshire. During the exercise, a complex scenario would be



flown by the participants to the exercise every other day. During the past non-flying days, the units were able to deploy their own exercises locally to prepare for the Cobra Warrior missions. Experience shows that this option was used daily by all participants of the training.

## 92 Tactics and Training Squadron

The no 92 Squadron, also known as no 92 (East India) Squadron, and currently as the



no 92 Tactics and Training Squadron of the Royal Air Force is a test and evaluation squadron of the RAF and is currently based at RAF Waddington, Lincolnshire. The unit was formed as part of the Royal Flying Corps at London Colney as a fighter squadron on 1 September 1917. The squadron deployed to France in July 1918 and saw action for only four months, until the end of the First World War. During the conflict, the unit flew both air superiority and direct ground support missions. After a long history with the RAF, the unit has evolved into the current no 92 Tactics and Training Squadron. The unit is responsible for establishing modern tactics

and to provide training opportunities to the operational units so that the RAF can grow along with the current military situation in the world. As part of its duties at the Air Warfare Centre, the no 92 Squadron helped to set up and conduct the exercise Cobra Warrior in 2019. This exercise was then conducted for participating units of the RAF, Luftwaffe, Italian and Israeli Air Force. Since then, Cobra Warrior has grown to its current format as it is being implemented by the unit this year. The commander of the current no 92 Squadron is Squadron Leader John McFadden. He is the person within the squadron who coordinated this exercise in 2023. McFadden stated, “We

are looking forward to delivering Exercise Cobra Warrior 23-1. 92 Sqn have developed a challenging air-led multi-domain exercise focused on pitting our NATO, JEF and International partners against a capable peer adversary within a contested degraded and operationally limited threat environment. Over three weeks, we will bring together our capabilities and deliver the full spectrum of Air Operations, including Defensive and Offensive Counter-Air as well as Strike Operations. These will include RAF Regiment Precision Strike Teams, Air Manoeuvre operations to support ground forces, and also developing our Joint Personnel Recovery Capability”.



## Objectives

The Cobra Warrior exercise is the final piece of the Royal Air Force’s tactical training. The exercise is designed to qualify personnel in various roles in the Royal Air Force. During the exercise, the training of the Qualified Weapons Instructor, Qualified Multi-engined Tactics Instructor, Qualified Intelligence, Surveillance and Reconnaissance and Qualified Space Instructor is completed. All these roles are dealt with in a tactical chess game and can train optimally in a unique environment. The goal of Cobra Warrior is to develop the tactical skills of the participating aircrews and support elements within a Composite



Air Operation (COMAO) environment. The exercise provides valuable opportunities for all participating elements to practice and develop tactics, techniques and procedures in complex scenarios against a realistic opponent. The military world is constantly changing. The world of 10 years ago is no longer the world of today. With the use of the expertise of the no 92 Squadron, the exercise is continuously further developed and adapted to the geopolitical and military balance that is current in the world at that time. The lessons of this edition of the exercise, together with editions from the past, are the input for the edition that will take place later this year. Group Captain Jim Calvert, is the Exercise Director of the exercise Cobra Warrior. Jim explains; "What Cobra Warrior provides us is what we call collective training. What nations and squadrons will do is they will train their crews to be tactical experts on their individual platforms. What an exercise such as Cobra Warrior does is it brings all of those platforms together, both UK and partner-nations. It just allows us to train and integrate together, so that we can prove, and we can test, and adjust and enhance our interoperability." For the Royal Air Force, another important aspect of the exercise is that it provides the opportunity to complete training within the Mission Employment Phase for future RAF weapons instructors.

The level of training combined with the variety of training partners helps to achieve the required standards within the Weapons School criteria.

### RAF Waddington

The majority of the Non-English or Non-American units were based at RAF Waddington near the city of Lincoln in the United Kingdom during Cobra Warrior. One of the countries that used this airbase was Finland. This country sent a total of six McDonnell Douglas F/A-18C Hornets to the United Kingdom. The Finnish Hornets came from Rovaniemi Air Base in the north of the country. The aircraft are assigned to

the HävLLv 11, which is part of the Lapin Lennosto Wing. The Finns' fighters were supported by some PC-12 light transport aircraft which took ground crew and support equipment to RAF Waddington. Finland was on the threshold of NATO membership when the exercise started. On Tuesday, 4 April 2023, the country officially joined NATO as the 31st member state in response to, among other things, the Russian threat as a result of the Ukraine war. Finland has been a loyal member of the Partnership for Peace programme for many years. The PfP countries are closely linked to NATO but not member states. PfP participants often train together with





units from the NATO countries. Finland has also been a participant in the United Kingdom-led Joint Expeditionary Force (JEF) programme for some time now. The JEF includes the countries Denmark, Finland, Estonia, Iceland, Latvia, Lithuania, Netherlands, Norway and Sweden. All countries, except Sweden, are members of NATO. The JEF is intended to be a pool of troops on high readiness and adaptability designed to enhance the UK's ability to respond quickly anywhere in the world. This is done with like-minded allies or on behalf of international organisations such as the United Nations or NATO. The Finns would usually fly twice a day on the non-Cobra Warrior days for their individual training.

The Belgian Air Force also participated in Cobra Warrior. The Belgians came from the 10 Wing of the Belgian airbase Kleine-Broegel in northern Belgium. In total, the Belgians participated with six F-16AM Fighting Falcon fighter aircraft. The aircraft of the Belgian Air Force were logistically supported during the exercise by several Airbus A400M transport aircraft from the 15 Wing, which is based at Brussels Melsbroek Air Base. What is special is the fact that the Belgians only participated in the first two weeks of the exercise. On Friday during the second week, the F-16s returned home. On the non-Cobra Warrior days,

the Belgians also flew various individual training sessions from RAF Waddington. Several aircraft have also been sighted in the low flying area in the Lake District in the north of England. The Belgians usually use this area more often to train low flying skills and are therefore qualified to fly here. "It is wonderful once again to welcome our fellow RAF and international colleagues to RAF Waddington to participate in this world class air exercise," stated Group Captain Mark Lorrimer-Hughes, the RAF Waddington Station Commander. "Cobra Warrior provides an invaluable opportunity for international Allies and Partners to train together in developing operational tactics in the air", he added.

### Indian Air Force

One of the most remarkable participants in the exercise Cobra Warrior 2023-1 was the participation of the Air Force of India (IAF). The IAF had travelled to the British RAF Waddington for Cobra Warrior with a total of more than 145 air force personnel. The delegation had gathered from all corners of India at Jamnagar Air Force Station. The main objective for the Indians was to learn to participate in exercises that allow training with multiple types of combat aircraft. Practicing combat scenarios with and against types such as the F-16 Fighting Falcon, F/A-18 Hornet and

the Eurofighter Typhoon is very special and also very educational for the Indian delegation. Flight Lieutenant Samarth Shukla of the Indian Air Force explained, "We have travelled halfway around the world, including stops in Saudi Arabia and Greece, to reach this place. Exercise Cobra Warrior is a great opportunity for us to learn and to fly with other nations. It has given us the opportunity to learn from other nations, share our experiences and, all in all, improve us. The aim of the exercise is to participate in diverse fighter aircraft engagements and learn from the best practices of various Air Forces. When we get back, we will share our experiences and improve the Indian Air Force as a whole."

Group Captain Pranav Raj, is the commander of the 7th Mirage squadron 'Battle Axes'. He is the Exercise Director of the Indian Air Force during this detachment. Pranav stated, "The team has faced several challenges, including the weather, which is quite different from Gwalior in Central India. More than 80% of the team saw snow for the first time. Despite these challenges, the maintenance team has done a great job keeping all five aircraft available for missions. The exercise was a great learning experience as the Indian Air Force has flown with F-18s and F-16s and participated in the full spectrum of air operations, including offensive and defensive counter missions".

The participating delegation from India consisted of five Mirage 2000I and 2000TI fighters (respectively two Mirage 2000I and three Mirage 2000TI aircraft). The fact that Mirages from the IAF come to this exercise can simply be called special. The IAF has only a relatively small pool of these aircraft in its orbat. Most fighters in the Indian Air Force are MiG-21 and Su-30 fighters. The Indian Air Force has only one wing that operates with the Dassault Mirage 2000. This unit is the 40 Wing based at Gwalior/Maharajpur Air Force Station which is part of the Central Air Command. The 40 Wing was formally established on 28 November 1982. After its establishment, the wing would immediately be equipped with the Mirage 2000. The 40 Wing is the only wing in India to fly the Dassault Mirage 2000. The first Mirages were delivered to this wing from the end of 1985. The Mirages during Cobra Warrior came from two squadrons, namely the 1 Squadron 'The Tigers' and the 7 Squadron 'Battle Axes'. The aircraft were escorted by an Ilyushin IL-78 'Midas' tanker during the long flight from India to Europe. The IL-78 comes from Agra Air Force Station of the Central Air Command and is assigned to the 78 Squadron of the 4th Wing. This unit is also known as 'Valorous Mars' in India. Two Boeing C-17A Globemaster III strategic transport aircraft were used for the transport. These

aircraft both came from Hindon Air Force Station of the Western Air Command. These aircraft fly there with the 81 Squadron 'Skylords', which is part of the 28th Wing.

The fact that the Dassault Mirage 2000 of the Indian Air Force came to Europe was very unique, given that the aircraft are already getting old and the fact that the IAF only has 56 airframes in use. The Dassault Mirage 2000 is referred to in India as the Mirage 2000 'Vajra', freely translated from Hindi this means 'Lightning'. The Air Force of India has received a total of 48 single-seat Mirage 2000H and eight two-seat Mirage 2000TH aircraft. The big difference with the version in service with the French Air Force is the fact that the Indian Mirages are able to carry the Russian R-73AE Archer missile under the wings. As is known, the Indian Air Force also has many Russian types in service, which made the upgrade to carry this missile a logical choice for the Indians. The Mirages can carry the R-73AE since the 2007 upgrade. From 2015, the IAF's Mirages were upgraded to the Mirage 2000-5 MK2 standard. Following the upgrade to the Mirage 2000-5 standard, the IAF's Mirages are referred to as the Mirage 2000I and Mirage 2000TI. This version of the aircraft is an Indian specific version for the Indian Air Force, the aircraft is similar to the Mirage 2000-5 Mk2 which

is equipped with a mix of Indian, French and Israeli avionics and weapons packages. The contract was signed in 2011 and the first upgraded aircraft was delivered in 2015. Dassault-Aviation updated the first few Mirage 2000H, 2000TH aircraft to 2000I, 2000TI standard. The later updates were carried out by Hindustan Aeronautics Limited. It is the intention that the Mirages of the IAF standard will last at least until the year 2030. From that moment on, the intention is that the aircraft will be replaced by a new type to be purchased. Which type is for now still an unanswered question.

### RAF Coningsby, Lakenheath, Brize-Norton, Leeming

In addition to RAF Waddington, many participants of the exercise were based at RAF Coningsby in Lincolnshire. The Royal Air Force participated from this airbase with a large number of Typhoons from the local units on this air base. The Royal Saudi Air Force was one of the foreign participants in the Cobra Warrior exercise. The Saudi Arabian Air Force participated with a total of six EF2000 Eurofighter Typhoon aircraft. The aircraft all came from Taif/King Fahd Air Base where the aircraft are part of the Royal Saudi Air Force (RSAF) 2nd Wing. This unit has three squadrons flying the Typhoon on active duty at this air base. These squadrons are; the no 3 Squadron,





the no 10 Squadron and the no 80 Squadron. During the Cobra Warrior exercise, all three of these units were present at RAF Coningsby to train with the International Alliance. All three squadrons were present in the United Kingdom with two aircraft and were all equipped with the squadron markings of the relevant units. It is quite special to see these planes in Western Europe, because these aircraft don't come this way very often. The RSAF aircraft were supported by transport aircraft of the type Lockheed C-130 Hercules. The Typhoons were escorted to the United Kingdom by two Airbus A330 MRTT

aircraft which carried also the associated ground crew on board. These aircraft would also refuel the Typhoons in the air during the flight to the west.

From the American airbase RAF Lakenheath, F-15E Strike Eagle fighter aircraft participated in the exercise. These aircraft are assigned to the 48th Fighter Wing of the United States Air Force Europe. The specific unit that took part in Cobra Warrior was the 492nd Fighter Squadron 'Bolars/Madhatters'. The entire exercise was supported by several Voyager tankers operating from RAF Brize-Norton

in the south of England. In addition, the British Joint Helicopter Command was temporarily stationed at RAF Leeming from where it took part in the exercise. The RAF's Air Mobility Force also took part in the exercise where elements of 16 Air Assault Brigade were deployed on an associated ground mission which formed part of the overall exercise scenario. The helicopters were deployed and were in the meantime supported by the combat aircraft in the same area. 🇬🇧

**Text: Joris van Boven and Alex van Noije**  
**Photos: Alex van Noije**



# IAF at Exercise Desert Flag VIII



An Indian Air Force contingent comprising of 110 Air Warriors arrived at Al Dahfra airbase of United Arab Emirates and participated in Exercise Desert Flag VIII. The IAF participated with five LCA Tejas and two C-17 Globemaster III aircraft and this was the first occasion when the LCA Tejas has participated in an international flying exercise outside India. Exercise Desert Flag is a multilateral air exercise in which Air Forces from UAE, France, Kuwait, Australia, UK, Bahrain, Morocco, Spain, Republic of Korea and USA also participated. The exercise was conducted from 27 February 2023 to 17 March 2023. The aim of the exercise was to participate in diverse fighter engagements and learn from the best practices of various Air Forces. ✈



# Indian Air Force at Exercise Iniochos-23



The Indian Air Force (IAF) participated in Exercise INIOCHOS-23, a multi-national air exercise hosted by the Hellenic Air Force. The exercise was conducted at the Andravida Air Base in Greece from 24 April 2023 to 4 May 2023. The Indian Air Force participated with four Su-30MKI's and two C-17 aircraft.

The objective of the exercise was to enhance international cooperation, synergy and interoperability amongst the participating Air Forces. The exercise was conducted in a realistic combat scenario involving multiple types of air and surface assets. It also enabled the participating contingents to engage in professional interactions, providing valuable insight into each other's best practices.

The Exercise was divided into three phases: Phase 1: Detachment Deployment, 18–23 April 2023; Phase 2: Execution Phase, 24 April–4 May 2023 and Phase 3: Force Redeployment, 5–7 May 2023.

Planning, execution and debriefing of all missions was supervised by the Hellenic Air Force (HAF) Fighter Weapons School (FWS). The missions covered the full spectrum of air operations performed by HAF, such as Offensive Counter Air Operations (OCA), Defensive Counter Air Operations (DCA), Strategic Air Operations, Air Power Contribution to Counter-Land Operations (APCLO), Air Power Contribution to Maritime Operations (APCMO), RECCE, Combat Search and Rescue (CSAR), Time Sensitive Target (TST) and High Value Airborne Asset (HVAA).

During Iniochos 2023, the F-16 Tactical Simulators of the newly established HAF's Synthetic Training Squadron were

used for a number of missions, expanding Iniochos to the virtual world. Iniochos 2023 involved a large number of HAF assets, such as fighters, including the recently acquired Rafale, air defence systems, helicopters, transport and training aircraft. Additionally, Hellenic Army, Navy and Special Operations assets and personnel





contributed significantly to the creation of complex and realistic scenarios across the exercise areas which spread over the Greek mainland and seas.

Austria participated with INTEL personnel and Canada with Air Battle Managers. The significant regional impact of Iniochos 2023 prompted the interest of a number of Nations which declared the intention to participate with observers, such as Bahrain, Germany, Montenegro, Morocco, Slovakia, Tunisia and UAE. 🇺🇦

(All photos: IAF/HAF/Greek Embassy)

### Iniochos 2023 participants

- ♦ Cyprus with an AW139 Helicopter
- ♦ France with Rafales
- ♦ India with Su-30
- ♦ Italy with Tornados
- ♦ Jordan with F-16s
- ♦ Saudi Arabia with F-15s
- ♦ Slovenia with PC-9s
- ♦ Spain with EF-18s
- ♦ USA with F-16s and MQ-9s





# IAF and Exercise Orion 2023

**A**n Indian Air Force (IAF) contingent departed for France, to participate in Exercise Orion at Mont-de-Marsan, an Air Force base of the French Air and Space Force (FASF) on 10 April 2023. The exercise was conducted from 17 April to 5 May 2023, with the IAF contingent comprising four Rafales, two C-17s, two Il-78 aircraft and 165 air warriors. This was the first overseas exercise for the IAF's Rafale aircraft.

Besides the IAF and the FASF, Air Forces from Germany, Greece, Italy, Netherlands, United Kingdom, Spain

and United States of America also flew in for this multilateral exercise. France launched its biggest military exercise in decades, together with its NATO Allies. The second phase of Exercise Orion 23 involves 7,000 personnel and assets from France and several Allied countries, including Germany, Greece, Italy, the Netherlands, Spain, the United Kingdom and the United States, and focuses on defensive operations on land, in the air, at sea and in cyberspace.

The drills are conducted over several months, starting in late February and ending

in May 2023. The peak of the exercise is scheduled from late April to early May, in north-eastern France. During this phase, around 12,000 troops will be deployed on the ground and in the skies to repel a simulated high-intensity attack.

As highlighted by the French Chief of Defence Staff (CEMA) in his strategic vision, the changing international context requires France to envisage the nature of future operations in a three-phase continuum of competition-contest-conflict. Exercise Orion 2023 is the first exercise in what French Joint Forces Command





hopes will be a triennial cycle of exercises aimed at reinforcing joint forces operational readiness.

Orion is based on a scenario developed by NATO to apprehend the different phases of a modern conflict and will be on a scale unprecedented in recent decades. It aims to train the French armed forces within a multinational joint forces framework, with the goal of refocusing the armed forces and their various branches and administrative levels on a joint, multi-domain (MDO) exercise in a contested environment. The exercise also involves an inter-ministerial perspective extending beyond purely military concerns. So, one of the major training themes of Orion 23 will be the coordination of assets and effects over the full spectrum of operations, in order to tackle these hybrid strategies. For example, as a joint forces inter-ministerial exercise, Orion will bring together the energies of civilian and military personnel working on the cohesion of the French nation and on France's resilience in the face of the challenges presented by an international context of growing instability.

"The integration of our Allies in the exercise reinforces the credibility of the defence alliance, while demonstrating France's capability to engage as a leading coalition partner. Several international partners (United States, United Kingdom, Spain etc.) have confirmed that they are taking part in the various phases of the exercise. This multinational dimension will enable every branch of French command to integrate allied units and optimise interoperability with them. This exercise will directly help to demonstrate France's role as a major force for balance, able to commit to the defence of its own interests and to live up to its ambitions by engaging its effective

participation in any actions that the Alliance may take in response a crisis. In this respect, the exercise will enable France to position itself as one of the few European nations able to summon this level of expertise in the operational planning and conduct of large-scale military exercises", stated FASF officials.

Exercise Orion will also enable the various branches of the French armed forces to maintain their response capability and their capacity to meet the demands of their operational contract. It will integrate around twenty training exercises (AsterX, DEFNET, POLARIS etc.) that are normally conducted separately by the armed forces. Consequently, the training will gain in density, with greater realism and higher intensity, while reducing the logistic workload and achieving economies of scale. ✈️

**Text: Indian and French MoD**  
**Photos: IAF/FASF**



The IAF Team made a quick halt in Egypt on their way to France for Orion 23: "Shukran Jazeelan to our Egyptian partners for the hospitable stay".



# IAF and Exercise Cope India 2023

**E**xercise Cope India 23, a bilateral Air Exercise between the Indian Air Force (IAF) and the United States Air Force (USAF) was held at Air Force Stations Arjan Singh (Panagarh), Kalaikunda and Agra. The exercise aimed to enhance mutual understanding between the two Air Forces and share their best practices.

The first phase of the exercise focussed on air mobility and involved transport aircraft and Special Forces assets from both the Air Forces. Both sides fielded the C-130J and C-17 aircraft, with the USAF operating an MC-130J, as well. The exercise also included the presence of Japanese Air Self Defence Force aircrew who participated in the capacity of observers.

The next phase of the Exercise Cope India 23 commenced at Air Force Station Kalaikunda on 13 April 2023. This segment of the exercise witnessed participation of B1B bombers of the United States Air Force (USAF). F-15 fighter aircraft of the USAF also joined the exercise subsequently. The Indian Air Force (IAF) element included the Su-30MKI, Rafale, Tejas and Jaguar fighter aircraft. The exercise was supported by aerial refuellers, Airborne Warning and Control System and Airborne Early Warning and Control aircraft of the IAF. The exercise concluded on 24 April 2023. ✈

(All photos: IAF/USAF)





# Cobra Warrior 23-1 at RAF Waddington and RAF Coningsby



## IAF participates for the first time

*Indian Air Force Mirage 2000 at RAF Waddington*

**C**obra Warrior (CW) is a Royal Air Force exercise that takes place twice a year. CW 23-1 took place from 6–24 March 2023. The exercise focussed on training international allies in developing operational tactics in the air. Contrary to other exercises the flying windows were limited to two or three days a week with only one mission flown on these days. Fighter aircraft were supported by refueling aircraft which included the Voyager KC.2/KC.3 assigned to 10 and 101 squadrons based at RAF Brize Norton. Other refueling aircraft were provided by the 351 ARS, 100 ARW based at RAF



Mildenhall. During the CW 23-1 missions, the fighter aircraft departed to the North Sea. Here several Air-to-Air refueling tracks were established. This included ARA8 from RAF Waddington located directly east off the coast of Lincolnshire. During the non-CW days the participating crews flew other missions which saw them using the low flying areas “Lake District” in Cumbria and “Mach Loop” in west-central Wales.

### First time participants

CW 23-1 saw three air forces participate for the first time. From Europe, the Finnish Air Force took part with their F/A-18C Hornets. Finland has been a long-time partner of NATO and joined the alliance



of frontline XIII squadron assigned the MQ-9 Reaper. 14 squadron operating the Shadow R1+, a military modified Beech 350. 51 squadron is equipped with three RC-135W Rivet Joint aircraft. 54 squadron borrows aircraft when required to fulfill its ISTAR Operational Conversion Unit role. Their sisters, 56 squadron are tasked with Air C2ISR Test and Evaluation. The Central Flying School display team the Red Arrows also calls RAF Waddington home after they relocated from RAF Scampton located just to the north of Lincoln.



on 4 April 2023. Besides taking part in the exercise, they also used their stay in the United Kingdom to train in support of “JEF Warrior”, a UK led Joint Expeditionary Force. From the Middle East, the Royal Saudi Arabian Air Force participated with its Typhoon fighters. From Asia and flying the longest distance were the Mirage 2000’s of Indian Air Force (IAF) 7 squadron “Battle Axes” one of the three Mirage 2000 squadrons, stationed at Maharajpur AFS. It was not the first visit of the IAF to the UK. Earlier, their Su-30 fighters deployed to RAF Coningsby however then to take part in exercise Indradhanush.



## 92 squadron

Cobra Warrior is organised by the Air Warfare Centre’s 92 squadron. Once flying the Phantom FGR.2 out of RAF Wildenrath, Germany the squadron was deactivated on 1 July 1991. It was reactivated as 92 (R) Squadron for just two years (23.09.92 – 01.10.94) at RAF Chivenor flying the Hawk T.1 On 30 June 2009, the squadron was again reactivated designated 92 Reserve and Tactics squadron at RAF Cranwell and organised within the Air Warfare Centre at RAF Waddington. Since 2019 the squadron has been organising Cobra Warrior (the Cobra originating from their batch) in support of the RAF international participating squadrons.

## Royal Air Force bases and Cobra Warrior

The main base during Cobra Warrior was RAF Waddington located just south of the city Lincoln, Lincolnshire. It serves as the Royal Air Force Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) and the main operating base for airborne intelligence aircraft and systems. Five squadrons are based here, all reporting to No 1 Group. These consist

RAF Coningsby is the second base from where Cobra Warrior missions were flown. It serves as home to No 1 Group squadrons as well and is one of the two Typhoon bases. Two front line squadrons are based, 3(F) squadron and XI (F) Squadron. 29 squadron is the Operational Conversion Unit while 41 (test and evaluation) squadron focus primarily on the Typhoon capability and tactics development. The fifth Typhoon unit is the joint Qatar/RAF 12 squadron

## Fighter aircraft participants

Country	Aircraft	Squadron, wing	Home base	CW 23-1 based
Belgium	F-16AM (6)	349 smaldeel, 10 wing	Kleine-Brogel	RAF Waddington
Finland	F/A-18C (6)	HävLLv 31	Kuopio/Rissala	RAF Waddington
India	Mirage 2000I (2) Mirage 2000TI (3)	7 squadron	Maharajpur AFS	RAF Waddington
Saudi Arabia	Typhoon F.2 (1)	3 squadron	King Fahd Air Base	RAF Coningsby
	Typhoon F.2 (2) Typhoon T.3 (1)	10 squadron	King Fahd Air Base	RAF Coningsby
	Typhoon F.2 (2)	80 squadron	King Fahd Air Base	RAF Coningsby
United Kingdom	Typhoon FGR.4	3 (F) squadron	RAF Coningsby	RAF Coningsby
	Typhoon FGR.4	11 (F) squadron	RAF Coningsby	RAF Coningsby
United States	F-15E	48 FW	RAF Lakenheath	RAF Lakenheath



It's unknown if 492 FS and/or 494 FS participated as well as the number of F-15E's were assigned to CW 23-1.

Almost all RAF Typhoons are devoid of squadron markings. Exceptions are 12 and 41 squadrons of which most but not all are wearing their squadron batches. The same applies to a few of the RAF Lossiemouth based squadron Typhoons. Therefore, it's unknown how many Typhoons of these squadrons took part in Cobra Warrior.

## Cobra Warrior 23-2

CW 23-2 is scheduled to take place in September. The exact dates are unknown as well as the countries which will arrive at RAF Waddington and perhaps also RAF Coningsby. Rumours have already started. It will be nice to follow all these. 🦅

**Article and photos: Manolito Jaarsma**  
**Instagram: Phantomaviation**  
**Twitter: @Phantomaviation**



formed after Qatar purchased the Typhoon. Finally, the base is home to the Battle of Britain Memorial Flight operating several World War II aircraft.

The UK's Joint Helicopter Command (unifying Royal Navy, Army Air Corps and Royal Air Force battlefield helicopters into a single command) also took part in the exercise. Several helicopters were deployed to RAF Leeming. These due to the lack of information and not having visited the base are not listed in the table.

The 48 Fighter Wing also participated in the exercise with its F-15E Strike Eagle.

# IAF Mirage 2000s at RAF Waddington for Exercise Cobra Warrior



All photos: Manolito Jaarsma  
(Instagram: Phantomaviation Twitter: @Phantomaviation)

# The IAF's Suryakiran Aerobatic Team



The Suryakiran Aerobatic Team is a renowned aerobatic display team of the Indian Air Force, captivating audiences with their breath-taking aerial manoeuvres. Combining precision, skill and grace, they have become a symbol of pride and excellence in the Indian aviation industry. Suryakiran - Rays of the sun (in

Sanskrit) was born in 1996 and has been personifying the motto of the Indian Air Force "Touch the sky with glory" ever since. The Day-Glo orange and white paint scheme on the aircraft signifies the meaning of the team's name i.e. Suryakiran. Formed in 1996, the Suryakiran Aerobatic Team consists of highly trained pilots

from the Indian Air Force who showcase their expertise in precision aerobatics. The team enthralled many spectators in India as well as abroad on the Kiran Mk II till 2011 and in 2015 the team was resurrected on Hawk Mk 132 aircraft. Since its resurrection has steadily grown from a 4 aircraft formation to the current glorious







9 aircraft formation. The team is based in Bidar, North Karnataka.

The team currently has 12 pilots, 3 engineering officers, 1 commentator and 1 medical officer and is led by Gp Capt. GS Dhillon. All the pilots are Qualified Flying Instructors and belong to the fighter stream of the IAF and are specially handpicked to be a part of this prestigious team.

The Team's displays involve a seamless fusion of individual skills, teamwork and

meticulous planning. Their synchronized movements in the sky demonstrate not only the precision and mastery of their pilots but also their dedication to perfection. From stunning formation loops and barrel rolls to gravity-defying crossovers, their performances push the limits of aerial artistry. Beyond their awe-inspiring displays, the Suryakiran team plays a vital role in inspiring the next generation of aviators. They participate at air shows,

public events and exhibitions, igniting the passion for aviation among young enthusiasts.

The Suryakiran Aerobatic Team continues to amaze audiences worldwide, showcasing the pinnacle of skill, precision, and artistry in aviation, deriving directly from the high standards and traditions set by the Marshal of the Air Force Arjan Singh. ✈️

**Article and photos: Mayyank Kaul**





## Red Arrows at RAF Waddington

We had the pleasure of visiting the famous Red Arrows Aerobatic Team (of the RAF) at Waddington. Having seen the team displaying and aweing one and all around the world including at airshows and ofcourse having performed in India many years ago, it was a full circle by us visiting them at their new homebase at RAF Waddington.

Since flying the first time in 1965, the Royal Air Force Aerobatic Team has performed more than 4,900 times across the globe. The Red Arrows are lucky to have both a wonderful history and the support and interest of millions of well-wishers. It was in 1964 when the Royal Air Force amalgamated its display teams into one, premier unit – the Red Arrows. The name was taken from the Black Arrows team and the colour scheme as a tribute to the Red Pelicans, while the aircraft chosen to be flown, the Gnat, had been used by the Yellowjacks.

In the first season of 1965, the team – flying seven aircraft in a display and based at RAF Fairford – performed 65 shows. A media event at RAF Little Rissington on 6 May was the team's first official display, with the first public performance in the UK on 15 May at Biggin Hill Air Fair.

The team permanently increased to nine display aircraft in 1968 and the Diamond Nine became the Red Arrows' trademark formation.

The Gnat, which had flown 1,292 displays, was replaced by the BAE Systems Hawk, a modified version of the RAF's fast jet and weapons trainer, for the 1980 season. Also that year, permission was given for the team to have the motto Eclat – meaning excellence. RAF Scampton – the Lincolnshire station famous for its role in the 1943 Dambusters raid – became the team's new home in 1983, moving from RAF Kemble – its base since 1966. The Red Arrows temporarily relocated to RAF

College Cranwell, also in Lincolnshire, between 1995 and 2000.

During the team's world tour of October 1995 to February 1996, the Red Arrows performed to nearly a million people in Sydney on Australia Day. In 2002, the Red Arrows flew with a British Airways Concorde over London to mark Her Majesty The Queen's Golden Jubilee. A decade later, the Red Arrows performed another series of flypasts over the capital, for the Queen's Diamond Jubilee, the 2012 Olympic Games Opening Ceremony – seen by a global television audience in excess of one billion people – and the Athlete's Parade.





The 4,500th Red Arrows display took place at the RAF Waddington International Air Show in July 2013 – in the team's 49th season and the year concluded with a highly-successful tour of the Middle East. In 2014, the 50th display season was marked as a major milestone with a series of celebrations throughout the year. The Red Arrows were the main feature and theme of the year's airshows. There were also television and radio documentaries, magazines produced and even a high speed train named after the team.

A special, one-off, tailfin was revealed on the team to recognise the anniversary season, with the design incorporating both a Gnat and Hawk jet outline to reflect the two types of aircraft flown by the team in its history. For the 2015 season, instead of returning to the traditional three-stripe tailfin livery used since the 1960s, a fresh new paint scheme was revealed on the jets during a live television broadcast from RAF Scampton. This Union flag-inspired design features flowing red, white and blue lines and emphasises the Red Arrows' role as national ambassadors for the United Kingdom.

In September 2016, after a busy domestic season, the team embarked on its biggest overseas tour in a decade. The nine-week deployment to the Asia-Pacific and Middle East regions covered 20,000 miles. The tour took the Red Arrows to 17 countries – including visiting China for the first time in the Squadron's history. It is estimated the team's activities were seen by a global audience, in person or through media channels, of up to one billion people. The

deployment contributed to the Government's GREAT campaign, supporting UK interests across business, trade and education and promoting the best of British innovation, technology and creativity.

For 2018, the Red Arrows spearheaded celebrations marking the Royal Air Force's centenary - including providing the colourful finale to a flypast of more than 100 aircraft over central London



# Red Arrows in action!

*All images: Twitter @rafredarrows*



first the Folland Gnat which was replaced in 1979 by the BAE Systems Hawk T1. The Hawks are modified with an uprated engine and a modification to enable smoke to be generated; diesel is mixed with a coloured dye and ejected into the jet exhaust to produce either red, white or blue smoke.

All Red Arrows display pilots are fast-jet pilots, having previously flown with frontline Royal Air Force squadrons. Once they have finished their tour with the team - usually three years in total - they will return to operational, training, staff duties or other roles in the Royal Air Force.

in July of that year. In 2019, the team carried out its largest-ever tour of North America, spanning 11 weeks, with award-winning, coast-to-coast performances that reached hundreds of millions of people and supported a range of UK businesses, trade and interests.

A move to a new Lincolnshire home – RAF Waddington – came in late-2022, with the team leaving its celebrated home of RAF Scampton after a near 40-year presence there.

The team use the same two-seat training aircraft used for advanced pilot training, at





RAF pilots must meet these criteria to apply for selection to the Red Arrows: Have a minimum of 1,500 flying hours, have completed a frontline, operational tour and be assessed as being above average in their flying role. A shortlist of up to nine applicants are examined during a thorough selection week, and are put through a gruelling flying test, formal interview, media test and peer assessments. Up to three new pilots are chosen each year to replace the three that have finished their tour. The Team Leader must have completed a three-year tour as a team pilot earlier in their career and is appointed in a separate selection process.

It is the hard work of the team's support personnel that keep the Red Arrows flying. The teamwork shown by the pilots in the air is reflected in the dedication and professionalism of the support staff on the ground. The support team's success results from their Royal Air Force training, the pride they take in their work, and their determination, motivation, and, very often, sheer hard work. Without them, the Red Arrows could not function.

Reds and Blues! (Image @rafredarrows)

This team is made up of a Team Manager, a Public Relations Manager, Aircrew Planning Officer, Operations Officers, Engineering Officers, an Adjutant and approximately 85 engineering technicians and other support staff. The latter are known as 'The Blues' because they wear distinctive royal blue flying suits during the display season. The Blues represent several of the

Royal Air Force's broad range of professions. Every team member has undergone intensive training in their particular specialisation throughout their Royal Air Force career. ✈️

**Text: UK MoD/RAF Red Arrows/Vayu Team**

**Photos: Vayu Team except where mentioned**



# FLY NAVY, FLY

## A HISTORY OF INDIAN NAVAL AVIATION



**PUSHPINDAR SINGH**  
**ANGAD SINGH**



# **VAYU** (re)visits the Armée de l' Air at Base Arienne BA118 Mont-de-Marsan



## **With fighter squadron EC 2/30 Normandie-Niemen**

*Rafales on alert at BA118 : the largest Air Base in France*

**I**n June 2013, we covered the visit to France, courtesy the French Ministry of Defence along with its major aerospace and defence players that included Safran, Dassault, EADS Eurocopter, Thales, Nexter and MBDA.

A week long tour then had *Vayu* visiting Cazaux Flight Test Base (BA120), the BA118 Rafale squadron at Mont-de-Marsan, being briefed on air defence systems, space imagery and defence/intelligence telecommunications, the Military Air Experiment Centre (CEAM) in Mont-de Marsan and thereafter Eurocopter

facilities in Marignane. The focus this article is on airbase BA118 (in particular the Rafale squadron EC 2/30) at Mont-de-Marsan.

BA 118 at Mont-de-Marsan is home to the CEAM, the Air Force military experimentation and trials organisation, air defence radar command reporting centre, instruction centre for air defence control and, of course, fighter squadrons.

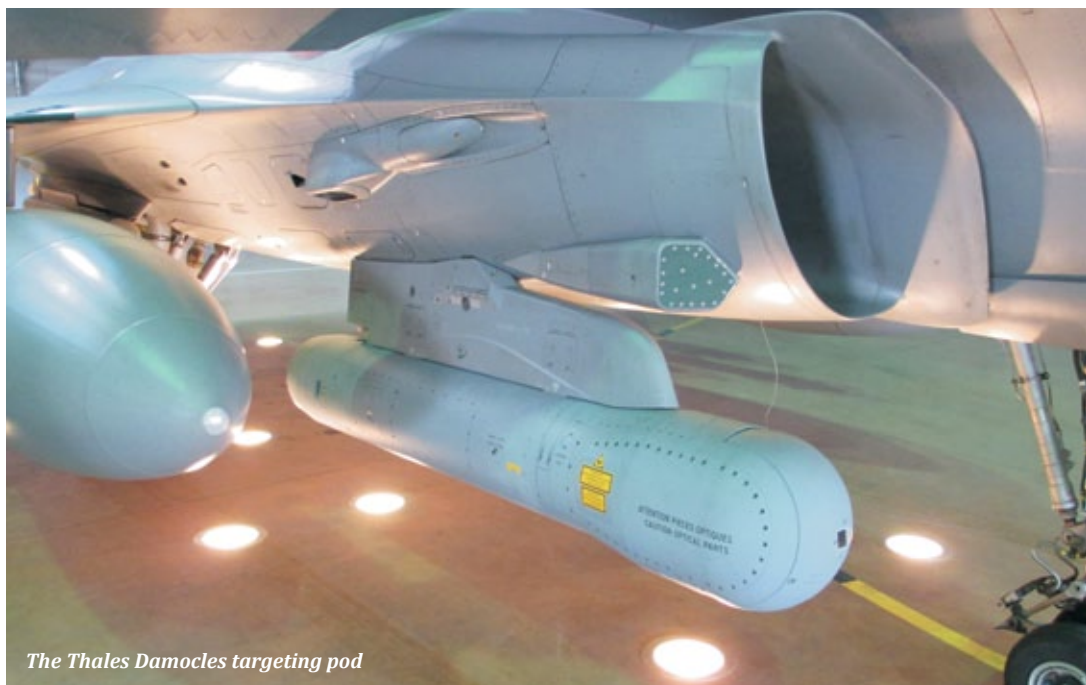
CEAM's mission is to "study, experiment and define future uses of the equipment that is tested", and consists of 'Team brands', small units of experts in the field. This includes the Squadron

for experimentation 5/330 *Silver Coast* equipped with several types of fighters used for the development of new weapons that equip the Mirage F1, Mirage 2000 and Rafale as also EPIGE 07/330 Squadron Programming and Instruction Electronic Warfare, which is responsible for testing and programming of self-protection systems for aircraft (fighter aircraft, transport aircraft and helicopters).

The Reconnaissance Squadron ER 2/33 *Savoie* with Mirage F.1CRs as well as EC 2/30 *Normandie-Niemen* are based here too.



BA 118 also houses the School of Air Traffic Controllers (CICDA) and the Centre of Detection and Control (CDC), which scans skies of the southwest quarter of France, EDSA (squadron of ground-air defence) which has direct control over surface to air missiles like the Crotale (for protection of the airbase) and, of course, air traffic controllers in the tower managing the airfield. The base is also one of five where the state-of-the-art Aster SAMs are deployed. 🦅





*A pair of Snecma/Safran M88 engines give the Rafale its power.*



*MBDA's Scalp is well suited for the Rafale, with its effectiveness proven in recent conflicts over Afghanistan and Mali.*



*For precision strike missions, the Rafale is fitted with six Sagem AASM Hammer INS-GPS-IR guided weapons.*



*The ER 2/33 'Savoie' headquarters.*



*Mirage 2000 in its shelter*



*Mirage F1 at BA118*



*Insignia of Squadrons that have flown the Mirage F1s.*



*Vayu's taxi! An Airbus Military CN-235 configured for paratroops is what the media team travelled in all around France.*

# Beyond “Gaming”

How videogames and VR are also shaping military tactics and Operations around the World



*Rishav tries to analyse the significance of professional video games in training military forces around the world, and offering them a wide range of flexibilities for combat simulations.*

Just like humans, technology has also evolved throughout the generations. The early iterations were primitive, weak and more vulnerable to threats while the modern-day variants are quite developed, robust, and adaptive. One such domain of technology is video gaming, one that is still regarded as just a bootless errand in common households. However, the significance of videogame has already broken the barriers of casual refreshment for people, and reached the serious levels of professional military-grade training, covering conventional soldiers to even commanders. And multiple factors have driven it to this stage.

## Create any form of environment virtually, anytime

There is a dedicated category of videogames, referred to as “sandbox”. These are specially aimed platforms that focus on expanding players’ creativity. It helps in simulating various scenarios by placing multiple virtual assets on the given terrain. For example,

we can create a situation in Afghanistan by using an arid terrain, containing mountains, cliffs, and small-scale infrastructure, then placing infantry and other virtual representation of combat units. A tactically realistic videogame will be able to simulate near-accurate results, allowing the viewers to witness how combat will unfold in its most basic form. The simulations can also

be carried out independently by Artificial Intelligence, or the human brain at either one side or both sides.

## The evolution of Virtual Reality (VR) is offering a great degree of realism

If someone asks to define VR, it is all about bringing real-world things into a virtual environment. Modern VR systems are able



VR-based training in Indian Air Force

to offer so much visual and simulation realism which can let the user enjoy the bulk of the experience, which includes 360-degree coverage of the environment, which also allows the trainee to study any system as well. For example, a virtually created interior of any combat vehicle or aircraft like the cockpit of a Su-30MKI will be easy to explore by a trainee cadet who needs early exposure to the complex set of internal facilities inside a fighter jet's cockpit, which includes a plethora of instruments, screens, switches, etc. Later, however, they would definitely go through the complete conversion training including physical experience inside a real cockpit and flying course which will be necessary for their qualification. Many Indian startup companies are also offering VR solutions, as both training and combat aid solutions. While many are still in development and trial phases, a small proportion is also deployed on small scale and looking forward to being expanded in coming years as forces get familiar with these technologies along with their maturity.

### Promote an affordable and safe environment

A full package simulator requires a large space and commodities for proper setup, plus logistical and technical support for long-term uninterrupted operation. However, a videogame integrated simulator does not need a big hall or crores of investment for an excellent setup. In fact, a monitor, a CPU, a keyboard, HOTAS, and Throttle devices paired with wireframe can do the job very precisely. And VR headset as an add-on can provide the desired low-cost setup which gives a good enough training environment for the cadet. Also, it removes the challenge of having dedicated physically existing replicas of the system that will be simulated. In fact, with VR, it can be implemented virtually and hence, one simulator can be used in training for more than one system, or environment. The United States Air Force (USAF) 355<sup>th</sup> wing, already uses a similar concept for training fighter pilots on the A-10 attack aircraft, which is a dedicated close air support aircraft in the service. Speaking

of safety, such simulators are also helpful for Air Forces with low budgets since their trainee pilots would be able to score high hours on the simulator and fine-tune their skills before jumping into the real cockpit and facing other extreme challenges which can be experienced only in real sorties, at least for now.

### Beneficial for non-combat training

Apart from combat, a military work environment also demands several other skills for smooth functioning and precision decision-making. It includes being aware of the culture, language and people in the area of culture. Indian Armed Forces are regular participants in UN Peacekeeping forces which is entirely different from the Indian subcontinent in every domain. Soldiers need to be familiar with the civilian population, their culture, and their language so that they would be able to cooperate with each other, which is necessary since UNPKF operations also include having healthy relationships with the civilian population of their area of operation. US Marine Corps had a dedicated game in 2006-07 called Tactical Iraqi Language and Culture Training System (TILTS), which would educate them about the Arabic language and culture practiced in Iraq. The game turned out effective due to the fact that the 3<sup>rd</sup> Battalion, 7<sup>th</sup> Marines which was the unit to get training on the videogame, managed to be the first unit of the service to return back from Iraq deployment without any fatalities. TILTS was credited for the fact that soldiers were able to communicate with the local mob and solve disputes.

### Real-time data collection

Virtual Simulations allow real-time quick data collection and analysis. For example, if someone is practicing in a virtual shooting range, the results regarding their accuracy, range, and speed can be presented very quickly since it is all conducted by the computer itself without human involvement, while in actual shooting ranges, manpower is required to study and judge the quality of the shooter. If the shooter or the instructor is disappointed by the performance, they can restart the same training session to improve the quality. They can also customise the session by placing new virtual challenges and aids to study the shooter's potential in different situations.



Pilots from the USAF 355th Training Squadron at Davis-Monthan Air Force Base, Arizona. Via: The Drive-The Warzone

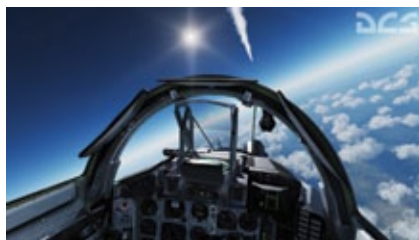
## Dedicated wargaming strategy games allow a great understanding of potential actions

There is another genre of video gaming called strategy games which is entirely based on players' decision-making skills. Unlike most of the other common videogame genres, strategy games require the player to think of both short-term and long-term outcomes of their decisions. In varieties of strategy games available strategy games, players control their own fictional country, where they have to take decisions related to the economy, politics, and military as well. Consider it unlike shooting games where we play as a soldier, in strategy games, we roleplay as a general, or even president. And hence, their decision can cause large-scale effects. Therefore, only a brainiac needs to be on the chair to properly guide his units to victory. One of the strategy games to focus dedicatedly on military simulation is Command Modern Operations: Naval Operations, where the player can simulate multiple battle scenarios and see how effectively the weapons will perform if pitched against various adversaries and through various situations. While the publicly available version has limitations, the one made exclusively for military forces contains an accurate set of data associated with their weapons and platforms, which has impressed multiple armed forces around the world, like the US, UK, Japan, Ecuador, Finland, Germany and France, officers of whom are trained on this game so that they would be able to conduct a thorough review of their planning and gain an idea regarding the outcomes of their planning before real-world execution. Defence contractors like BAE Systems and Lockheed Martin are equally determined to pitch this strategy game for various purposes like testing the quality of their systems virtually.

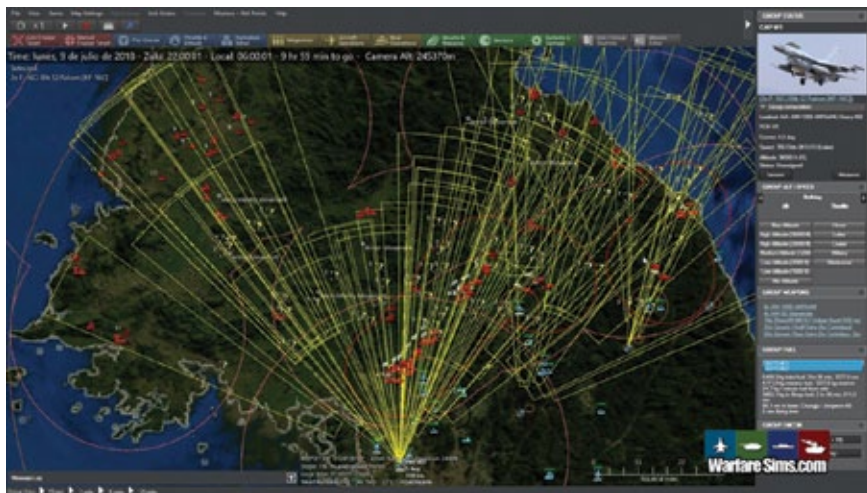
Let's look at some popular videogames which are currently adopted by some military forces.

## Known examples

**DCS World:** This is a professional combat aircraft simulator videogame, where a wide range of combat aircraft and rotorcraft are available to fly, that too with pure immersion, which means every button of the cockpit is accessible. And as mentioned earlier, the USAF is utilising it for training its A10 pilots. The base setup uses systems like VR, joystick, and throttle. This video



**Arma-Virtual Battlespace:** Arma 3 is a military First Person Shooter (FPS) plus sandbox game where one can engage in realistic combat situations and play various soldier roles, and use equipment, like that of a medic, sniper, or fireteam leader, performing tasks like calling fire support by marking co-ordinates, or be fire-support



game is a safe, low-cost but at the same time, equivalent solution for pilot training.

**Command Modern Operations:** It is a professional role-playing strategy game that has a near-accurate weapon database and event simulation algorithm. Here, a player can plan his strategies and plan his offensive accordingly, which can include where to place the strike teams, when to deploy, from where to enter the hostile territory, etc. The capabilities of each weapon play a significant role in deciding the outcome of the simulation. This is the reason why many armies in the West and various defence companies are also using a professional version of this game to polish their weapons, tactics, and decision-making.

themselves and aim precisely at the target coordinates, etc. The US Army has been using a professional version of Arma 3 for a long time, Virtual Battle Space to provide tactical training to its soldiers.

Overall if we observe, these video games are incapable (today) to replace the traditional mode of training. But since these technologies already started integrating into the forces slowly, eventually they are likely to attain an influential role as modern-day training and combat solutions with a large influence on refining the capability of a military. Where will India stand then? 🦋

By Rishav (Twitter @\_devildog\_rv\_)





# Arjun: The Journey of India's MBT

*This article is a humble tribute to Lt. Gen. Ajai Singh, who gave almost everything to make India's indigenous main battle tank programme a success. He was commissioned into the Poona Horse in June 1956 and served in the wars*

*of 1965 and 1971. He was a member of the Vijayanta trial team in the UK. He was involved in projects to modernise Vijayanta, up gunning of AMX-13 and T-54, and even draught the first GSQR of the Indian Main Battle Tank! In terms of achievement, he is*

*no less than legendary IDF Major General (Aluf) Israel Tal, who designed and developed the famous Merkava tank. Unfortunately, in India, a man of such calibre has gone into almost oblivion. He left us on his eternal journey on 18 April 2023. So I'm trying my best to pen down the epitome of the warrior Arjun in honour of the legendary personality.*



## Preface

To pen down the journey of Arjun tank is quite a colossal task. Unlike Western, Russian, Israeli, or even Korean tanks, the sheer lack of easily available credible sources on Indian projects has made this job much harder. The lack of a prime source definitely raises questions about credibility. Many old good sources have simply gone to extinction, leaving only marks hosted by third parties. And the rest are scattered here and there without following any continuity. Some information is taken from old news papers and magazines as well as analysis by veterans. The memoir by Lt. Gen. Singh

(on Salute) itself has helped to bridge some missing links. So I tried to assemble all of them as accurately as possible. Honestly, I am feeling like a ship travelling through an unknown sea on a dark, foggy night, depending on just an old chart! So a humble request to readers: bear with the person who, in good faith, tried his best to write it down fervently without any embroidering.

### How it started

The first GSQR for an Indian Main Battle Tank dates back to the late 1950s, which couldn't be materialised, and the army ended with the procurement of the Centurion, Vickers Mk.1, and T-54 in the coming decades. India witnessed extensive armoured action in both 1965 and 1971 and achieved glorious victories in most of the battles. However, one might be surprised to find none of the tanks then, with services, could meet all the requirements of the original GSQR. So after the 1971 war, the Indian Army decided to go full throttle with the design, development and manufacture of an indigenous design. The objective was to eliminate dependence on foreign countries for the design and manufacture of modern armoured fighting vehicles for India. It would stop the outflow of valuable foreign exchange as well. In case one wonders, India developed an indigenous APC as well; unfortunately, it didn't see an induction.

### 1970-1982

It was October 1970 when the Armoured Corps Centre and School, Ahmednagar, arranged a colloquium on the Main Battle

Tank (MBT) for the Indian Army. It was attended by representatives of various branches of the army, the Ministry of Defence, and DRDO. The main aim of the symposium was to formulate a General Staff Qualitative Requirement (GSQR). A Steering Committee was constituted, and the Secretary of Defence Production was appointed chairman. Other members of the committee were from the army, DRDO, DGOF and public sector industries for dialogue, review and direction.

The first GSQR No. 326 was issued in August 1972. The project for the development of the next-generation tank was assigned to DRDO in May 1974, and by November 1974, the system design had been initiated. The project for design and development was sanctioned in May 1974 at a total cost of Rs. 15.50 crore, involving a foreign exchange component of Rs. 3.70 crore. The design and development of MBT based on GSQR No. 326 was taken up by the Combat Vehicle Research and Development Establishment (CVRDE). The Project Development Certification (PDC) of the project was envisaged for 10 years. Thus, it was hoped that the MBT would be ready for induction by 1985. The committee quickly came to formulate the dimensions, weight, armaments, mobility, optics and fire power. The armour would be 5 percent nickel steel armour. It would be powered by a 115-mm smoothbore main gun capable of firing anti-tank guided missiles (ATGM). The gunner's sight was envisaged to be equipped with a laser range finder (LRF) and thermal imager. It would be powered by a liquid-cooled diesel engine.

According to the one and only information available, the weight was capped at 50 tonnes. DMRL started working on armour while the responsibility for armament was taken by ARDE/HEMRL. IRDE looked at the development of optics and a stabilised fire control system. Incapacity to meet immediate requirements by indigenous means was countered by prudent changes in some specifications. The smoothbore gun requirement was replaced by a rifled gun, and the missile option was dropped. In case one wonders, India was manufacturing a 105-mm rifled gun developed indigenously, so developers continued with the one holding competence. An imported engine was preferred for the prototype stage.

The procurement of a preferred engine, however, failed, leading CVRDE to take a bold step. The CVRDE, with no prior experience, succeeded in designing and developing an air-cooled engine with an output of about 1500-Hp, which was subjected to extensive tests. Indigenous suspension and transmission hardware were ready for development testing. The progress on the main gun was commendable, and trials were carried out for proof at Balasore ranges. The lethality was found to be superior to that of the 105-mm L7 gun, and the range was doubled. HESH, smoke ammunition, and APDS rounds were preferred. IRDE was also doing well on their project except for the TI. One prototype hull in mild steel was fabricated to check the fitment and assembly. While the armour plates would be made available for tests by December 1981. The hardware was getting ready for assembly and integration of the first mild steel prototype.

### 1982-1985

At a point when everything seemed to be going well, the project hit a hiatus. The Army surmised the rapid evolution and emergence of new technologies. It was a critical juncture, as contemporary technology was evidently going to become obsolete in the coming decades. So in April 1978, another meeting was called to formulate new requirements. A series of meetings between DRDO and the Indian Army, chaired by VCOAS, resulted in changes in GSQR. The new GSQR No. 431 was issued in August 1982.

The changes brought an increase in dimension. A more powerful 120-mm gun with an improved fire control system was



asked for. Optics were also to be improved. A sum of Rs. 56.55 crore was sanctioned for necessary changes. The PDC for the project was revised. The first prototype was to be built by October 1980, and subsequently, 12 prototypes were to be developed, one every 6 months. Ultimately, the first prototype was developed. It was subjected to technical tests at Avadi and trials in the Jodhpur desert during the tenure of then-COAS Gen. AS Vaidya and Dr. V.S.R. Arunachalam, the scientific advisor to the MoD. However, the indigenous engine programme couldn't move any further than early success. So import was the only option. Initially, a 700-hp engine for fitment trials was procured from MTU, which was subsequently replaced by a 1100-Hp one. Finally, MTU made a 1400-hp engine as per Indian requirements.

### 1985-1993

In 1983, DRDO entered into a consultancy agreement with Krauss Maffei of West Germany to provide total cover in the field of design, development, evaluation, and establishment of testing facilities at a cost of Rs. 89.50 lakh. This facilitated CVRDE's getting an opportunity to observe the German Leopard 2 tank. This would heavily influence the future development of indigenous tank.

As tank technologies saw rapid growth at that time, the Indian Army feared the induction of the latest Western platforms in services with Pakistan. This prompted GSQR to be changed once again in November 1985. The GSQR No. 467 required improvements over the course of development. This ultimately would lead to the redesign of the turret and hull to provide protection from Nuclear, Biological, Chemical (NBC) warfare. The platform was capable of medium fording. A more lethal 120-mm gun with missile firing capability was developed as a crucial achievement to enhance firepower. Fin Stabilised Armour Piercing Discarding Sabot (FSAPDS) was given a priority. A stabilised fire control system was developed with night-fighting capability. And for enhanced protection, the armour was developed to withstand enemy 120mm APFSDS! For the revised GSQR, a sum of Rs. 280.80 crore was sanctioned in 1987. Dr. M. Natarajan became the programme director of the Arjun programme. At that time, the post of Director-General, Combat Vehicles



Photo: Angad Singh

(DGCV) was created and Lt. Gen. S.P.M. Tripathi became the first to chair it. He was succeeded by Lt. Gen. Singh himself. And during the tenure of these two DGCVs, the Arjun project got the required impetus. An armoured fighting vehicle (AFV) evaluation centre was set up for realistic assessment of technical and user trials. The prototype developed under this programme was finally publicly unveiled at the Republic Day parade of 1988. The behemoth of the 64<sup>th</sup> Cavalry took the nation by storm. The highly motivated and mission-oriented team worked day and night to improve individual systems, and the platform was put through rigorous tests. Kanchan armour was tested against then-available 125-mm Soviet-origin APFSDS and HESH rounds. The BEML developed an indigenous hydropneumatic suspension (HSU) which proved better than its German counterpart. For road wheels, the first German company, Clouth, was approached in 1991, which was subsequently complemented by an indigenous product from TVS Rubber. The firepower was validated in various weather and night conditions as well.

A total of 12 prototypes were built by 1990 and subjected to extensive field testing. The indigenously developed air-cooled engine unfortunately couldn't go beyond 900-Hp. By then a 1400-Hp engine from MTU was ready. The prototypes covered around 20,000 km in various terrains, ranging from desert to soft riverbeds, as

part of the automated trial. As a proof of firepower, 3,000 rounds were fired. However, the project hit another hiatus in 1991 when the then COAS General SF Rodrigues refused to order 50 tanks as recommended by Dr. V.S.R. Arunachalam (SA to MoD). But the situation changed during the tenure of the next COAS, Gen. Bipin Chandra Joshi. Satisfied with the results of intense tests and trials, Arjun was prepared for a live demonstration at the Suratgarh range.

### 1993-1995

It was 28 February 1993, when Arjun showcased his mettle in front of the COAS, Gen. Joshi, and other high-ranking officers from the army. Then Raksha Mantri Sharad Pawar was invited as the Chief Guest. The grand demonstration witnessed excellent mobility, obstacle-crossing capability, and firepower. Arjun, from a static position, fired at ranges of 1,200 m, 1,500 m, and 2,000 m. It also demonstrated firing capability on the move and against moving targets. Lt Gen Ajai Singh quoted "The tank is a winner" and placed it "rank with the US XM-1 in the bracket of top tanks in the world". Even the COAS himself came out in support of the tank and turned down criticism on indigenous content, saying, "What is indigenous about the tank is its design, which is tailored to meet our operational requirements. Only those items which are restricted need to be indigenised."



### 1995-2004

Dr. Arunachalam was succeeded by Dr. A.P.J. Abdul Kalam as SA to the MoD, and Lt. Gen. Ajai Singh retired from the post of DGCV. But he became a part of DRDO as CCR&D (Land Systems). Since then, Dr. Kalam and his team tried their best to make project Arjun a success. It was a watershed moment, as finally, India's ambitious programme saw the possibility of a bright future. The MBT project was finally closed on 31 March 1995, after approval by the CCS and government. The expenditure on the programme stood at Rs. 307.48 crore. On 9 January 1996, then-PM, PV Narsimha Rao launched Arjun Main Battle Tank, in the presence of then-COAS Gen Shankar Roy Chowdhary and Dr. Kalam. By the end of 1996, 14 pre-production series (PPS) tanks had been built and delivered. As development of PPS-15 was initiated to address shortcomings, a joint action plan was initiated in 1997 to identify flaws. The PPS-15 of the 43<sup>rd</sup> Armoured Regiment made a public appearance in the 1997 Republic Day Parade. This design was to be followed for serial production. The PPS tanks together covered 60,000 km and fired over 6,000 rounds during trials. In 1998, AHQ gave clearance for the LSP tanks. In February 1999, the government accorded approval for the induction of two regiments (124 no.) of MBT Arjun, including 15 LSP. The first tank rolled out

in 2004, and the first batch of five tanks was delivered to the 43<sup>rd</sup> Armoured Regiment on 7 August 2004.

### Arjun vs. Bhishma

Post-induction, there has always been debate on the comparison between the Arjun Mk.1 and the T-90S Bhishma. Arjun has some clear advantages over Bhishma. Most notably, the Containerised Ammunition Bin With Individual Shutters (CABIS) and blow-off panel (BOP) provide enhanced survivability to the crew. It has a better power-to-weight ratio (24 Hp/T vs. 21.5 Hp/T) and less ground pressure (0.84 kg/sq cm vs. 0.94 kg/sq cm). Arjun has better water-fording capability. It has better off-road mobility. The main gun of Arjun assures a 90% first-round hit probability on a 2.3 m x 2.3 m target at a distance of 2,000 metres. But the T-90 has a firing accuracy of 85% for the first round hit probability at the same distance for a 3 m x 3 m target. Arjun is equipped with an APU, which was originally absent in Bhishma. The Report No. 35 of 2014 by CAG briefly discussed the comparison of performance between Arjun and the T-90S Bhishma. It was found that Arjun has the upper hand in many aspects, even when T-90 was judged by relaxed parameters! Arjun showcased better mobility in the medium and heavy dunal terrain of Mahajan Field Firing Range. It crossed much steeper obstacles (35° vs.

30°). In medium fording, Arjun was found to have zero level water ingress! And even better, it showcased a better capability to engage enemies while on the run.

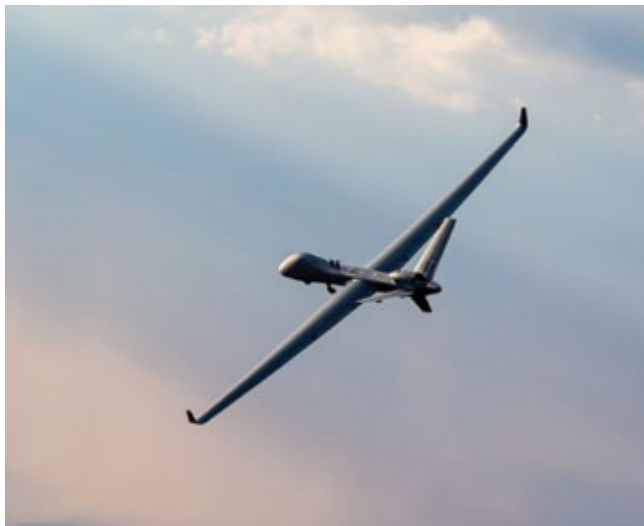
### At the end

The project initiated as MBT 80 "Chetak" was later renamed "Arjun." Arjun Mk.1 has further evolved into Mk.1A with 73 improvements! While Arjun could not meet some of the concurrent requirements, it's undoubtedly the best tank currently in service with the Indian Army and possibly in the region. The new Arjun Mk.1A has enhanced capability. The project has helped India achieve self-dependence in various complex fields. One cannot deny the unprecedented mettle India itself showcased at a time when such a complex task could be taken on by only established great powers. The journey has led India to new heights, which itself will steer towards self-dependence for the FRCV (Future Ready Combat Vehicle) programme. And Lt. Gen. Ajai Singh must be remembered for refusing to give up on Arjun even against the utmost odds. Like Dronacharya, he guided Arjun towards glory. On the thirtieth year of Arjun, this article will be my tribute to the legend. 🦋

**Sankalan Chattopadhyay**  
(Twitter @vinoddx9)

All photos Wikimedia/Indian MoD  
except where mentioned.

### AFSOC selects MQ-9B SkyGuardian



General Atomics has announced a new contract with US Air Force Special Operations Command (AFSOC) to provide three MQ-9B SkyGuardian remotely piloted aircraft systems to its first US customer. AFSOC's acquisition of MQ-9B builds on more than 20 years as a GA-ASI partner and more than 14 years flying the MQ-9A Reaper, operating more than 40 aircraft in harsh environments around the world.

### GA-ASI continues LongShot support



General Atomics "is pleased to continue supporting the Defense Advanced Research Projects Agency (DARPA) LongShot programme. LongShot changes the paradigm of air combat operations by demonstrating an unmanned air-launched vehicle capable of employing air-to-air weapons".

### Poland for 4 Bell 407GXis

Bell Textron signed a purchase agreement for four Bell 407GXis Aircraft by the Polish National Police (PNP). The helicopters will be purchased as part of the project "Safer on the roads – aerial



supervision over the road traffic," implemented with the use of funds from the Operational Programme Infrastructure and Environment.

### Kratos XQ-58A continues evolution



Kratos Defense & Security Solutions announced that through multiple contracts, Kratos has and is continuing to evolve and apply its XQ-58A Tactical UAS with a focus on experimentation to support operational missions and employment to satisfy multiple existing and forming application sets for the DoD.

### P&W F135 production contract for Lots 15-17

Pratt & Whitney announced that it had been awarded a \$5.2 billion contract to support production of the 15th and 16th lots of F135 engines, with an option to award a 17th Lot, powering all three variants of the F-35 Lightning II fighter aircraft.



## Aramco for 5 helicopters



The Milestone Aviation Group Limited, the global leader in helicopter leasing, announced it had signed lease agreements for five helicopters with Aramco. The agreements include the placement of three Leonardo AW139 helicopters and two Airbus H145 helicopters.

## Australia for 255 Javelin's



Australia has requested to buy up to two hundred fifty-five (255) Javelin FGM-148F missiles (includes five fly-to-buy missiles). Also included is US technical assistance, consisting of Tactical Air Ground Missiles (TAGM) Project Office technical assistance and other related elements of logistical and programme support. The estimated total cost is \$60 million.

## Japan for 5 E-2D's

Japan has requested to buy up to five (5) E-2D Advanced Hawkeye Airborne Early Warning and Control Aircraft; twelve (12) T56-



A-427A Engines (10 installed, 2 spares); six (6) Multifunction Information Distribution System Joint Tactical Radio System Terminals (5 installed, 1 spare); five (5) APY-9 Radars (installed), etc.

## Lockheed Martin and Bahrain celebrate 1st F-16 Block 70



Bahraini, American and Lockheed Martin officials celebrated the first F-16 Block 70 for the Royal Bahraini Air Force at Lockheed Martin in Greenville, South Carolina. This F-16 Block 70 jet is the first of 16 for Bahrain. From here, it will begin additional flight tests at Edwards Air Force Base before arriving in Bahrain in 2024.

## Agreement for GCAP advanced electronics

The national industry champions for advanced defence electronics representing Japan, the UK and Italy have announced the signing of a collaboration agreement, the next formal step towards a permanent industrial construct. The companies: Mitsubishi Electric representing Japan, Leonardo UK representing the UK and both Leonardo and Elettronica representing Italy, have agreed to forge a closer business relationship and assess appropriate commercial and international operating models, readying the partners for the next stage of the GCAP programme.



### Romania for 95 M1278A1 JLTVs



Romania has requested to buy an additional ninety-five (95) Heavy Gun Carriers Joint Light Tactical Vehicles (JLTVs). This amendment will push the current case above the MDE and total case value notification thresholds and thus requires notification of the entire case. The original FMS case, valued at \$43.73 million, included thirty-four (34) Heavy Gun Carriers JLTVs.

### Spanish AF for another 16 PC-21s



The Spanish Air Force, Ejército del Aire, decided to purchase 24 PC-21s in early 2020. The final PC-21 of this order was delivered to Spain in mid-2022. The Spanish Air Force has now decided to buy another 16 PC-21s. The contract signed with the Dirección General de Armamento y Material (DGAM) makes Spain the largest PC-21 operator in Europe.

### Poland for 800 Hellfire's

Poland has requested to buy eight hundred (800) AGM-114R2 Hellfire missiles; and four (4) M36 Hellfire Captive Air Training Missiles (CATM). Also included is Tactical Aviation



Ground Munition Programme Office technical assistance; Security Assistance Management Directorate technical assistance; Joint Attack Munition Systems technical assistance. etc. The total estimated cost is \$150 million.

### Australia for 200 Tomahawks



Australia has requested to buy up to two hundred (200) Tomahawk Block V All Up Rounds (AUR) (RGM-109E); and up to twenty (20) Tomahawk Block IV All Up Rounds (AUR) (RGM-109E). Also included is support for all three segments of Australia's Tomahawk Weapon System (TWS) to include the All Up Round (AUR), the Tactical Tomahawk Weapon Control System (TTWCS), etc. The estimated total cost is \$895 million.

### British Army in artillery deal with Sweden

The first 14 Archer artillery systems will have ownership transferred to the British Army and be fully operational by next April, forming an interim replacement for the 32 AS90 artillery systems the UK gifted to the Armed Forces of Ukraine.



### 3 Bell 505's for Bahrain



Bell Textron announced the delivery of three Bell 505 helicopters to the Royal Bahrain Air Force. Bell delivered the aircraft during an inspection and acceptance event at Bell's Mirabel facility.

### Greece for 63 AAV's

Greece has requested to buy sixty-three (63) Assault Amphibious Vehicles, Personnel Variant (AAVP-7A1), nine (9) Assault Amphibious Vehicles, Command Variant (AAVC-7A1), four (4) Assault Amphibious Vehicles, Recovery Variant (AAVR-7A1), and sixty-three (63) 50-Caliber Machine Guns (Heavy Barrel), etc.



### NGC MESA for USAF E-7

Northrop Grumman will enter into production of the Multi-role Electronically Scanned Array (MESA) sensor for the US Air Force E-7 aircraft. As part of the E-7 weapons system, the MESA sensor will provide critical long range sensing, detection and identification in challenging environments equipping the US Air Force with simultaneous air and maritime sensing capabilities, critical early warning and air battle management capabilities.



### Raytheon and StormBreaker



The US Air Force has awarded Raytheon Technologies a \$320 million contract to produce and deliver 1500 StormBreaker smart weapons, which are air-to-surface, network enabled weapons that can engage moving targets in all weather conditions using its multi-effects warhead and tri-mode seeker. StormBreaker is fielded on the F-15E Strike Eagle with testing underway on the F-35B and F/A-18; between the three platforms, StormBreaker has had hundreds of successful operational test shots to date.

### Hensoldt contracts for Philippine Navy

Sensor solutions specialist Hensoldt UK has been awarded two contracts by Hyundai Heavy Industries (HHI) to supply Kelvin Hughes Mk11 SharpEye navigation radars to the Philippine Navy. The six 2,400-ton Offshore Patrol Vessels (OPVs) and two 3,200-ton Corvettes are currently being built at HHI and will be delivered over the next four years.



### GE Marine's LM500 to power Korean PKX-B's



The Korean Navy has selected GE Marine's LM500 gas turbines to power the first four PKX-B Batch-II ships. Two LM500s, each rated at approximately 4.6 MW, will help propel one of the fastest and most technologically advanced vessels in the ROKN fleet with a top speed of 40 knots.

### Raytheon JPALS for USN



Raytheon Technologies has delivered all 23 contracted Joint Precision Approach and Landing Systems low-rate production units to the US Navy on time or ahead of schedule. JPALS is a software-based GPS navigation and precision approach landing system that guides aircraft onto carriers and amphibious assault ships regardless of sea state or weather conditions, bolstering safety and operational capability.

### Airbus FAL in China delivers 1st A321neo



Airbus has delivered the first A321neo aircraft assembled at its Final Assembly Line Asia (FAL Tianjin) to China's Juneyao Air in Tianjin, China. The aircraft is powered by Pratt & Whitney GTF engines and features 207 seats, 8 in Business and 199 in Economy class.

### Aster 30 fired from FREMM DA Lorraine

The French Navy's Lorraine multi-mission frigate enhanced with air defence capabilities (FREMM DA) has successfully fired the Aster 30 air defence missile. Aster missiles, which come in two versions (Aster 15 with approximately 30 km range, and Aster 30 with approximately 100 km range), are carried by multi-



mission frigates, air-defence frigates and the Charles de Gaulle aircraft carrier. They will also be carried by the new defence and intervention frigates. The missiles have been specifically designed to destroy attacking aircraft and missiles.

### Raytheon in USN contract for Spy-6



Raytheon has been awarded a \$619 million contract to continue to produce AN/SPY-6(V) radars for the US Navy. This is the second option exercised from the March 2022 hardware, production and sustainment contract that is valued up to \$3 billion over five years.

### BAE tests guided projectile

In partnership with the US Army, BAE Systems successfully fired a Sub-Caliber Artillery Long-Range Projectile with Enhanced Lethality, concept for the US Army's XM1155 sub-caliber programme, from a 155 mm XM907E2 58 caliber cannon and impacted a fixed target beyond ranges previously demonstrated by other precision guided projectiles fired from the same type of cannon.



### Navantia's S-81 performs first dive tests

Navantia's S-81 submarine 'Isaac Peral' has made its first dive tests, as part of the test schedule agreed between Navantia, the Navy and the Ministry of Defence. This is the static dive which has allowed the submarine's displacement to be verified, the transverse and longitudinal stability to be determined and the resulting draughts.



### Bundeswehr orders type Pzh 2000

The Federal Office for Bundeswehr Equipment, Information Technology, and In-Service Support (BAAINBw) has awarded Krauss-Maffei Wegmann (KMW) a contract for the production of ten new type PzH 2000 self-propelled tank howitzers. The two parties signed the contractual agreement in Berlin and delivery of the systems is scheduled to begin in 2025.



### 100 Boxer's for Bundeswehr

Rheinmetall has welcomed the Germany-Australia letter of cooperation to progress a proposal to build Boxer combat vehicles in Australia for export to Germany, expanding the close cooperation and defence partnership between the two nations in



the land domain. The Boxers to be built in Australia are intended for the German Army's "schwerer Waffenträger Infanterie" (heavy weapon carrier infantry), a direct tactical fire support vehicle for infantry forces.

### Aegis Combat System intercepts target

USS Daniel Inouye (DDG 118) successfully intercepted a Medium Range Ballistic Missile (MRBM) target using upgraded Aegis software during a recent flight test. This marks the first Aegis Baseline 9.C2.0 (BMD 5.1) intercept of an MRBM target using the Standard Missile-6 Dual II with software upgrade, bringing improved performance against evolving threats.



### JAGM and Hellfire production contract

The US Army awarded Lockheed Martin a multiple-year production contract for Joint-Air-to-Ground Missiles (JAGM) and Hellfire missiles with a Programme Year 1 (PY1) award total value of \$439 million. This contract will provide JAGM and



Hellfire procurement and production support for the US Army and international customers. Because it's a multiple-year award, the contract offers three additional follow-on awards starting in late 2023, allowing for a total contract value of up to \$4.5 billion over the next four years.

### Patriots for Switzerland



Raytheon has been awarded a \$1.2 billion foreign military sales contract from the US Army to provide Switzerland with the Patriot air defence system. With the sale, Switzerland becomes the 18th global Patriot partner and the eighth European country to choose the system as the backbone of their air defence.

### LM and F-35 JPO for fleet support



Lockheed Martin and the F-35 Joint Programme Office (JPO) have signed the Lightning Air System National Capability Enterprise (LANCE) 23-27 contract to support the United Kingdom's F-35 fleet. The aircraft support contract is valued at approximately £147M and will ensure and enhance the UK F-35 fleet's availability and capability to conduct combat missions worldwide.

### Block 4 F-35 EW systems



BAE Systems has received \$491 million in contracts from Lockheed Martin to produce Block 4 electronic warfare (EW) systems for future Lot 17 F-35 Lightning II fighter jets, adding to the 1,200 F-35 EW systems it has delivered to date. The Block 4 systems will accelerate the delivery of advanced EW capabilities to warfighters by combining adaptable hardware and incremental software updates.

### GDAT for 50 H160's

During French President Macron's visit to China, Airbus Helicopters signed a contract with GDAT, one of China's most prominent helicopter lessors and operators, for 50 H160 helicopters. This contract is the largest single order for the H160 on the civil and parapublic market since the helicopter was unveiled in 2015.



## Morocco for 18 HIMARS



Morocco has requested to buy eighteen M142 High Mobility Artillery Rocket System (HIMARS) launchers; forty M57 Army Tactical Missile Systems (ATACMS); thirty-six M31A2 Guided Multiple Launch Rocket Systems (GMLRS) Unitary; thirty-six M30A2 Guided Multiple Launch Rocket Systems (GMLRS) Alternative Warhead, etc.

## Morocco for 40 JSOWs

Morocco has requested to buy forty AGM-154C Joint Stand Off Weapons (JSOW). Also included are Dummy Air Training Missiles; Captive Flight Vehicles (CFVs); Free Flight Vehicles (FFVs); containers, etc.



## NGC F-16 EW suite testing

Northrop Grumman's AN/ALQ-257 Integrated Viper Electronic Warfare Suite (IVEWS) has completed US Air Force Laboratory Intelligence Validated Emulator (LIVE) testing.



The system exceeded multiple benchmarks and demonstrated the ability to counter modern radio frequency (RF) threats. This was the first time the ultra-wideband architecture in IVEWS underwent LIVE testing.

## MQ-20 with LEO SATCOM datalink



General Atomics has conducted live, tactical, air combat maneuvers using Artificial Intelligence (AI) pilots to control a company-owned MQ-20 Avenger Unmanned Aircraft System. Collaborative maneuvers between human and AI pilots were conducted using GA-ASI's Live, Virtual, Constructive collaborative combat aircraft ecosystem over a Low Earth Orbit satellite communication provider's IP-based Mission Beyond Line of Sight datalink.

## UK's Future Combat Aircraft

The UK Ministry of Defence has awarded a contract extension worth £656 million to BAE Systems and on behalf of British defence firms; Leonardo UK, MBDA UK and Rolls-Royce to progress the concepting and technology of the next generation combat aircraft, known as Tempest in the UK. The new funding will build on the ground breaking science, research and engineering



already completed under the first phase of the contract delivered by UK Tempest partners BAE Systems, Leonardo UK, MBDA UK and Rolls-Royce.

### Sweden for Patria's armoured vehicles

Patria signed a contract with the Swedish Defence Procurement Agency (FMV) for FMV to purchase 20 Patria 6x6 armoured vehicles. The first deliveries of the vehicles, which in Sweden will be called "Pansarterrängbil 300", will take place within 2023.



### AMRAAM variant AIM-120D-3 progress

The US Air Force has completed the Functional Configuration Audit, or FCA, of the latest variant of Raytheon's Advanced



Medium Range Air-to-Air Missile. The AMRAAM AIM-120D-3 is on-track toward fielding by both the Air Force and Navy this year. The AIM-120D-3 features modernised hardware, including 15 upgraded circuit cards developed with model-based systems engineering initiatives under the Form, Fit, Function Refresh programme.

### MBDA wins major Polish contract

MBDA has been contracted by the Polish Armament Agency to supply CAMM missiles and iLaunchers for Poland's PILICA+ air defence upgrade programme. In total, MBDA will provide missiles and missile launchers valued at £1.9 billion to support Poland's modernisation and manufacture of a total of 22 PILICA+ air defence batteries – making it the largest European short-range air defence acquisition programme in NATO.



### 1st American-made military versions of H125



Airbus Helicopters is introducing the first US built H125 military configurations, known as AH-125 and MH-125 Ares, to the Airbus range of military helicopters. These will feature militarised options that meet the needs of military and parapublic allies and partners around the world. The AH-125 Ares will be configured as the armed variant of the helicopter, while the MH-125 Ares will be configured as a multi-role helicopter capable of a wide range of operations.

## UK/Germany in next phase in joint tank ammo



Germany and the United Kingdom will work together on the next phase of development for advanced armour-piercing tank ammunition. They signed a Statement of Intent to work together on the Enhanced Kinetic Energy (EKE) round – an advanced armour-piercing ammunition providing a step change in the Army's ability to defeat evolving enemy threats.

## UK for 768 APKWS-II's



United Kingdom has requested to buy up to seven hundred sixty-eight (768) Advanced Precision Kill Weapon System-II (APKWS-II) All Up Round (AURs) (Single Variant). Also included is support equipment; spare and repair parts; publications and technical documentation; transportation; US Government and contractor engineering, technical and logistical support services; and other related elements of logistical and programme support. The total estimated cost is \$31.2 million.

## MBDA and MAADS/CAMM-ER missile

MBDA recently performed a successful qualification firing of the new Medium Advanced Air Defence System (MAADS), a new generation medium-range missile defence system developed by MBDA using the CAMM-ER missile.



## Australia for MASS systems



The Royal Australian Navy and the Commonwealth of Australia have ordered the Multi Ammunition Softkill System, or MASS, which will initially be used to equip its Hobart-class destroyers and ANZAC-class frigates.

## IAI unveils BlueWhale AUV

Israel Aerospace Industries has unveiled its BlueWhale Large Autonomous Underwater Vehicle for the first time. Like manned submarines, BlueWhale performs covert intelligence-gathering above the sea surface, can detect submarines, underwater targets and gather acoustic intelligence, and also search for and detect naval mines on the seabed.



# Key figures of Dassault Aviation Group for 2022



The Board of Directors, on 9 March 2023, chaired by CEO Mr. Éric Trappier, approved the 2022 statement of accounts. The audit procedures have been completed and the audit opinion is in the process of being issued.

“The war in Ukraine has featured prominently over the past year, not least because of the human consequences it has taken since it first started. Our thoughts are with the Ukrainian people. It also serves as a reminder to EU countries that armed conflicts are not consigned to the past and that we must be prepared for them. This is why President Macron, who was re-elected in April 2022, is calling for a war economy to be established. France’s Military Procurement Law, which will be enacted in 2023, should reflect that mindset. Apart from the war in Ukraine, 2022 saw a succession of crises (persistence of the Covid-19 pandemic, particularly in Asia, geopolitical crises, shortages of raw materials, inflation, energy supply, social unrest). These crises have destabilised our suppliers, directly impacting our supplies, production and development. Supply chains were severely affected in 2022 and remain under significant pressure, particularly in the aviation sector” stated the CEO.

“Like 2021, 2022 was a historic year for order intake (EUR 21.0 billion and 156 aircraft – 92 Rafale Export and 64 Falcon). As a result, our backlog is the



In the presence of senior Egyptian authorities and Dassault Aviation representatives, a ceremony to celebrate the Rafale’s 10,000 flight hours was held recently on the operational air base where the Egyptian Air Force’s Rafale “Wild Wolves” squadron is stationed. After an initial order in 2015, that made Egypt the Rafale’s first export customer, followed by a second in 2021, the Rafale has now reached a new milestone thanks to the Egyptian Air Force: the first 10,000 flight hours operated by a user other than the French air forces.

largest in the Group’s history: EUR 35.0 billion (251 aircraft – 125 Rafale Export, 39 Rafale France and 87 Falcon), Net sales totaled EUR 6.9 billion and we delivered 46 aircraft: 13 Rafale Export, 1 Rafale France and 32 Falcon. Lastly, concerning the FCAS, the agreement on the development of the demonstrator

(detailed specifications) establishes the role of Dassault Aviation as lead architect of the New Generation Fighter (NGF). This is good news for our engineering department, since the agreement protects our intellectual property” further stated the CEO.

In the military sector, 2022 saw the commercial success of the Rafale for export,



notably with the entry in the order book of the contract for 80 Rafale for the United Arab Emirates following receipt of the first advance plus the signing of contracts for 42 Rafale (6+36) for Indonesia. The first advance has been received for the first six aircraft, which have been included in 2022 order intake. The entry into force of the order of the additional 36 Rafale is pending, the sale to Greece of an additional six new Rafale.

As a result, Rafale order intake in 2022 equals 92 aircraft (80 for the United Arab Emirates, 6 for Indonesia and 6 for Greece). The backlog as of 31 December 2022 now includes 164 new Rafale (125 Export, 39 France), the delivery of 13 Rafale to export customers (Greece, India and Qatar), resumption of the delivery of Rafale to France, with one aircraft accepted in 2022. This delivery follows a four-year hiatus, at the request of the French State for budgetary reasons, the continuation of development work on the Rafale F4 standard, for the FCAS, of which Dassault Aviation is leader for the NGF demonstrator, the first phases of work on the demonstrator (Phase 1A) were completed in 2022. Dassault Aviation and Airbus have reached an agreement, allowing phase 1B to be awarded. Dassault Aviation is prime contractor and architect

of pillar 1, the NGF, and is involved (as co-contractor or sub-contractor) in pillars 3, 4, 5 and 7, as well as in item 0 (continuation of technical operational studies with the military).

Work has begun on the Eurodrone contract. Dassault Aviation is responsible in particular for flight controls and mission communications, as a sub-contractor of Airbus Defence and Space.

Regarding the Falcon multi-mission aircraft, development work is continuing on the Archange (Falcon 8X) and Albatros (Falcon 2000LXS) programmes. Business development efforts resulted in order intake for 4 Falcon 2000LXS for the South Korean Air Force; architectural study of the Futur PATMAR, based on Falcon 10X, has been launched in January 2023, (in competition with Airbus), the vertically integrated contracts signed with France for the Rafale (Ravel), Mirage 2000 (Balzac) and the ATL2 (Ocean) are continuing, with performance exceeding the contractual targets.

In the civil aviation segment, 64 Falcon were ordered and 32 Falcon were delivered in 2022. The business aviation market was dynamic, despite the slowdown observed at the end of the year. The year also saw the continuation of development efforts

on the Falcon 6X and 10X; the Falcon 6X is continuing its test flight campaign and certification process. This aircraft will enter service in mid-2023. It was unveiled at the EBACE and NBAA trade shows and is continuing to be ramped up; the Falcon 10X reached several milestones in 2022 (industrialisation of its first parts, wing tests). A full-scale mock-up was unveiled at the EBACE and NBAA trade shows; the award to Dassault Falcon Service of a support contract for France's Falcon aircraft; the expansion of the network of service centers, with the upcoming opening of service centers in Dubai in 2023 and in Melbourne (Florida) and Kuala Lumpur in 2024. Wilmington service center has ceased its operations; the Company's commitment to the decarbonisation of its Falcon aircraft, in particular with preparation for the expansion of Falcon SAF capability. The Falcon 10X will be natively 100% SAF compatible as soon as it enters service, the launch of the "SAF plan," which envisages the ambitious use of SAF for internal flights and the development of a flight plan optimisation tool.

The backlog as of 31 December 2022 is 87 new Falcon, compared with 55 at the end of 2021. 🦅

(All images: Dassault)

# News from Israel

## IAI and Daronmont Tech MoU for BARAK-MX



Israel Aerospace Industries (IAI) has signed an MOU with Daronmont Technologies, to deliver advanced air and missile defence capabilities within the framework of Australian MOD Tender (AIR-6502) for the purchase of defence systems and other ADF programmes. IAI will leverage Daronmont's proven integration, development and manufacturing capabilities as part of its broad Australian Industry Capability (AIC) strategy to deliver the combat proven BARAK-MX Air and Missile Defence (AMD) system providing effective defence to the ADF and Australian national assets, rapid initial operational capability (IOC).

## IAI conducts first flight of a B777-300ER P2F

Israel Aerospace Industries (IAI) announced the successful completion of the first test flight, as part of the final certification process for the B777-300ER passenger aircraft converted to a cargo



configuration, known as, The Big Twin. On conclusion of the certification process by the Civil Aviation Authorities, The Big Twin will be the first twin engine aircraft of this type, able to carry 100 tons' cargo payload. This programme adds to IAI's 45-year aircraft conversion track record including the B767-200/300, B747-400, and B737-700/800 freighter programmes, in service today.

## IAI and Korea for B777 P2F



Israel Aerospace Industries (IAI) has signed an agreement with Sharp Technics K (Sharp) and Incheon International Airport Corporation, to establish a facility for the passenger-to-freight conversion of Boeing 777-ERSF (Big Twin) aircraft. The signing ceremony took place at South Korea's Incheon International Airport, in the presence of senior officials and representatives of each of the companies. Within the framework of the collaboration agreement, IAI plans to convert Boeing B777-300ER aircraft, starting in 2024.

## IAI delivers 100<sup>th</sup> Wing for USAF T-38s

Israel Aerospace Industries (IAI) has marked the delivery of the 100<sup>th</sup> IAI-produced T-38 wing to the United States Air Force, in a special ceremony held at the company's headquarters. The T-38 Talon is a twinjet supersonic jet trainer, developed for the United States Air Force, which has been operational since the 1960s.



## Elbit order for the 120<sup>th</sup> Hermes 900



Elbit Systems has received and order for its 120<sup>th</sup> Hermes 900 Medium-Range Long-Altitude (MALE) unmanned aerial vehicle (UAV). The family of the Hermes 900 multi-role MALE UAV is Elbit Systems' largest unmanned aerial vehicle and is capable of performing a wide range of missions including persistent intelligence, surveillance, target acquisition and reconnaissance (ISTAR). The advanced UAV can also perform ground support and maritime patrol missions, and provides the capabilities for integrated multi-platform, multi-sensor operations.

## Israel MoD and Rafael for Navy's Typhoon cannons



For the first time, a civilian industry will provide comprehensive maintenance support services for operational systems employed by the Israeli Navy. The multi-year agreement will extend for over 20 years and includes maintenance services for dozens of "Typhoon" remotely-controlled naval weapon stations (RCWS). The services will bolster the technological and operational cooperation between Rafael and the Israeli Navy and establish maintenance capabilities for additional systems.

## Elbit in contracts with Romania

Elbit Systems has been awarded four contracts to supply the Romanian Ministry of National Defense with aircraft upgrades as well as electronic warfare suites, electro-optical infrared (EOIR)



payloads and Brightnite systems for the IAR 300 helicopters. As part of one of the contracts, the Company will integrate Elbit Systems SPECTRO XR payload onto IAR 300 helicopters to enhance the Romanian Navy's operational capabilities.

## Aeronautics Orbiter 4 for Thailand



Aeronautics Group has signed a collaboration agreement with one of the leading defence companies in Thailand, RV Connex, for in-country production of the innovative tactical UAV, Orbiter 4. Local production will serve the interests of customers of both companies in the APAC region. Aeronautics will transfer knowledge for production of the system including the air vehicle, its sub-systems and its ground support system which the company offers its customers worldwide.

## Greece purchases Spike missiles

The Israeli Ministry of Defence announced that the Hellenic Ministry of National Defence is acquiring Rafael Spike Missiles in agreement which is valued at approximately 370 million Euros.



## Aeronautics to supply Greece Orbiter 3



Aeronautics has announced a contract to supply dozens of its Orbiter 3 systems to the Greek Ministry of Defence. As part of the contract, Rafael will provide an advanced solution enabling significant operational advantage to the modern battlefield; While the Orbiter 3 systems detect, recognise and identify (DRI) the target, the Spike missiles, launched from the air, sea, or land can rapidly close the sensor-to-shooter loop, using the “Fire Weaver” C4I system. The rapid Sensor to Shooter process implementing advanced technologies, enables mission success.

## Elbit to supply Intelligence and EW aircraft

Elbit says it has been awarded a follow-on contract worth approximately \$100 million to convert commercial aircraft into Intelligence and Electronic Warfare (EW) aircraft for an international customer. The contract will be performed over a

period of three years. As part of the contract, Elbit Systems will equip the aircraft with advanced Intelligence Mission Suite and EW capabilities. This solution will provide a comprehensive operational picture of the arena generated by SIGINT and Electro-Optics VISINT sensors and systems as well as the capability to activate Electronic Counter Measures against a range of threats. The aircraft will also be equipped with Immune Satellite Navigation Systems (ISNS) and an advanced self-protection solution.

## Elbit to supply ATMOS artillery systems



Elbit has been awarded a contract worth \$102 million to supply artillery systems to an international customer. The contract will be performed over a period of eight years. Under the contract Elbit Systems will supply a battalion's worth of ATMOS (Autonomous Truck Mounted Howitzer) 155mm/52 caliber truck-mounted howitzers systems. 🦋

## IAI to provide airborne SIGINT solutions

**I**srael Aerospace Industries (IAI), through its defence electronics subsidiary, ELTA Systems, announced that it has been awarded with a contract to provide airborne Signals Intelligence (SIGINT) solutions to an international customer. The contract size including systems delivery and maintenance will surpass \$100 million. Under the contract, ELTA will provide SIGINT systems and airborne communications suites for installation both on manned and unmanned aircraft. The SIGINT capabilities are designed to cope with the challenges of modern, dense communications and electronic environments, to analyse complex signal formats, and to build a real-time Electronic Order of Battle (EOB) providing time-critical intelligence.



# Dassault celebrates 60 years of Falcon business jets



**F**or an aircraft to fly well, it must be beautiful,” Marcel Dassault famously said. Already well known for the sleek Mirage fighters, Dassault—the man and the company—proved the adage once again on 4 May 1963, with the first flight of the Mystère 20, the company’s first business jet. With an eye toward the sizable American market, the Mystère 20 would soon be rebranded the Falcon 20.

Sixty years and more than 2,700 business jets later, Dassault Aviation continues the tradition of building beautiful, advanced-technology aircraft.

“The formula has not changed,” stated Dassault Aviation’s Chairman and CEO Eric Trappier. “Every Dassault aircraft must have superb handling, beautiful lines, and rugged construction. And, of course, it has to provide state-of-the-art comfort.”

The Falcon 20 wowed some of the top aviation leaders of the time, including Charles Lindbergh, Pan Am chief executive Juan Trippe, and FedEx founder Fred Smith. It went on to spawn 27 different model types that found eager buyers among entrepreneurs, government agencies, and several nations’ armed forces. Its pioneering safety features, including the use of rugged fighter structures and systems, set the standard for countless future safety improvements, from head-up cockpit displays to digital flight controls—technology that subsequently became widespread across the industry.

Today, Dassault’s strong corporate values, design ethos, and relentless focus on elegant lines, inside and out are embodied in two brand new models, the 5,500 nm Falcon 6X and the 7,500 nm.

Falcon 10X. These aircraft feature the largest cabin cross sections in business aviation, setting a new standard for long-range passenger comfort.

Each has been recognised by the design community with prestigious interior design awards. The 6X, which enters service this year, is equipped with Dassault’s most advanced digital flight control system to date. The 10X, which is in the early stages of assembly, will come with even more advanced systems and safety features.

## The first Dassault business jet takes off

A little after 5 pm on 4 May 1963, test pilots René Bigand and Jean Dillière “gave it the gas,” as one historical account recalls, taking the Falcon 20 for an inaugural one-hour flight. The flight occurred late



in the day because of the visit of Charles Lindbergh, who dropped by to inspect the new business jet on behalf of Pan Am. It was only after he had departed Dassault's Mérignac final assembly plant, near Bordeaux, that the flight team readied the aircraft for flight.

Lindbergh reportedly wired Pan Am CEO Juan Trippe: "I've found our bird." The airline promptly ordered 40 units with an option for 120 more and established Pan Am Business Jets to run its executive jet operations. The new entity later evolved into Dassault Falcon Jet (DFJ), a fully owned Dassault Aviation affiliate. Headquartered in Teterboro, New Jersey, DFJ is responsible for representing and supporting Falcons in the US and elsewhere in the Western Hemisphere.

### More orders

In 1973, Fred Smith launched FedEx with a fleet of 33 Falcon 20s modified with a large cargo door, helping set that company on the road to success. In the 1980s, the US Coast Guard ordered 41 Falcon 20's (designated the HU-25) modified for search and rescue. In all, Dassault went on to build nearly 500 20-series aircraft.

### A history of continuous advances

In the years following, the company introduced a series of aircraft models widely considered by pilots to be among the best business jets to fly. Currently, more than 2,100 Falcons are operating in over 90 countries around the world. The best-selling



model has been the Falcon 2000, a highly economical, super-efficient twin that has been continuously updated to remain at the top of its class. Nearly 700 have been delivered so far. The second-best seller has been the workhorse Falcon 900, which has also gone through numerous iterations. To date more than 550 of these aircraft have been delivered, including two that were recently handed over to the Royal Air Force for VIP transportation service.

Also popular has been the fly-by-wire Falcon 7X/8X line. Some 400 of these ultra-efficient, versatile, very long-range models have come off the assembly line. "Through these different models, we have built up a strong legacy and a solid base of technological know-how that makes us confident in our ability to continue developing new products that fully meet customer expectations," stated Trappier. "Sixty years on, Falcons are still completely distinctive in the business jet world: beautiful, delightful to fly, and always on the leading edge of technology, bringing safety, comfort and productivity benefits to operators around the globe." 🦅

**Text and photos: Dassault Aviation**



**E**mbraer and Saab on 9 May 2023 inaugurated the production line of the Gripen E in Brazil, at Embraer's plant in Gavião Peixoto (São Paulo State). This is an important milestone in the technology transfer programme and the companies' commitment to work together on new business opportunities. The event was attended by the President of Brazil, Luiz Inácio Lula da Silva, the Minister of Defense, José Mucio Monteiro Filho, and the Brazilian Air Force Commander, Lieutenant-Brigadier Marcelo Kanitz Damasceno, among other important civil and military authorities plus and representatives of different sectors of Brazilian society.

The inauguration of the final assembly line, which is the only one for Gripen E outside of Sweden, marks the delivery of one the most significant contributions to the Gripen fighter ecosystem in Brazil. The Embraer plant in Gavião Peixoto with the Gripen Design and Development Network (GDDN), the Gripen Flight Test Centre (GFTC), and now the assembly line, is home to the development, production, and testing stages of the aircraft.

Since the signing of the contract to supply 36 fighters - Gripen E (single seater) and eight Gripen F (twin seater) - to the Brazilian Air Force in 2014, Embraer and Saab have been working together on the

largest ongoing technology transfer project in the country. Recently, with the signing of the Memorandum of Understanding between the companies, the production line has also become an opportunity for new business.

"Today we celebrate not only the inauguration of the Gripen fighter production line, but the success of the collaboration between Saab and Embraer, which grows stronger every day with the common goal of serving our client, the

Brazilian Air Force. Since the beginning, Embraer has played a relevant role in the Gripen programme, participating, for instance, in the development of the Brazilian version of the twin-seater aircraft. As a natural evolution of this relationship, we hope that soon we can together expand our business into new markets," stated Bosco da Costa Junior, President and CEO, Embraer Defense & Security.

"The start of operations of the Gripen production line marks our commitment



to transfer technology and knowledge to Brazilian industry. Here, we will produce 15 of the 36 aircraft currently contracted to the Brazilian Air Force. The aim is also to produce here any future Gripen orders from Brazil as well as other countries. We want Brazil to become an export hub to Latin America and potentially other regions”, said Micael Johansson, President and CEO of Saab.

“The start of production of the F-39 Gripen aircraft in Brazil symbolises the achievement of an ambitious project that translates itself into technology transfer, job creation and the consequent development of Brazil’s aerospace sector. Thanks to a solid partnership between the Air Force, Saab, and Embraer, we are now part of the select group of countries that have the capability

to build supersonic aircraft. Congratulations to all involved!”, stated the Brazilian Air Force Commander, Lieutenant-Brigadier Marcelo Kanitz Damasceno.

The production line at Embraer receives the aerostructures produced at the Saab plants in Linköping (Sweden) and São Bernardo do Campo (São Paulo State, Brazil). On the assembly line the fighter aircraft will be produced by the joining of these aerostructures, the installation of cabling, equipment of various systems, landing gear, avionics, tactical equipment, canopy, ejection seat and engine. Once a Gripen is completed, functional tests and production flights are carried out to prepare the aircraft for final delivery. The Embraer plant will be responsible for producing 15 Gripen E fighters. Units assembled in Brazil will be delivered from 2025.

To acquire the necessary skills for the production of supersonic fighter jets in Brazil, Embraer technicians carried out theoretical and practical training – on-the-job training - at Saab in Linköping. There they worked side by side with Swedish employees to produce the aircraft that have already been shipped to Brazil. 🇧🇷

**Text and photos: Embraer**



# Precision Strikes with LORA



into the Indian Navy, while the Indian Army is looking for an extended ranged (500-km) version.

LORA was the result of collaboration between Israel Aerospace Industries, MLM Division, and IMI. The missile was first publicly shown in 2006 at the Eurosatory exposition and then officially displayed in 2007 and 2011 at the Paris Air Show. With a weight of 1,600-kg and length of 5.2-m LORA is an all-weather surface to surface missile, combining long range, precision and lethality. The missile includes a single-stage; solid rocket motor with all solid-state electronics and all electric drives (no hydraulics). The LORA is capable of engaging strategic targets deep in the enemy's territory from mobile or maritime platforms and is an effective solution

into the Indian Navy, while the Indian Army is looking for an extended ranged (500-km) version. System (INS)/Global Positioning System (GPS)/terminal Television (TV) guidance, the 440-kg High Explosive (HE) or 600-kg penetrator warhead can be delivered with significant accuracy, with a circular error probable (CEP) of 10-m across the whole range that varies from 90 to 430-km. With an Angle of Attack (AoA) of 60° to 90° the missile can accurately hit wide range of targets, including tactical Surface-to-Surface Missiles (SSM), MLRS units, air bases, air and missile defence units, command posts and other military infrastructures and capable of penetrating fortified targets.

The missile can be launched within minutes from unprepared positions. Any target whose location is known within the range of the missile can be attacked and destroyed within less than 10 minutes from the launch decision. The LORA uses a shaped trajectory flight mode and is stored in a sealed canister, enabling very low maintenance costs. In the naval configuration, the missile is delivered in a four-cell container, with minimal deck space requirement. In the land-based configuration, LORA is launched from a sealed four-cell launcher mounted on a flatbed truck.

A typical LORA mobile battery comprises four ground launchers (16 missiles), four reload vehicles (16 ready-to-reload missiles), and a separate Battery Command, Control, Communications, Computers & Intelligence (C4I) post. 🦋

**Sayan Majumdar**  
(All images courtesy IAI)

**B**harat Electronics Ltd. (BEL) had signed a MoU with Israel Aerospace Industries (IAI) for domestic manufacture and supply of its Long Range Artillery Weapon System (LORA) for the Indian Tri-services. The state-of-the-art tactical weapon system will be manufactured by BEL, as the prime contractor, based on the work share arrangement with IAI. The MoU, signed during Aero India 2023, "is an outcome of the growing partnership between India and Israel in the field of high technology strategic defence systems, and is in line with the Government of India's 'Make in India' initiative for major weapon systems", a BEL statement said. "Developed by IAI's 'MALAM' division, LORA is a sea-to-ground and ground-to-ground system which comprises a long-range ballistic missile, a unique launcher, a command and control system, and a ground/marine support system", it said. "The LORA system provides ballistic assault capabilities for multiple ranges with a precision level of 10-metres CEP (circular error probable)," it added. LORA missiles are already inducted

for destroying targets deep inside enemy territory. The missile follows a ballistic trajectory at supersonic speed to the target but can perform random or programmed in-flight evasive manoeuvres to mitigate tracking and interception.

Typical targets are fixed or transportable including infrastructure assets. Thanks to Inertial Navigation



# Rafael registers record breaking 2022



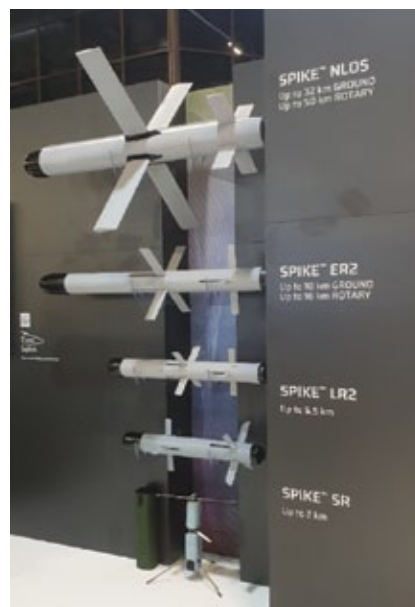
In March 2023, Rafael Advanced Defense Systems Ltd announced its financial results for 2022, as approved by the company's board of directors, with sales amounting to \$3.45 billion and a net profit (without the special tax for previous years' profits) of \$150 million. The volume of orders is \$4.8 billion and the order backlog is \$10.1 billion, which is about 3 years of sales. The backlog of orders breaks a record, crossing the 10 billion dollar mark and standing at approximately \$10.2 billion compared to approximately \$9.2 billion in the corresponding period last year- the increase is mainly due to orders received in Israel and abroad.

The net profit (without the special tax) in 2022 amounted to about \$150 million, compared to the net profit of about \$133 million in 2021. The company's sales in 2022 totaled approximately \$3.45 million, compared to approximately \$3.07 billion in 2021.

CEO and President of Rafael, Maj. Gen. (Ret.) Yoav Har-Even stated. "2022 was a challenging year in many respects: Starting with the continued impact of the COVID-19 Pandemic, the challenge of recruiting and retaining manpower, difficulties in the supply chain, and of course the changes and transformations in the markets in Israel and globally which were impacted by the campaign in Ukraine and other major events. Through proper preparation and the practical implementation of the company's strategic

vision, Rafael completed 2022 with a successful year. This financial year brought with it technological breakthroughs and marketing achievements, both in Israel and worldwide, and again with very promising financial results. Even through the challenges and complexity of the past year, Rafael continued to be a central pillar supporting the country's security, with significant contributions to the IDF and the defence establishment as a whole by providing a wide range of capabilities and advanced systems that are the products of the considerable investments in research and development. Above all, we rely on the

quality of our manpower, this is what allows us to overcome challenges and achieve the goals set before us. In this regard, we have taken major steps on all levels to preserve, develop and recruit the best candidates for our workforce and we will continue to do so moving forward in 2023. We are already in the midst of another very successful year. I would like to take this opportunity to thank the outgoing Chairman of Rafael, Dr. Uzi Landau, for his 6 years of leadership and invaluable work for the company and on behalf of Rafael's management and board of directors, I would like to thank the Rafael employees and their families." 🇮🇱



# Gripen E: Evolve every day



It's hard to imagine that the smartphone in your pocket has anything in common with the Gripen aircraft. However, they have more similarities between them than meets the eye.

Both rely on software technologies with built-in flexibility and adaptability. Technologies which can be effortlessly upgraded without a need for costly design and replacement efforts, allowing the product to evolve and be customised to meet any changing need of the user. This is a prerequisite for performance at optimal levels, to stay not only relevant, but to lead the way.

In the same way that you can download apps for your smartphone, with Gripen, software adaptations can be made to counter new and evolving threats. The ability to customise Gripen's systems has been made possible due to a new revolutionary design of the Avionics Platform Software (APS) and hardware architecture.

Compared with the smartphone, the Saab engineers has however taken this concept to a whole new level with Gripen E. The software is actually not dependent on what hardware it runs on, and vice versa. This means as computational power develops, new standard hardware can continuously and swiftly be installed without having to requalify the software. This in turn enables new advanced AI software that requires such computational powers to be introduced in a continuous

synergistic spiral. Using the smartphone analogy would mean that you could change processor to unlock more powerful apps without having to buy a new phone.

Disruptive innovations and several years of hard work has gone into creating this unique form of avionics software and hardware structure. As technology becomes increasingly advanced, Gripen E evolves with it, in an ever changing process. By designing the avionics architecture in the Gripen to truly separate tactical system functions from the flight critical, changes can be made very rapidly. At the same time, the Saab principle is to keep the software as generic as possible. By also using generic computers it becomes much easier to make the upgrade work. The separated avionics architecture in Gripen E is certified to the highest software assurance level. In software terms, this means that Gripen E is the most secure fighter system on the market.

## Never obsolete, always available

The Gripen E avionics architecture enables the integration of tailor-made customer applications, and it removes risks of the system ever becoming obsolete. The flexible avionics also allows for ease of integration of virtually any weapon of any origin. And maybe best of all, this all means that Gripen E will never spend a lot of time on the ground for time consuming requalification of the entire aircraft, so it's available for the next mission quickly.

This is of course absolutely critical in a war time scenario.

Since the first flight of Gripen E in June 2017, the software platform has been updated numerous times. In addition to upgrading the hardware and its performance, all of the Gripen E computer processors have also been updated. Thanks to the unique avionics core, these updates are done very rapidly; in a matter of days and sometimes in only a few hours, where no flight critical re-qualification needs to be done. As further artificial intelligence enhancements and machine learning capabilities are introduced, the system's tactical agility and adaptability ensure that these will be able to be incorporated with ease, and the Gripen fleet will be updated and ready for the next mission long before anyone else. 🦅



By Kent-Åke Molin, Head of Gripen for India Programme

# Saab updates

## Order for Gripen C/D development

Saab has signed a contract with the Swedish Defence Materiel Administration (FMV) concerning support and maintenance services for the JAS 39 Gripen C/D fighter aircraft. The order ensures continued operation and a cost-effective solution regarding maintenance and availability of the system. The order is valued at SEK 308 million.



The order includes development, studies, and testing regarding rear maintenance of JAS 39 Gripen C/D, development of a packaging concept, and studies on how, from a maintenance perspective, Gripen C/D and Gripen E can effectively coexist in the fleets. The order also includes avionics computers.

## Carl-Gustaf ammunition for Lithuania

Saab has received an order from Lithuania's Defence Materiel Agency for Carl-Gustaf ammunition. The order value is SEK 145 million and deliveries will start during 2024.



The order is placed within a framework agreement initially signed between Saab and the Swedish Defence Materiel Administration, which allows Lithuania, together with Latvia and Estonia, to place orders for Carl-Gustaf M4 weapons and ammunition during a ten-year period.

## 4th GlobalEye in 1st Flight


"The first flight of the fourth GlobalEye is an important milestone in Saab's Airborne Early Warning & Control (AEW&C) programme and highlights that Saab can rapidly and reliably deliver GlobalEye. The aircraft took to the skies from Saab's airfield in Linköping, Sweden on 3 April 2023 and performed several tests related to the aircraft's capabilities", stated the company.



GlobalEye is a most modern multi-domain Airborne Early Warning & Control (AEW&C) solution with an array of active and passive sensors that provide long-range detection and identification of objects in air, at sea and over land. By providing real-time information to units in air forces, armies and navies, GlobalEye enables enhanced situational awareness of the surrounding areas and early detection of threats. It can also be used for non-military tasks such as leading and coordinating rescue missions during natural disasters or larger accidents at sea or on land.

Saab has the largest AEW&C customer base in the world, having delivered solutions over the last 30 years across the Americas, Europe, Middle East and Asia for multiple mission roles.

## Saab and Embraer MoU for new opportunities

Saab and Embraer S.A. announced the signature of a Memorandum of Understanding (MoU) to deepen the collaboration between the companies in several areas, mainly related to business development and engineering opportunities. The companies will collaborate to position the C-390 Millennium aircraft as the preferred solution to meet the Swedish Air Force tactical air transport requirements, and will also evaluate the integration of Saab equipment and systems into the C-390 Millennium multi-mission aircraft. 

C-390 at Aero India 2023



# Rosoboronexport launches Typhoon-K MRAP vehicles



Rosoboronexport (part of the Rostec State Corporation) has started promoting fully import-substituted Typhoon K-53949 mine resistant ambush protected (MRAP) vehicles in foreign markets.

“Rosoboronexport presents to its partners an armoured vehicle of the Typhoon-K family assembled exclusively from Russian-made components. This vehicle has proven to be a reliable and highly protected personnel carrier. The Typhoon-K is in service with the Armed Forces of the Russian Federation and has substantiated its performance under actual operating and combat conditions. Moreover, many of Rosoboronexport’s partners are operating armoured vehicles based on this family of vehicles and have given positive feedback,” stated Rosoboronexport Director General Alexander Mikheev. “This MRAP vehicle is of great interest for Middle Eastern, African, Latin American, Asia-Pacific and former USSR countries. Independence from foreign components in the production of the Typhoon-K gives us and our partners confidence in timely and complete after-sale service of the vehicles supplied, their modernisation and development.”

The Typhoon-K vehicles feature high reliability, maneuverability, cross-country ability and innovative approaches to their protection, ergonomics, layout and equipment. They can ford up to 1.5 meters without preparation and climb 30-degree

slopes. With a new generation 350hp diesel engine, the Typhoon K-53949 can reach a maximum speed of 100 km/h.

All models of the 4x4 Typhoon-K family are equipped with an onboard information management system, a central tire inflation system, bullet-proof tires, an all-round video surveillance system, an automatic fire-extinguishing system, and a diesel auxiliary power unit (APU). In addition, remotely controlled weapon stations with stabilised armament can be mounted on them. The armament suite varies depending on customer needs.



The 4x4 vehicles are equipped with a hinged ramp in the rear to allow troops to board and disembark from them quickly and easily.

Vast experience in the development and operation of army vehicles has been complemented by new approaches to design and state-of-the-art technologies of protection against the most dangerous threats.

Typhoon K-53949 armoured vehicles are distinguished by enhanced mine and ballistic protection corresponding to NATO STANAG 4569 Level 3 with the possibility of strengthening it to Level 4.

A high level of protection is provided by composite armour, including an armoured hull and add-on armour plates with ceramic elements, as well as a streamlined hull design and removable anti-mine plates. Troop seats have a suspended system of attachment to the roof, are equipped with blast energy absorbing elements, safety belts and head restraints for fixing the head. In addition, the designers have provided for the possibility of installing additional protection – internal spall liners, as well as special hinged mats to increase the level of protection against anti-tank grenade launchers.

Vehicles for various purposes are being developed from the Typhoon-K chassis by installing weapons, process, engineer and other special equipment.

“Rosoboronexport sees great interest from foreign customers and is ready to cooperate in the format of industrial partnership in the production of various versions of Typhoon-K vehicles, including localisation of their production. Today, we have a significant portfolio of completed projects on licensed production, cooperation within joint ventures, as well as building an infrastructure for the maintenance and modernisation of Russian military equipment in the territory of partners,” Alexander Mikheev added. 🦋

# Vympel R-37M: Bullet of the Aerial Sniper



up to 8-g at an altitude from 15-m to 25-km. The hypersonic (Mach 6) missile is armed with a 60-kg high explosive fragmentation warhead. The R-37M is launched in fire-and-forget mode towards the target's hypothesised position, and once the R-37M comes within suitable range of the target; it activates its own active seeker and homes in on the target at high speed providing little reaction time to the adversary. The active seeker is equipped with a new miniature digital processor with an abundant memory and increased speed and resistant to electronic warfare. The missile is equipped with non-contact active radar and standby contact fuzes.

In Russian Air Force service the R-37M missiles arm the MiG-31BM interceptors, Sukhoi Su-35S and Sukhoi Su-57 air superiority fighters. It is not clear whether R-37M/RVV-BD arms Indian Air Force Sukhoi Su-30MKI air superiority fighters although the missile has supposedly undergone extensive live firings in India's test ranges. 🦋

**Sayan Majumdar**

(Images: en.missilery.info and Wikipedia)

On 19 October 2022, Russian, and subsequently Indian media claimed that a Russian Sukhoi Su-57 shot down a Ukrainian Sukhoi Su-27 using the Vympel R-37M Beyond Visual Range Air-to-Air Missile (BVRAAM). This was the first registered "kill" by the fifth-generation Sukhoi Su-57 while the R-37M missile has risen to prominence during the 'Special Military Operations' repeatedly demonstrating Single Shot Kill Probability (SSPK) and enabling the Russian Air Force to maintain air superiority. R-37M was derived from the Vympel R-37 (AA-13 Arrow) BVRAAM developed to replace the MiG-31 mounted R-33 (AA-9 Amos). R-37 was designed and developed to shoot down ultra-high-value airborne platforms like Airborne Early Warning & Control (AEW&C), Air-to-Air Refuelling (AAR), Long Range Maritime Patrol (LRMP) and Joint Surveillance Target Attack Radar System (J-STAR) platforms, from stand-off ranges without necessarily having first to deal with their fighter escorts. Mid-body strakes enhance lift while folding tail controls allow semi-conformal carriage.

The new version is known as R-37M/ Izdeliye 610/ RVV-BD (Raketa Vozduh-Vozduh Bol'yshoy Dal'nosti) armed with powerful Agat 9B-1388 active seeker. The dual-mode solid-fuelled R-37M/RVV-BD BVRAAM was unveiled at MAKS 2011 for the first time, capable of fulfilling the BVR role for "outer-air battles" by taking

out enemy AEW&C and AAR platforms at the initial stages of conflict. However, the missile has proven potent even against fighter sized targets. The 4.06-m long RVV-BD weighs 510-kg, has a range up to 398-km in "cruise glide" mode and is capable of destroying targets with overload



# The Evolution of IAI/Boeing Arrow ATBM



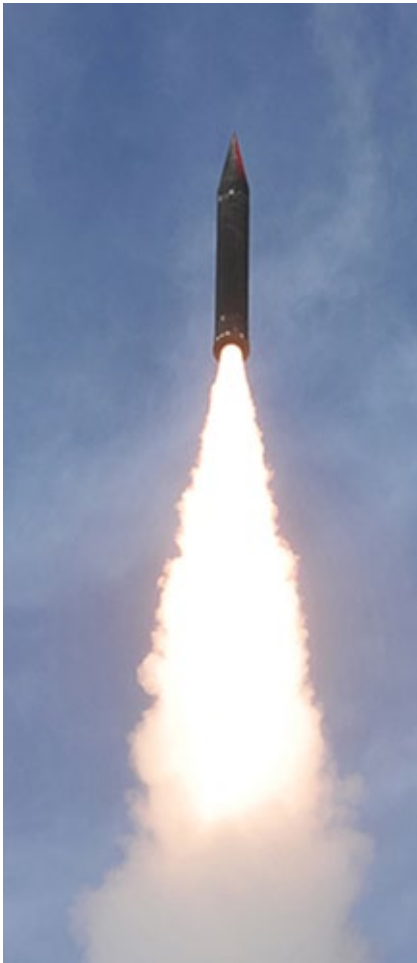
As Israel faces the grim prospect of potential Tactical Ballistic Missile (TBM) strikes with Nuclear, Biological or Chemical (NBC) warheads not only from its adversary nations but also from “sub-states” (read terrorist groups) those could be supplied with Scud type TBMs by “sponsor” nations, to tackle such threats the Israeli Defence Force (IDF) prefers deployment of a combination of Ballistic Missile Defences (BMD) systems with IAI/Boeing Arrow 2 Anti-Tactical Ballistic Missiles (ATBM) developed by MLM Division of Israel Aerospace Industries (IAI) presently forming the centre piece of Israel’s layered system of strategic missile defence under Homa (Fence)/Israel Missile Defence Organisation (IMDO). The first battery at Palmachim Airbase south of Tel Aviv became operational in October 2000 followed by one in Ein Shemer to the south of Haifa in 2002. They are deployed in such a manner that the coverage of the systems overlaps over vital military, commercial installations and concentrated civilian population. A third battery became operational at Tal Shazar

in 2012. The system practically forming National Missile Defence (NMD) in Israeli context is standalone yet integrated with national command & control, and has the capability to provide early warning for itself and of dealing with multiple threats. In Israel Arrow 2 functions as the upper-tier of a multi-tier combined air defence/ATBM network. The middle tier comprises of United States and Israeli Patriot MIM-104 PAC-2/PAC-3 and United States Navy (USN) ship-borne AEGIS systems in addition to IDF David’s Sling Weapon System (DSWS). Iron Dome forms the lower tier.

The refined and leaner (1300-kg) Arrow 2, was first tested in 1995 being derived from Chetz (Arrow) 1 technology demonstrator, a project initiated by the United States Strategic Defence Initiative (SDI) to be developed by IAI. Arrow 2 is meant to intercept tactical ballistic missiles just as they start re-entering atmosphere after reaching the highest point in their flight trajectory. The first missile was delivered by IAI on 29 November 1998 to Israeli Ministry of Defence. Subsequently a

successful full system interception test was held on 1 November, 1999. On 14 March, 2000, the first complete Arrow 2 battery was rolled out in a ceremony at Palmachim Airbase. In February 2003, IAI signed an agreement with Boeing to establish the production infrastructure to manufacture components of the Arrow missile in the United States with Boeing responsible for the production and co-ordination of approximately 50% of the missile components in United States while IAI undertakes integration and final assembly of the missile in Israel.

Under Arrow System Improvement Programme (ASIP) being carried out jointly by Israel and United States Ballistic Missile Defence Organisation (BMDO), a real (as against simulated) Scud-B Short-Range Ballistic Missile (SRBM) was successfully intercepted and destroyed at an altitude of 40-km at Naval Air Station (NAS) Point Mugu naval test range in California in 29 July 2004. In December 2005, an Arrow 2 Block 3 missile successfully intercepted a target at an unspecified but reported record low altitude. In 11 February 2007,



the mid-range Blue Sparrow. The Silver Sparrow is also considered as a candidate for air-launching of Rafael's future LiteSat micro-satellite, providing Operationally Responsive Space capability supporting ad-hoc requirement for satellite imagery.

ASIP acquires importance in light of emergence and proliferation of more formidable and lethal ballistic missiles in Israel's neighbourhood. The operational Arrow Weapon System (AWS) is currently the Block 3 and Block 4. The final firing test conducted on 22 February 2011 validated the block 4 missile performance, which scored a direct hit on this test. Among the improvements introduced in the Arrow 2 Block 4 missile are refined midcourse guidance section, improved target identification and discrimination and enhanced lethality. Other improvements were implemented throughout the system, increasing the situational assessment and overall target engagement, battle management.

An Arrow battery is equipped with typically four or eight launch trailers, each with six launch tubes and ready-to-fire missiles, a truck mounted IAI Hazelnut

Tree Launch Control Centre (LCC), a truck mounted communications centre, and a trailer mounted Elisra Citron Tree Fire Control Centre (FCC) and the units of a mobile Green Pine early warning radar system. There are microwave and radio data and voice communications (Link-16) between the LCC and the radar command and control centre with the launch system deployable up to 300-km from the site selected for the radar command & control centre offering unparalleled protection and flexibility to the AWS.

The two-stage Arrow 2 ATBM is equipped with solid propellant booster and sustainer rocket motors. Arrow 2 is launched vertically, separately or in salvos, giving 360-degrees coverage to each battery. The Green Pine L-band, phased array, dual-mode (detection and fire control) radar determines the intercept point and thereby up-linking very accurate data to the Arrow 2 guiding the intercepting missile to within 4-m of the target. The missile uses an initial burn to carry out a vertical hot launch from the container and a secondary burn to sustain the missile's trajectory towards the target at a maximum speed of Mach

the system successfully intercepted and destroyed a Rafael Black Sparrow target missile, simulating a ballistic missile; at high altitude in a distributed weapon system test with two Arrow units deployed some 100-km apart. On 7 April, 2009 the Arrow 2 Block 4 was successfully tested against the Blue Sparrow (compact Blue Sparrow 2 can even be launched from a fighter sized aircraft) target missile which simulates more agile ballistic missiles, such as the Iranian Shahab-3. The Blue Sparrow target missile was developed by Rafael as an air-launched target simulating medium-range ballistic missile of the Scud B/D class. Rafael is already building a larger version known as 'Silver Sparrow'. The Sparrow targets have a modular warhead section carrying different payloads such as inert, high explosive or water. This 8.39-m long missile weighs over 3-tons and as mentioned, will simulate Shahab-3 class missiles (range 1500-2000-km) for the testing of the Arrow-3 interceptor. The Silver Sparrow uses a single stage solid rocket propellant, and shares a common re-entry vehicle with





9, or 2.5-km per second. Thrust Vector Control (TVC) is used in the boost and sustained phases of flight. At the ignition of the second stage sustainer motor, the first stage assembly separates. The Kill Vehicle (KV) section of the missile, containing the warhead, fusing and the terminal Electro-Optical (EO) seeker is equipped with four aerodynamically controlled moving fins to give low altitude interception capability. The dual mode missile seeker has a passive infrared seeker (Raytheon developed indium antimonite focal plane array) for the acquisition and tracking of TBM and an active radar seeker developed by Lockheed Martin, used to home on air breathing targets at low altitudes. After Arrow 2 is brought to the best engagement point on the TBM, its EO sensor acquires the target to allow very near pass and then activate the Rafael developed high explosive directed blast fragmentation warhead which is capable of destroying a target within a 50-m radius or sufficiently deflecting it beyond the confines of defended territory. The Arrow also has the capability to simultaneously intercept a salvo of more than five incoming missiles, with the target missiles arriving within a 30-seconds span.

The ELTA Electronics subsidiary of IAI developed the EL/M-2080 Green Pine Early Warning & Fire Control (EW & FC) radar for the AWS system. The Green Pine radar has a proven track record demonstrated in over twenty successful ballistic missile intercepts. The radar includes the trailer mounted antenna array, the power generator, a cooling system and a control centre. Developed from the ELTA Music phased array radar, Green Pine is an dual mode, electronically scanned, solid state, phased array radar operating at L-band in the range 500-MHz to 1,000-MHz, or 1,000-MHz to 2,000-MHz, weighs 60-t and comprises of 2,000 transmit-receive modules. Green Pine is said to be capable of detecting ballistic missiles from a range of up to 500-km and is able to track 30 targets up to speed of over 3-km/s while intercept of the attacking missile may occur 90-km away at an altitude of 10 to 50-km. The long range of Green Pine radar system ensures that a second and third shot can be taken at the incoming ballistic missiles if the first shot fails to secure the “kill”. The ballistic missiles are again intercepted at a much higher altitude (exo-atmospheric or endo-atmospheric) to prevent them

from disintegrating as they approach lower altitude, thus “faking” multiple targets on radar screens. Israel also receives data from the United States Defence Space Programme (DSP) early warning satellites and Boeing RC-135S Cobra Ball intelligence aircraft capable of picking up rapid movement or a rocket launch flash.

Interestingly India placed an order and received its first Green Pine EW & FC radar in 2001 and has since been integrated with the country’s indigenous missile defence system as the Swordfish radar system. At least two sites are currently operational – northeast of Bangalore, and on India’s northeast coast. The Green Pine radar’s strategic value along the Indian-Pakistani border is well appreciated covering all of Pakistan’s military command centres and bases between Islamabad, the capital, and the Indian frontier reportedly providing India with surveillance of Pakistan’s nuclear centres and missile sites and relevant Telemetry Intelligence (TELINT) data. An enhanced version of Green Pine was the key to India’s first Prithvi BDM test. The enhanced Super Green Pine/Green Pine Block B/Great Pine pushes the detection range to 800 to 900-km.



*The Green Pine radar*



Tadiran Electronics Limited Golden Citron Tree Battle Management/Fire Control Centre (BM/FCC) capable of conducting multiple, simultaneous (up to 14) interceptions and includes ten battle stations. Launches are controlled by Hazelnut Tree launcher control centre. Citron Tree, which is trailer mounted, downloads the radar data along with data from other sources and uses powerful signal processing tools to manage the threat interceptions along with man-in-the-loop intervention capability at every stage. The BM/FCC has computer workstations for the Sky Situation Coordinator, Intelligence Officer, Post Mission Analysis Officer, Resource Officer and Senior Engagement Officer as well as the Commander's station. Citron Tree BM/FCC has three banks of operator consoles laid out in a "U" shape. The Centre Commander takes his position at the centre not only to oversee the engagement but also has links to the other parts of the battery, as well as to the Air Force Headquarters. Extensive communication systems ensure National Policy to govern the ATBM engagements as information available includes incoming TBM tracks, predicted impact points and engagement profiles. The Engagement Officer sits at the right of the Centre Commander assigning targets to four other engagement officers sitting on the right-hand leg of the "U". Each is assigned a geographical area to defend and two of the officers have an overview of the lower-tier Patriot Anti-Tactical Ballistic Missile/Surface-to-Air Missile (ATBM/SAM) batteries. The Resource Officer sits at the left of the Centre Commander and monitors the status and readiness of the missiles. On the left of the "U" the Sky Picture Officer who is in contact with the home-front command and predicts the

impact point to alert the civil authorities. An Intelligence Officer and a Post Mission Analysis/Debrief Officer manage the recordings.

The workstations display a large electronic map showing the area of battle. Predicted and confirmed launch sites are colour coded to show priority sites. "Link-16", "Tadil-J", communications is being developed to allow inter-operability with Patriot PAC-2 FC units. Assigned targets can be handed over to the Patriot's AN/MPQ-53 phased array fire control radar. Tests carried out by the United States and Israel has successfully linked the Arrow and United States Patriot PAC-2/3 and also the Arrow and IDF Patriot version. There is one disadvantage of Arrow and this is its "narrow specialisation" because in contrast to its counterparts this system is practically unable to fight aircraft in terrain following mode and requires additional Patriot PAC-2/3 batteries to provide anti-aircraft cover. Patriot batteries are in turn supported by additional Beyond-The-Horizon (BTH) radar, array of satellites and Boeing E-8 Joint-Surveillance Target Attack Radar System (J-STARS) reconnoitring system.

Meanwhile the United States and Israel continues development of an upper-tier component (including an exo-atmospheric interceptor) to the Israeli Missile Defence architecture, commonly known as Arrow 3, based on an architecture definition study conducted in 2006-2007, determining the need for the upper-tier component to be integrated into Israel's Ballistic Missile Defence system in addition to Arrow 2 Block 4 ATBM. The KV of Arrow 3 is to be propelled by rocket motor and equipped with flexible nozzle to offer exceptionally large divert capability, while the state-of-the-art long-range acquisition high-resolution gimballed EO seeker will

obtain hemispheric coverage. By measuring the seeker's line of sight relative to the vehicle's motion, the KV would employ 'proportional navigation' deflecting the KV to divert its course and align exactly at target's fight path, hence achieving an accurate Hit-To-Kill (HTK) even at very high closing speeds and over long distances. Thus two-stage Arrow 3 interceptor is part of the AWS which is the world's first operational, national, stand-alone ATBM defence system, also effective against Intermediate Range Ballistic Missiles (IRBM). Integrating seamlessly into the AWS and complementing the current and future blocks of the Arrow 2 interceptor, the Arrow 3 ATBM enables upper-tier multiple engagement opportunities.

Arrow 3 and Arrow 2 Block 4 are expected to form the top and upper layers, with Rafael David's Sling providing the mid-tier and lower tiers, defending against tactical missiles, long range rockets, cruise missiles and attack aircraft. The low-level will be protected by Rafael's Iron Dome Countering short-range rockets (C-RAM) and 155-mm artillery shells. The spaceflight upper-tier portion of IMDO, Arrow 3, was declared operational on 18 January 2017, operating at greater speeds, greater range and at greater altitudes than Arrow 2, intercepting ballistic missiles during the space-flight portion of their trajectory. According to the chairman of the Israeli Space Agency, Arrow 3 may serve as an Anti-Satellite (ASAT) weapon. On 17 March 2017, the Arrow missile scored its first operational intercept when it shot down a Syrian S-200 (SA-5 Gammon) Surface-to-Air Missile (SAM) fired at an Israeli aircraft. 🦋

**Sayan Majumdar**  
(All photos: IAI)

# The Gendarmerie Air Forces

A strong air force with a great future perspective



Colonel DRY is the Group Commander at the Gendarmerie Air Forces since August 2021. He is in service with the Gendarmerie Air Forces since 2006 and has about 4000 flight hours on various types of helicopters, and he still flies for about 180 hours per year. He told us about the history, organisation, training within the Gendarmerie Air Forces.

## Organisation

Brigadier Emmanuel Josse was appointed as the chief of staff of the French Gendarmerie Air Forces in August 2020. His career has comprised postings in both territorial ground units and gendarmerie air units.

Student at Saint-Cyr, the French Army's military academy and a graduate of the French War College, he is also a recognised specialist in air safety issues after two assignments at the BEA-E (Bureau of Enquiry and Analysis for State Aviation Safety), first as an investigator and subsequently as deputy director.

The Gendarmerie Air Forces (FAGN) has about 500 people, which compared to 100.000 Gendarmerie personnel means that they are a mere 0.5% of the total



Gendarmerie. They have around 150 pilots which are based at the 30 bases, training centres and headquarters.

Besides this, the pilots have a 24/7 duty. That means that they have to run shifts on a frequent basis. Next to the 150 pilots, the Gendarmerie Air Forces have about 200 mechanics, flight engineers, officers, and

non-commissioned officers. And they have also about 450 drone pilots and about 27 drone instructors.

The headquarters of the Gendarmerie Air Forces is based at BA107 Vélizy-Villacoublay near Paris, which also houses an operational unit. This unit is specialised in all types of operations, and is responsible



*An EC135 lifts off from the helipad while 2 H145s enjoy the afternoon sun*



for the planning, supervision debriefing of all helicopter missions of the units throughout France and the overseas departments. At the headquarters, there is also a special group of people, and their work has everything to do with logistics and implementation of this like buying for example the uniforms and computer equipment, but they also prepare all the external maintenance contracts. There are different levels in this system, and everything is about getting the most capacity of the equipment from helicopters, the camera system and other smaller equipment for the missions.

Another office in headquarters is a special department with dedicated staff, and for them the most important subject is that air safety comes first in all helicopter operations at all times. This means that for anything that doesn't meet up to requirements, these issues are brought directly to this office, and here they create the safety reports and the follow up feedback back to all units.

"For them, air safety is something which is very important," Colonel DRY stated. "It is a key point for them. It is a shame if the mission cannot be conducted completely, but the most important thing is that the aircraft and the crew come back in good condition."

## Training

Initial pilot training for the Gendarmerie Air Force is centralised at one central training facility. All the helicopter pilots of the French Army, Airforce and Navy start their flying helicopter training in the South of France at Dax, and the Gendarmerie is no exception. After this initial training,

they go to their environment training for the Gendarmerie. In this case, these pilots will go to BA120 Cazaux near Bordeaux, and start practicing over there to work on the Gendarmerie missions.

Another very important mission for the Gendarmerie Air Forces is mountain rescue and for this, they have a flying school in Briançon in the French Alps. This school is very famous because all Gendarmerie pilots receive this specialised part of training there.

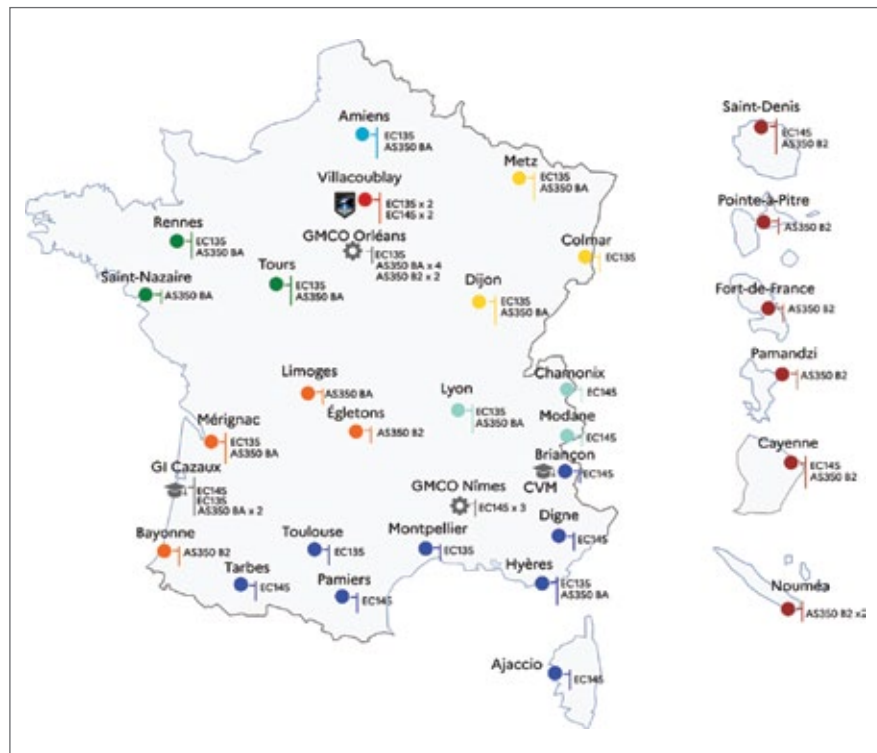
"This dedicated flying mountain school belongs to this main academy," Colonel

DRY explained. "So, every pilot that comes to the Gendarmerie has to train to fly in the mountains to improve their flying skills even if they don't want to be stationed in the mountainous environment". "There are also a lot of companies from different countries that send some of their pilots to this school to fly and train in the mountains and to see how the pilots of the Gendarmerie Air Forces are doing this".

## Locations

The Gendarmerie Air Forces has about twenty-four locations in France and six overseas (see map). The location that you don't see on this map is Calais. Since the migration problems and the 32 people that drowned in November 2021, the French authorities have decided to station one Gendarmerie helicopter over there.

When you are deployed to one of these six overseas locations, you are stationed there for about three years. "For the people that are working at one of these six overseas locations, it is very special. This is because they are very far from their home base in France. So, they have to be versatile, and they have to do almost everything by themselves. Their home base is about 12 hour's flight from the base they are working. There is a very important point for them and that is, sovereignty overseas," Colonel DRY stated.



## Missions

The missions carried out by the Gendarmerie Air Forces can be divided into four different groups.

The first mission is observation. This is because they have to be able to assist all the Gendarmerie and Police on the ground, with special camera equipped helicopters to assist them do their jobs whatever the conditions.

The second type of mission is counterterrorism, which is a support

is very special work for pilots and for flight engineers. So, they have dedicated training and a dedicated unit for this environment.

The fourth type of mission is projection, which means that with each helicopter they are able to send a special unit to the appropriate location in France, for example after the crash with the Germanwings Airbus in 2015, all the special police officers and air crash investigators were in Paris, and they had to be transported to the crash site as quickly as possible. So, from BA107 Vélizy-

Villacoublay, they had to bring them to the site in the French Alps. The crash site was only accessible by foot or helicopters because of the remote location within the mountains.

## The life of a unit

At the 30 locations, the duties are 24/7, 365 days a year. One unit exists of one helicopter, three pilots, four mechanics including flight engineers, and one additional Gendarme. This means that eight people have to keep one base operational and they can



*Two Airbus EC145s together on the platform at BA107 Vélizy-Villacoublay*

mission but with the specialised units, GIGN for Gendarmerie and RAID for Police, two specialised units in the vicinity of BA107 Vélizy-Villacoublay. Within ten minutes of the call, they can be seen in helicopters to go everywhere in France. "We will fly the GIGN and RAID forces when they need to go faster or to be dropped on inaccessible places like rooftops, in a forest, on a ship or when they need sniper overwatch," DRY commented. "We use the EC135 for observation and the EC145 for transportation and hoist operations. We can take about 4 or 5 of them with us, depending on their equipment."

The third type of missions they do is the intervention in a specialised environment which basically means that they have special capabilities to do flying in the mountains or above the sea but especially in the mountains. Flying in the mountains



*Airbus EC135 takes the sky from BA107 Vélizy-Villacoublay*



do this very well. This is the way they have organised it in all 30 locations. Most missions are conducted with only one pilot because they have only three pilots per location. So mostly they are flying with one pilot and one mechanic, to spread the workload.

The mechanics have two jobs. They are the technicians on the ground, but they wear different clothing during the flight, and they are not on board for technical matters but for operational work during the flight. They manage the hoist and camera system and assist the pilots during the flights.

### The helicopter fleet of the Gendarmerie Air Forces

The Gendarmerie Air Forces has about 56 helicopters in its inventory. First is the AS350 Écureuil in two variants, the BA (15x) and the B2 (11x). The B2 is an updated and stronger version of BA, the main reason is the stronger engine and some updated avionics, the airframe and gearbox are pretty much the same. This results in an increased performance of additional weight of about 100kg.

“When they want to operate them in the mountains, they need the B2 version, and also at sea to rescue people”, said Colonel DRY. They fly this helicopter for example in Cayenne in French Guyana. “Because it is very hot and wet over there, it’s not the funniest place to fly,” he stated. “But this type of helicopter is doing very well in

these circumstances, it’s like a Swiss knife for us.” He continues, “The pilots can do almost everything with this helicopter. For the people, this helicopter is very easy to maintain, and easy to fly but they are getting pretty old now so there is a sort of decision to take in the coming years. Now they have 26 AS350s and most of them are based overseas.





Next to the AS350s, they operate the EC145, and these are currently about 20 years old now. In the Gendarmerie, they are used in two different environments. At BA107 Vélizy-Villacoublay they are mainly used for the transportation of the RAID and GIGN, but most of the time they are used in the mountains. Because they are much bigger and more powerful.

Last but not least is the EC135 and is the youngest of the fleet. The main feature used by the Gendarmerie is the L3 Wescam MX-15i camera system. "When the first helicopter arrived with the Gendarmerie in 2010 it was a major gamechanger for the Gendarmerie", stated by Colonel DRY. For the first time they had a camera system which was already fully integrated into the helicopter. That means that they could use them for surveillance, criminal investigation, and assist the ground units

in their daily operations. When introduced 10 years ago it was a state-of-the-art camera system, with a really good infrared camera for night operations. Although superseded by more powerful cameras, the Gendarmerie is still happy to work with these. Another part of the equipment is the searchlight. Once again, something that is quite common now, was something very new twenty years ago, and it was the beginning of their night operations. Before the night missions started, there were only the ferry flights from point A to point B. With this kind of equipment, it started with the air support of the policeman on the ground.

"One thing which is really important to remember, the helicopter is very important but more important is the equipment installed, like the camera on the EC135. The camera system is absolutely useful to conduct our missions which makes it

expensive and requires maintenance and requires also training from the crews. It is a key point," Colonel DRY stated. "On the right side, we have a hoist system, and in the mountains without a hoist system, the job is not the same. Every year, we conduct more than 15,000 hoist operations with our helicopters. We have to keep training on this, it is so specific and complex, that we have to keep repeating this training for pilot and operator".

### Future of the Gendarmerie Air Forces

In December 2021, the French Home Office placed an order for ten H160s with Airbus helicopters. They placed this order because they were looking for an omni-role helicopter. The first H160 delivery for the Gendarmerie Air Force is expected in early 2024. The goal for Airbus is to deliver the first H160 on time for the 2024 Olympic Games in Paris. The ten H160s will be placed at their locations in Villacoublay, Lyon, Hyeres and Bordeaux.

For example, every time with the AS350, they have to choose if they need the hoist or the camera system. But as the new H160 is an omni-role helicopter, they have a new state-of-the-art camera system, a hoist system and the fast rope system already installed. Even with all these options fitted they can still perform their missions with a superb range, and they don't have to choose.

For the moment, the AS350s remain to fly at the overseas locations. But the decision to replace them is now at the Headquarters. "It is an old helicopter, and we need to replace them, maybe not with the H160 but probably with new H145s," Colonel DRY stated. He said, "Our H145s are C2 versions which is an old design with four rotor blades and rigid rotor hub. The new versions have five blades, and the performance has really improved compared to the ones we have. The key point of the Gendarmerie Air Forces is the people. Of course, we have good and sometimes new equipment, but the most important thing for us are the people who prepare and conduct the missions. The people are making the organisation".

*We would like to thank Colonel DRY, Captain Lahri and all the other people of the Gendarmerie Air Force for their help to make this possible.*

**Article and photos:**

**Roelof Jan Gort and Björn van der Flyer**

**[www.FlyHighAeromedia.com](http://www.FlyHighAeromedia.com)**

### Gendarmerie Air Forces (FAGN) Number and type of helicopter per base:

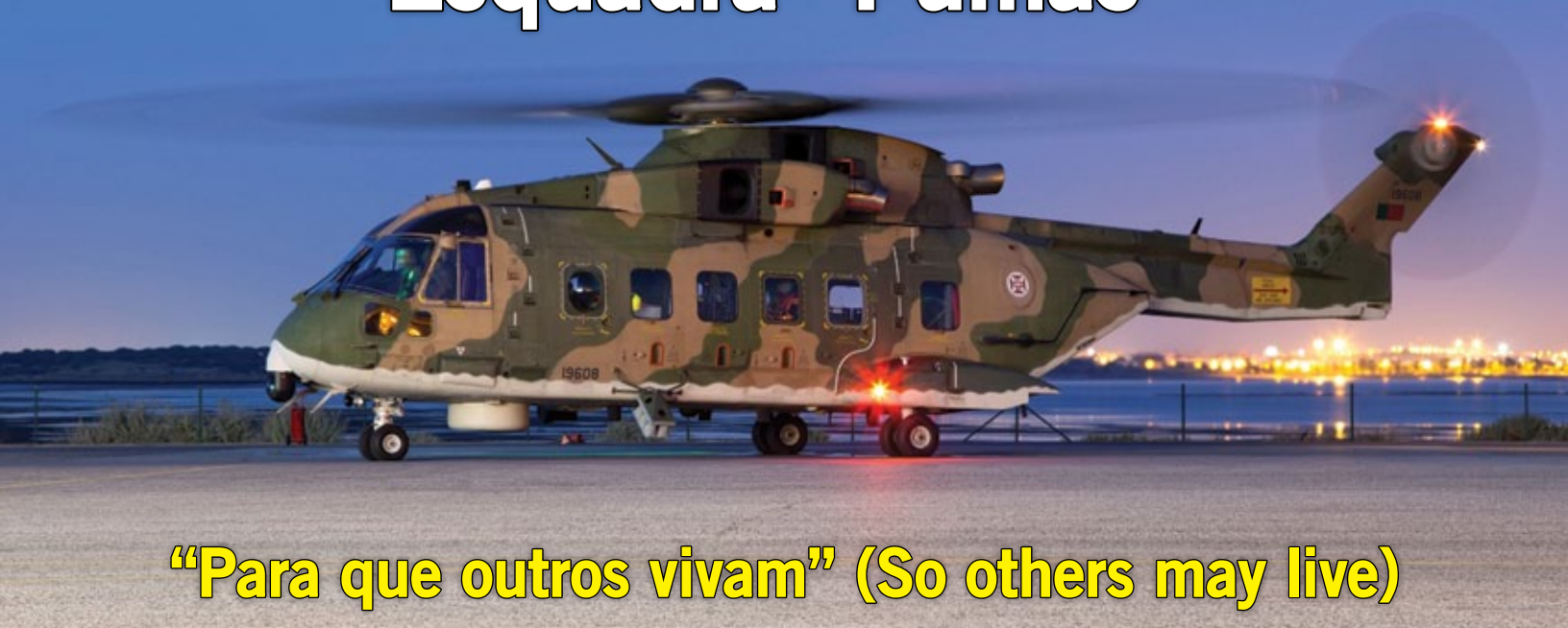
15x EC135 (2 Villacoublay, 1 Metz, 1 Dijon, 1 Colmar, 1 Lyon, 1 Hyeres, 1 Montpellier, 1 Mérignac, 1 Toulouse, 1 Cazaux, 1 Rennes, 1 Tours, 1 Amiens, 1 for maintenance)

15x EC145 (2 Villacoublay, 1 Chamonix, 1 Modane, 1 Dignes, 1 Briançon, 1 Pamiers, 1 Tarbes, 1 Ajaccio, 1 Cayenne, 1 Saint Denis de La réunion, 1 Cazaux, 3 for maintenance)

23x AS350 Écureuils (1 Guyane, 1 Mayotte, 1 Martinique, 1 Guadeloupe, 2 Nouvelle Calédonie, 1 La Réunion + 1 Metz, 1 Rennes, 1 saint nazaire, 1 Lyon, 1 Hyères, 1 Mérignac, 1 Bayonne, 1 Toulouse, 2 Cazaux, 1 Limoges, 1 Egletons, 5 for maintenance)

NB: 10 H160 will come in 2024/2025 : 4 Villacoublay, 2 Lyon, 2 Hyères, 2 Mérignac.

# Portuguese Air Force 751 Esquadra “Pumas”



**“Para que outros vivam” (So others may live)**

A peculiarity of Portugal is that it is not particularly large in terms of land area, but due to its geographical position, with an 800km coastline, the Atlantic archipelagos of the Azores and Madeira, have one of the largest Search and Rescue Regions (SRR) in the world (by far the first in Europe). It covers an area of about 5 million square kilometers, of which, mostly is over the North Atlantic Ocean.

In order to provide coverage to this vast maritime region, it was necessary to create a dedicated unit for Search and Rescue (SAR) within the Força Aérea Portuguesa (FAP - Portuguese Air Force). So, 45 years ago, in April 1978, the Esquadra 751 (751 Squadron) was activated and named “Pumas”, after receiving the helicopter it was initially equipped with: the Aerospatiale SA-330 Puma.

Part of Grupo Operacional 61, this unit is located at the large Base Aérea no. 6 (BA6), Montijo, southeast of Lisbon, near to the Tejo River.

## From Pumas to Merlins

With the activation of the 751 Squadron the Aerospatiale-made helicopter, previously used by FAP mainly for troop and general transport, were suitably modified to execute SAR missions. One helicopter with a crew of five was quickly placed on 24/7 permanent alert in both Montijo and Base Aérea N.º 4 (BA4) Lajes. Subsequently, as of 1990, a permanent detachment started operations from Porto Santo airport, Madeira.

In the late 1990s, the FAP started looking for a replacement of its aging Puma fleet. Although the SA-330 has carried out its tasks successfully since their introduction in service in 1969 (participating also in the Portuguese colonial wars), a replacement was needed due to its obsolescence.

Later in 2001, after an extensive evaluation which included also the Eurocopter Cougar Mk2 and the Sikorsky S-92, the Portuguese Government signed a contract with AgustaWestland (now Leonardo) to procure 12 EH-101s Merlin in three different variants.



*One EH-101 is permanently on alert 24-7 in Montijo*



*Merlins are washed after every a mission over the sea, to prevent corrosion*

Six in a basic SAR configuration called EH-101 Mk514, which feature emergency floats, bubble windows, searchlight for night operations, forward-looking infrared (FLIR) camera, a search radar, two winches and night vision goggle (NVG) compatible cockpit. The other two variants retained these standard features, but are also suited for secondary roles.

The four Mk516 for Combat SAR can be fitted with air-to-air refuelling probe and feature folding blades and tail, an electronic self-protection suite which include a missile approach warning system (MAWS), radar warning receiver (RWR) and chaff/flares dispenser, and the possibility to install machine guns.

The two Mk515, for Fishery Protection roles (SIFICAP – Sistema de Fiscalização e Controlo das Actividades da Pesca), can be equipped with a cabin mission console for surveillance operation and are easily recognisable with the external loudspeaker.

The first Merlin was delivered in February 2005, and was soon followed by three more to commence conversion to type training. The 12th and last EH-101 was delivered 18 months later.

The introduction of Merlins was initially characterised by low availability due to maintenance problems and lack of spare parts, forcing the FAP to put back into service part of the old fleet of SA330 just decommissioned. After problems were solved by reaching a new agreement with the manufacturer who provided technical support and spare parts, the SA330 were definitely rested from the service in 2011.

### 751 Squadron “Pumas”

The motto “Para que outros vivam” made it clear on which task the Squadron was founded that was Search and Rescue. The unit recently celebrated the prestigious milestone of 5000 saved lives: “We do not keep the number updated because we often have a real SAR mission. Normally we save 180-200 lives per year, with an average of one realistic mission every three days more or less. The only exception was during 2020 when the maritime traffic was reduced due to the Covid pandemic, so the Pumas had consequently less SAR live missions” Captain Rodolfo Curto explained.

When the alarm goes off for a rescue at sea, the first thing the Rescue Coordination

Centre (RCC) does, is to check out if a merchant ship is available nearby or if the Portuguese Navy can carry out the mission. Otherwise, they contact the FAP, who decides whether to send the Merlin, a P-3 or a C-295.

“We are ready to take off in 30 minutes during the day and in 45 minutes at night. It takes an extra 60 minutes if a helicopter needs to be reconfigured (with extra fuel tank or seat, etc.) for a complex SAR mission.” Captain Curto stated.

The Squadron has one helicopter and one crew on 24/7 alert at the main base in Montijo and Porto Santo (Madeira). In Lajes (Terceira island - Azores), the detachment consists of two helicopters and two crews, one of which is on 24/7 alert. The standard five-person SAR crew includes a winch/systems operator, a rescue swimmer, and a flight nurse, in addition to an aircraft commander and co-pilot.

Captain Curto informed, “The reason we have two crews and two helicopters in Lajes is because we have many more SAR missions there than in Madeira, and we are very busy with MEDEVAC missions. The Azores is an archipelago of nine islands but only São Miguel, Faial and Terceira have hospitals, so if something happens to someone in the smaller islands, we have to take them to these three main islands. A C-295 is also based in Lajes which is the main asset used for the MEDEVAC, being cheaper and being able to fly faster than us, but most of the times the helicopter is the best option since we can land almost anywhere. Doing the MEDEVAC in the



*The rescue bed can be accommodated inside the large cabin*



*Hovering over Tagus River with Vasco da Gama Bridge and Lisboa behind*

islands is often a demanding challenge as the weather varies constantly and the geographical territory often makes the flight complicated. We always end up using GPS and mapping the terrain with the radar”.

### **Top performances**

With the arrival of the EH-101 Merlin, there was a great leap forward in terms of operational capabilities, allowing the 751 Squadron to nearly double the range

during SAR missions, going from 200NM to 400NM. The longest rescue mission the squadron has ever performed with the Merlin lasted approximately 7.5 hours, with a range of 370 NM and 20 minutes on station.

Describing the excellent characteristics of the EH-101, Captain Curto stated, “Our operational scenario here on the Atlantic, push the EH-101 to its limit. We are very well known for traveling ultra-long distances

and the Merlin helps us a lot in this as it has three-engine and can carry 4.1 tons of fuel. When we do not need maximum power, we can turn off an engine and this allows us to save a lot of fuel, which is essential, especially in long transfer missions and during transition times. It is a procedure that other types of helicopters eventually use only in an emergency, but the Merlin allows us to do this in complete safety. By loading an additional 1.1-ton fuel tank in the cabin, we are able to cover the 1000NM routes from Montijo to Lajes in 10 hours with a single fuel stop halfway in Porto Santo. I don’t think many others can do what we do every day with this machine. The engines are very powerful, the load capacity is great and despite its generous size - the large cabin can eventually accommodate up to two dozen survivors - it is an agile helicopter.”

In addition to this, the sophisticated avionics of the Merlin are appreciated by pilots, “The powerful radar is of great help over the sea, with its capability to monitor 32 surface targets simultaneously. The autopilot is simply fantastic as we always use it during the transition flights at sea level, especially during night missions, when we don’t have reference points. In other words, we only switch to manual handling when hovering over a ship or flying over land,” added Captain Curto.



*Fast and low a very agile helicopter despite its dimension*



*EH-101 SAR equipment*

## Training

After five years at the Academy, one year at 101 Esquadra flying Epsilons, followed by the qualification on helicopters flying the new AW119 Koala; the young pilots destined to fly Merlins, still have a long way to go. They need 400 additional hours as co-pilots (which include handling with initial qualification on the type, training SAR, vessel winch and tactical flights) to become a pilot and be sitting on the Merlin's cockpit right side, while full qualifications are reached with 1000 flying hours.

SAR training and real missions account for the majority of the approximately 2,000 hours flown by the Squadron each year, with each crew flying an average of 150/180 hours per year. Although SAR remains the primary focus, the "Pumas" also carry out CSAR and troop/material transport as a secondary role.

"Last year, we cooperated with Navy Special Forces by boarding a ship that smuggled drugs from North America. It was the first time we did this type of operation. In fact, it is necessary to focus on the current role and consequently train in tactical roles as well by doing fast rope, sling loads, infiltration and exfiltration of Special Forces and CSAR; simulating the recovery of a downed pilot behind enemy lines" said Captain Curto. "We usually take part in the major national exercises such as Real Thaw, Hot Blade and Tiger Meet 2021 in Beja" he added.

Once a year, training also includes a one-week deployment in Spain to practice mountain flying and a deployment by personnel to train on the emergency simulator at RAF Benson (since there is no simulator for the EH-101 in Montijo).

## Maintenance

Long missions over the sea, often push the limits and consume significantly the airframes. So much so that normally half of the fleet is always under maintenance to prevent the risk of corrosion and ensure maximum reliability. Part of the Merlin's maintenance is done in the large hangar of 751 squadron, where 1st level maintenance and partly 2nd level maintenance are carried out. Minor inspections are made every 50 and 150 hours, while every 6 months a major 2-week-inspection is carried out. Subsequently, every year, the helicopters are sent to OGMA, in Alverca, for the more in-depth maintenance cycle which lasts a month or more.

## Conclusion

After more than 15 years of service, the Merlin is approaching half of its career with the FAP and a Mid-Life Upgrade will be necessary in future: "Although nothing has been decided at the moment, I believe the FAP will invest again in this machine: I can say that the Merlin is very expensive to maintain but at the same time we are aware that its performance is necessary to us. We wouldn't be able to do what we do with another type of helicopter. It's like having a Ferrari and a powerful luxury sedan: you can race with both but if you need more performance, you know which one you can get it with..." ✈️

**Article and photos by Fabrizio Capenti and Simone Marcato**



*CSAR demonstration with fast rope*

# Repetition makes perfection: Academia da Força Aérea, Brazil



*Pirassununga is the busiest air base in Brazil. Here a T-27M taxis back to the flightline with another one taking off.*

The Academia da Força Aérea (AFA, Air Force Academy) of the Força Aérea Brasileira (FAB, Brazilian Air Force) is located at Pirassununga air base in São Paulo state, just under 200 kilometres north of São Paulo. Providing training to aspiring pilots, Pirassununga is one of the biggest air bases of the Brazilian Air Force and one of the busiest when it comes to number of take offs and landings. Next to the obvious training squadrons, 1º Esquadrão de Instrução Aérea (EIA, Air Instruction Squadron) flying the Embraer EMB 312 Tucano and 2º Esquadrão de Instrução Aérea flying the Neiva T-25 Universal, the base is also home of the Esquadrão de Voo a Vela (Gliding Squadron) and the famous Esquadrão de Demonstração Aérea (EDA, Demonstration Team), as known as Esquadrilha da Fumaça (Smoke squadron)

which is flying the Embraer EMB 314 Super Tucano.

The Neiva T-25 is the primary instruction aircraft and has two side-by-side seats and a six-piston engine, the Lycoming IO 540 K1D5, providing 300 horsepower (HP). Even though the design is from 1963, the Brazilian Air Force is still operating the aircraft with great success. The prototype first flew on 29 April 1966. The Brazilian Air Force ordered 150 aircraft and increased this order in 1978 by an additional 28 aircraft. Its basic design makes it an ideal aircraft for basic training and simplifies maintenance. The training on the T-25 is carried out in the East Sector of Pirassununga air base, at the 2<sup>nd</sup> Air Instruction Squadron, which operates from a runway of 1,902 meter in length.

The Embraer EMB 312 Tucano is the advanced instruction aircraft which has two seats in the tandem configuration. The

Tucano is equipped with a Pratt & Whitney turboprop engine, PT6A-25C, providing 750 shaft horsepower (SHP). The T-27 has been around since 16 August 1980, when its first flight was made and the first of 151 deliveries to the FAB started in September 1983. With ever changing fighter aircraft, operating more sophisticated and modern avionics, an upgrade for the Tucano was needed as well. The upgrade was performed by the company Albatross, partnered with the Air Force at the Parque de Material Aeronáutico de Lagoa Santa (Lagoa Santa Aeronautics Material Park - PAMA-LS). The work includes a cockpit update, introducing new big multi-functional displays. Planning called for T-27s to be upgraded to T-27M standard by December 2022, while the first re-delivery was due in mid-2021.

The training on the T-27 is carried out in the West Sector of the base, at the 1<sup>st</sup> Air





*A T-27M returns to the flightline. The massive platform is shared with the demonstration team Fumaca.*

Instruction Squadron. This part of the base has two runways of 2,000 metre long. The AFA has an intense air activity schedule, due mainly to the instruction of cadets as well as their instructor officers. Keeping up with all the flight hours, the activities are reaching almost 2/5 of what is flown throughout the FAB, being considered the airfield with the largest movement of military aircraft in Latin America. For everything to happen within the most complete security, the AFA maintains a Search and Rescue (SAR) alert service, with a pair of Eurocopter H-50 Esquilo helicopters.

## Academics

The Air Force Academy is a higher education institution, which integrates the training and improvement system of aeronautical command. Its purpose is to train aviators, Intendants, and Infantry Officers of the Brazilian Air Force, encouraging and improving in each cadet the intellectual, moral and physical attributes essential to becoming an Air Force Officer. The AFA training courses are equivalent to full undergraduate courses, which, although not similar in the civil system, resemble the areas of Engineering and Administration. The use of the curriculum in civil higher education courses is regulated by the Federal Council of Education of the Ministry of Education. The moral, scientific, military and technical-specialized teachings are taught by a combination of federal civilian teachers, military instructors and monitors, following a predefined structure. Physical education and military instruction are both disciplines taught in parallel. This includes courses of skydiving and survival at sea and in the jungle. With a country as vast as Brazil there are a number of these specialised



*A full ramp at the 2nd Flight Training Squadron. A continuous flow of flights can be witnessed during the day, up to 200 take offs and landings.*



*After 3rd level maintenance the T-27M's receive a new digital colour scheme.*

courses that might not apply to a cadet in other countries.

There are three main courses taught by the AFA, as per the earlier mentioned goals for the Brazilian Air Force: CFOAV - Training Course for Aviator Officers,

CFOINT - Training Course of Intendant Officers and CFOINF - Infantry Officer Training Course.

CFOAV cadets begin their training, similar to all trainees, in basic training. During this first year at the AFA, they will learn their basic values as an officer. This initial year will prepare them for the rest of their training programme and will also show the Air Force which cadets "have what it takes". The enrolment into the programme is on a voluntary basis, but the Brazilian Air Force needs to make sure that their selection will deliver the required quality to make good aviators. It's key to make sure that the intensity of the courses

is clear and that the expectations are set from the start. After basic training, the aerial instruction part of the course will start in their second year, flying the Neiva T-25 Universal, a nationally manufactured aircraft. Each student will fly about 40 hours



*The AFA uses the T-25A and T-25C. The main difference is the T-25C has different avionics, making it more suitable for navigation training flights.*

in this small propeller aircraft. The third year of the cadet's is another academic year with further classroom learning. Over the course of their four-year period at the AFA, each cadet will finalise two degrees in flying science and public administration. This is on top of their graduation as a pilot. The fourth and final year will see the cadet moving on to the Embraer EMB 312 Tucano (locally designated T-27). This is the advanced-instruction turboprop aircraft, which is also a locally manufacture aircraft, in which they fly about 90 hours.

CFOINT cadets study in an administration and intendency laboratory,

where they learn the science and modern technology of economic-financial management and specialised services of intendency and technical supply, thus preparing for the tasks of a surface combatant, integrated into the Logistics System of the Ministry of Aeronautics.

CFOINF cadets study methods of defence and security of military installations, use of airfield and site anti-aircraft defence, command of fractions of troops and fire crews, military legislation and weapons use, military service and mobilisation.

The Air Force Academy has on average 100 graduates that move on to the next



*The T-25 is a side by side propellor aircraft. The seating arrangment is ideal for instructors to give directions.*



*The aerobatic display squadron, Esquadrilha da Fumaca, uses the A-29A Super Tucano for their air demonstrations. They celebrated their 70th anniversary in 2022.*



*Digital T-27M 1444 takes off from Pirassununga for another training sortie.*



*The T-2000 simulator uses 3 screens and can be configured as the T-25 and the T-27. It's an ideal system for the cadets to get initial and additional training.*

step in becoming pilots with one of the active squadrons within the Brazilian Air Force. From Pirassununga, the graduated cadets will move to Natal Air Base in the North of Brazil. At Natal, each pilot will receive further training and it is here where the type of aircraft they will be flying on will be decided. During this next phase it will be clear if the pilot will go on to fly a helicopter, a transport plane, or a fighter plane. This way of working ensures that the AFA is focussing on the overall abilities of the cadets and having the next step in their careers go into details of their next assignment. 🦋

**Text and Photos: Erik Bruijns**

# Exercise Orion 23/2



## Orion Background

The ORION 2023 exercise (an acronym for 'large-scale Operation for Resilient, Interoperable, high-intensity combat-Oriented and INnovative armed forces') is a new triennial military exercise cycle. ORION will be the first exercise of this kind in 2023.

Since the publication of the Defence and National Security Strategic Review in 2017, which provided a framework for reflection and laid the foundations of France's Military Planning Law 2019-2025 ("LPM" dated 13 July 2018). The deterioration of the international context,

which has rendered the traditional peace-crisis-war continuum obsolete, now requires us to envisage conflict in terms of a three-phase continuum of competition/dispute/confrontation. In response, the French armed forces must be prepared for every possible type of engagement.



The 2021 strategic update and the 2022 National Strategic Review highlighted the priority need for specific operational preparations. The accelerated deterioration of the international environment in 2022 confirms the relevance of ORION initiated in 2021, as the change of scale and the widening of the spectrum of engagement meet the requirements of high-intensity combat.

French armed forces are adapting their operational readiness accordingly. The objective is to train French armed forces in a joint and combined framework, based on a realistic and demanding scenario that takes into consideration the multiple domains of conventional (land, air sea, space) and hybrid warfare (influence, cyber, electronic). ORION 23 aims to refocus French military training on readiness to

any type of event through large-scale multi-domain operations; assess France's ability to conduct a large-scale joint operation; reinforce interoperability with our allies and test new capabilities.

Change of scale: in planning- high level expertise in operational planning; in the field: politico-military training, division-level maneuvers (on the ground) and at army corps level (for command headquarters) as

well as amphibious maneuvers with two amphibious helicopter carriers supported by the French Navy's carrier strike group; first entry operation from the national territory for acquiring and sustaining air superiority in a disputed environment; global air maneuver which consists of major airborne operations.

In support- support capabilities (human, logistics, medical, etc.) for a major operation. An exercise of an unprecedented type: inter-army, inter-ministerial and international training in a context that mobilises the entire nation. Integration of approximately 20 exercises that armed forces usually conduct separately. Consideration of all conflict domains (information, cyber, space, seabed...).

### ORION scenarios

ORION 23 is based on a scenario developed by NATO to study the various phases of a modern conflict. Although the narrative is fictitious, the exercise remains credible. The scenario enables all the components of a military force (land, air, navy, cyber, etc.) to work together as a coordinated team and to achieve the various training objectives. The intensity of the exercise further reinforces its realism. For example, the exercise will include the participation of a sizeable adversary force (FORAD), armed by French and allied units.

A country called "Mercure" seeks to re-establish its regional influence over the state of "Arnland". To do so, Mercure provided material and financial support to the "Tantale" militia, which destabilised

the south of Arnland. Mercure is also deploying significant military forces at the country's borders and maritime approaches, while employing "nonkinetic" methods of action (disruption of communication systems, disinformation as well as land, air and sea blockades). The state of Arnland is weakened. To prevent any further degradation of the situation and after a phase of planning (ORION Phase 01), France deploys its National Emergency Echelon (ORION Phase 2). A politico-military crisis management phase precedes (ORION Phase 3) a massive deployment in a coalition against Mercure (ORION Phase 4) as part of an operation under UN and NATO mandate.

### Credibility

An adversary naval force (FORAD) with about ten warships, most of them from partner countries, including an aircraft-carrier and a submarine; an air threat that is initially reduced (isolated airborne means such as drones, aircraft, ground-air systems) and then complete and integrated (modern aircraft, integrated control and ground-air systems) and an adversary land force, ranging from the Tantale militia to the Mercure division, played by units of the French army and representing more than 10% of the overall forces engaged in the exercise.

ORION is not a NATO exercise, but a French exercise with support of many



NATO countries. Whereby the exercise scenario is based on an existing NATO scenario.

### Four phases of ORION

1. Planning phase from May 2022 until February 2023
2. Initial entry phase from late February 2023 until mid-March 2023
3. Inter-ministerial and civil-military affairs (the political handling of the conflict) in March 2023
4. Large scale ground operations from mid-April 2023 until May 2023

### ORION phase 2

In phase 2 (the entry mission), some 7000 troops exercised for 19 days in southern France, south of the city of Montpellier. An amphibious group (consisting of the amphibious carriers PHA Tonnerre and the PHA Mistral) brought the one amphibious component (6th Light Armoured Brigade) to the shores of France. While one airborne component (11th Parachute Brigade) airdropped near the village of Castres. Both the amphibious and airborne components of the French Army joined up to establish a firm beachhead.

The French Navy protected the entry mission with the carrier air wing of the aircraft carrier PA Charles de Gaulle). And the Air Force protected and supported the entry mission with some 30 aircraft (fighters, tankers and transport aircraft).

### ORION phase 4

In phase 4 (the large scale operation), some 12,000 troops will exercise a full scale ground war in northern France, in the Reims-Champagne area. During phase 4, and for the first time at this level of engagement, the exercise will include simulated French and international units, up to division level, combined with units in open terrain. This technical and tactical challenge will increase the level of training. The conduct of the exercise will be assumed by the French Rapid Response Corps. The French Army will set up a command post of the 3rd division and this will supervise one multinational division comprising its units in the field (2nd armored brigade) and simulated units from the 6th armoured brigade and a UK brigade.

The French Air Force will deploy some 50 aircraft to acquire air superiority. They will conduct reconnaissance and force

projection missions. In addition, they will provide air support to protect ground forces. Besides, ground-to-air defense assets as well as detection and control systems will be deployed.

The French Navy will contribute with French Navy aircraft that will be integrated in the air component.

The ORION 23 exercise will enable France to position itself as one of the few European nations able to master this level of expertise in the planning and conduct of a large-scale military exercise. ORION 23 demonstrates the willingness to fully integrate the multi-domain aspect of the engagement in an operation.

### Participating commands of the French Defense forces

Joint Operations Command (CPOIA): The Commandement Pour les Opérations InterArmées (CPOIA, Joint Operations Command) is the key node of the French Defence Staff at operational level and is responsible for preparing and conducting phases O1 and O2. Divisional General Le Nen has been commander of CPOIA since 2020 and will assume the role of Phase 2 exercise director, working from a projected operational command post at the Lyon Mont Verdun base.

Troop Deployment Division of Joint Defence Staff: DIVision "EMPloi des forces de l'état-major des armées (DIV-EMP), commanded by Divisional General Metayer since summer 2021, will be responsible for matching operational ambitions to the deployable capacity of the armed forces. In particular, one of its missions will be to define the policy for joint forces operational preparation and the resulting strategic choices. DIV-EMP is in charge of the overall conception of ORION 23, guaranteeing its end-to-end coherence and, in coordination with SGDSN, is responsible for Phase 3's planning and conduct.

Rapid Reaction Corps-France: Corps de Réaction Rapide-France (CRR-Fr). As the only French corps-level command to meet NATO standards, Headquarters RRC-FRA will conduct the planning and build-up stages of Phase 4. Its expertise in this field is recognised in France and internationally. Corps General Gaulin, who has commanded RRC-FRA since 2022, will assume the role of exercise director and army corps director from his projected headquarters in Mailly-le-camp.

### A Multinational Force under French Command

Although the French armed forces preserve the capability to act alone, the normal framework of their deployment outside France is in combined action with its allies. The accelerated risk of conflict and expanding domains of confrontation confirm the need for strategic alliances and for the principle of solidarity that structures them. Putting this strategic solidarity into practice, France shares its experience feedback with its allies and in turn benefits from their shared experience. Several international partners have confirmed their participation in the different phases of the exercise, either as simulation players or as participants with the coalition or adversary forces in the field. This multi-national dimension is vital and will help to train the French command structures in integrating allied units and optimising interoperability with allies. This integration reinforces the credibility of defence alliance while also demonstrating France's capability to train our partners and, in an operational perspective, to undertake the role of framework nation in a coalition force. It is confirmation that France has the resources, expertise and operational experience to command or join an international coalition.

## Orion phase 2 reports

### Orion phase 2 AIR

On 1 March 2023, a media flight was organised in a French Airbus A330 MRTT tanker aircraft from the French Air Force (Armée de l'Air et de l'Espace, AAE). From Base Aérienne 125 'Istres-Le Tubé' "Charles Monier" (ICAO code: LFMI) a media flight in an A330 MRTT (Multi Role Transport Tanker) was planned. The A330 MRTT with registration 049/F-UJCO belongs to the 31 EARTS squadron (31e Escadre Aérienne de Ravitaillement et de Transport Stratégiques). Currently nine A330 MRTT aircraft have been delivered to the French Air Force, while a total of twelve aircraft are planned to be delivered by the end of this year. A grand total of 15 A330 MRTT aircraft will be used by the French Air Force for the next decades.

The predecessor of the A330 MRTT in the French Air Force is the Boeing C-135F/KC-135, currently 6 C-135s are still active, while the remaining 9 aircraft are stored at Aéroport de Nîmes-Alès-Camargue-Cévennes.



Next for refueling came four Mirage 2000Ds from Base Aérienne 133 'Nancy-Ochey' (ICAO: LFSO). The same procedure was followed for refueling the four aircraft, moving from the left side to the right side.

During a pause in the refueling, the cockpit could be visited while a C-135F was flying a couple of hundred feet higher. Plane commandant Mohammed told about this very large training ORION and about the fuel receivers of the mission.

After the pause, the four Mirage 2000Ds returned for second refueling, after attacking their ground targets of this ORION mission, to refuel for their flight back home. As a grand finale, one Mirage 2000D made a nice barrel roll diving towards the ground. The mission was finished and the A330 landed at BA Istres again. During the



Commandant Mohammed (due to security reasons, only first names) did the preflight checks before take-off, checking tires, engines, vision and refueling equipment. After take-off from Base Aérienne 'Istres-Le Tubé', the A330 flew some 175 kilometers to the JUDITH refueling area, north of Perpignan. After establishing in the JUDITH track, it was circling for the receivers and after a while four Dassault Rafales B from Base Aérienne 113 'Saint-Dizier-Robinson', (ICAO:

LFSI) arrived for refuelling. The Rafales used the hose-drogue refueling system mounted on the wings of the A330 and as the capacity of the hose-drogue system is lower than the tail-mounted boom refueling system, the Rafales stayed for a while refueling. The aircraft lined up on the left side of the tanker and started the refueling on the 2 wings simultaneously. After refueling, the aircraft lined up on the right side and they flew away for their task in the ORION exercise.

ORION phase 2, the tanker aircraft of BA Istres flew 2 missions per day, for both types C-135F and A330 MRTT; while some 30 aircraft were refueled.

### Orion phase 2 GROUND

On 2 March 2023, a media visit was organised to the command post of the 6th light armoured brigade, located in Sète, near Montpellier in southern France. The location was an abandoned factory where the command post was set up. In one of the



halls, a scaled model of the area was laid-out on the floor.

Brigade General Eric Ozanne commander of the 6th Light Armored Brigade (LAB) (6e Brigade Légère Blindée, 6e BLB) of the French Army (l'Armée de Terre, AT) explained about the landing of some 700 soldiers and 140 vehicles in the first 2 days of the exercise, starting from 26 February. The aim was to establish a bridgehead at 2 beaches near Frontignan and to capture the strategic port of Sète. From the 2 amphibious carriers PHA Tonnerre and PHA Mistral, sailing near the French coast, the landings were executed under cover of Army helicopters of the French Army Light Aviation (Aviation Légère de l'Armée de Terre, ALAT). Before the landing, Navy divers cleared the landing zones from submerged mines. And ALAT helicopters performed nightly insertions to bring Special Forces on land to prepare for the main landing force.

On 25 February, several hundred soldiers from the 11th parachute brigade (11e Brigade Parachutiste 11th BP) and equipment were dropped from transport planes on the Castres landing zone. This airborne operation marks the start of the first entry phase of Exercise Orion 2023. Transport aircraft of the French Air Force (Lockheed Hercules C-130J, Airbus A440M) flew many missions transporting



the paratroopers and their equipment to southern France.

### Orion phase 2 SEA

On 2 March 2023, a media visit was organised to the amphibious helicopter carrier PHA Tonnerre (L9014) of the French Navy (Marine Nationale, MN), anchored close to Sète, near Montpellier in southern France. With the landing craft, the trip from the port of Sète was made to the PHA Tonnerre. During this trip, the ships that participated in the exercise and were moored at sea could be seen.

On board of the PHA Tonnerre, a press conference was given by capitaine de frégate Juste (deputy commander of the embarked staff, French Navy) and lieutenant-colonel Sébastien (chief of staff of the embarked staff, French Army). They explained the





first part of the exercise, whereby the 2 amphibious helicopter carriers sailed from Corsica towards the southern part of France, under cover of the 'Charles de Gaulle' battlegroup that sailed from Italy towards Sardinia. During the second phase, both helicopter carriers were located near the coast of France offloading the troops and equipment, with the 'Charles de Gaulle' battlegroup taking up a protective position near Spain. In this phase, the opposing forces, by means of the Juan Carlos battle group, positioned themselves between Italy, Corsica and Sardinia to attack the amphibious carriers.

A second press conference was given by the Division General Nicolas le Nen, the commander of CPOIA (Commandement Pour les Opérations InterArmées, Joint Operations Command). He explained that as exercise director, it was his task to oversee the planning and the execution of phase 2 of the Orion exercise ORION.

In between the press conferences, a visit was brought to the hospital of the PHA Tonnerre, where (fake) wounded persons were treated during surgery and during the triage.



At the end, a small helicopter flight in an Army NH90 helicopter was organised to fly overhead of the PHA Tonnerre and the PHA Mistral. 🦋

**Report: Joris van Boven and Alex van Noije**

**Text: Joris van Boven and Alex van Noije**

**Photos: Joris van Boven, Fred Schellens, O. Pierru/armée de Terre/Défense (photos of the air landing at Castres)**

# New M346's for HAF



A new era began at Kalamata Air Base when the first two Leonardo M-346 Master advanced jet trainers were delivered to the Hellenic Air Force (HAF) on 11 May 2023. These jet trainers joined the 120th Air Training Wing, the HAF's Unit tasked for the pilot's advanced flying training, and they will be used in lead-in fighter training (LIFT) roles. The M346s will replace the last half dozen venerable T-2E Buckeye jet trainers used by the HAF for more than 45 years and scheduled to be phased out by the end of 2023.

In early 2021, Israeli company Elbit Systems announced that it had won an order to supply, operate and maintain 10 M-346 advanced trainers. This contract, part of a larger framework agreement worth about 1.7 billion euros, followed the intergovernmental agreement signed

between the Greek MoD and Israeli MoD for the creation of Hellenic International Flying Training School (IFTS) operated by the Israeli's defence firm and designed the same as Israeli Air Force Flight Academy.

The deal includes the construction of new training and logistics facilities, the supply of flight simulators, as well as a series of ground training stations (GBTS) along with advanced Embedded Virtual Avionics (EVA) aboard the M346s. In the same way as it is doing with the aircraft in service within the Israeli Air Force, the company will also provide the maintenance over the next 20 years for the HAF's Beechcraft T-6 Texan II turboprop trainers, which are also based in Kalamata.

The decision to select the Israeli defence company to set up the IFTS in Kalamata testifies once again to the close links between

the air forces of the two Mediterranean countries, which for years have regularly participated in joint multinational exercises, such as the "Blue Flag" in Israel and the "Iniochos" in Greece.

It is worth noting that the delivery of the first Masters occurred in a relatively short time (the first M346 for HAF only flew on 23 January 2023), indication of the urgency of rapidly updating the training syllabus following the introduction into service of advanced fighters such as the F-16 Block 70/72, the Rafale and, in the near future, the F-35A stealth fighter.

The HAF thus becomes the seventh customer to introduce the Italian-made trainer into operational service after the air forces of Italy, Singapore, Israel, Poland, Qatar and Turkmenistan. 🇮🇹

**Text and photos: Fabrizio Capenti**





# Dutch military rotor update

## Chinook

Recently Boeing Helicopters completed the order from the Royal Netherlands Air Force by delivering the 20th and final CH-47F MYII CAAS Chinook to the Dutch Helicopter Command (DHC). In 2016, a first contract with Boeing contained the delivery of 14 new produced Chinooks and in 2017 the agreement was enlarged for adjusting 6 CH-47F's already in use by DHC, to the same standard as the 14 new MYII CAAS (Common Avionics Architecture System 9.4) Chinooks.

DHC has been operating the Chinook since 1995 when the CH-47D entered service within 298 squadron based at Soesterberg Air Base. Due to the closure of Soesterberg AB, the helicopter fleet re-positioned to Gilze-Rijen Air Base, main base of the DHC. With the entry of the new CH-47F MYII CAAS, the older "Delta" models were gradually taken out of service, until the final CH-47D operational

flight took place in 2021. At least 6 type D Chinooks are likely to pursue a career in civilian aviation, as recently it was made

public that an intentional agreement had been reached to sell these helicopters to Billings Flying Service, based in Montana,



USA, a family owned company specialised in aerial firefighting.

5 of the new Dutch CH-47F MYII CAAS Chinooks will remain in the USA for pilot training within 302 squadron at Fort Hood. The other 15 helicopters will all be based within 298 squadron at Gilze-Rijen.

## Cougar

At the Royal Netherlands Air Force main helicopter base, you can also find 300 squadron which operates 12 Cougar helicopters. Several years ago the AS-532 u2 Cougars were appointed to be taken out of service due to defence budget cuts during 2011. Remarkably this decision was quickly revoked as the general helicopter capacity appeared to become insufficient when looking at commitments



to international missions, but also because of a low availability of the new NH-90 navy helicopter facing delivery delays and technical problems. The revival of the Cougars in Dutch military service was supported by a new contract with Heli-One for maintenance of the helicopters. Heli-One is a subsidiary of the civilian

CHC group and specialises in worldwide helicopter Maintenance, Repair and Overhaul (MRO). As the original contract was approaching its normal end of term, Heli-One announced early March, to have agreed with DHC to activate the option for a Cougar maintenance contract extension until 2030. The maintenance to the

helicopters is taking place at Woensdrecht AB in The Netherlands.

## Apache

Also the 3<sup>rd</sup> helicopter squadron which operates out of Gilze-Rijen AB and flying the AH-64D Apache made further announcements of the transition to the



“Echo” type. The 301 squadron flies the AH-64D since 1998 and the current 28 helicopters had been contracted for a complete re-built programme to AH-64E v6 standard by Boeing Helicopters. Late last year the first 2 new “Echo” models were handed over to the RNLAf and stationed at Fort Hood, USA, for further pilot training. The Dutch Apache re-building programme, which includes upgraded engines and gearboxes with increased power in combination with new rotor blades, a complete new fuselage as well as a new modernised flight system, is expected to run until somewhere in 2025. 🦋



**Text and photos by Peter ten Berg**

# Training of Ukrainian soldiers, South England



**O**n invitation from the UK Ministry of Defence, a select group of Indian media were invited to a location somewhere in the south of England to witness firsthand training of young Ukrainian recruits in March 2023.

The UK has offered to train Ukrainian soldiers in battlefield skills based on the UK's basic soldier training to help them "sustain their heroic defence in the face of some of the most intensive fighting seen in Europe in decades". Since 2015, British

troops have trained more than 22,000 members of the Ukrainian Armed Forces and this new training programme will continue this work.

"We continue to work closely with Ukraine and will review and adapt



our support in line with its evolving requirements. We have identified four military bases in the UK to host this new training programme. These are in Yorkshire, Kent, Wiltshire and Northumberland. The duration of the training has initially been set for a period of around 120 days, subject to Ukrainian requirements and operational capacity of British and Ukrainian personnel. The course is based on the UK's basic infantry training and will be offered to new or entry level recruits of the Armed Forces of Ukraine. The training includes weapons handling, battlefield first aid, fieldcraft, patrol tactics and teaching on the Law of Armed Conflict. Each soldier will spend five weeks on the training course, learning skills for the front line. These skills will support Ukraine to rebuild their forces and scale-up their resistance. The training requirements will be refined according to Ukrainian needs and could be enhanced by collaboration with Ukrainian personnel to reflect their recent battlefield experience. The size of each tranche of training is subject to the ability of Ukraine to provide trainees given the changing conditions in country. However, we expect the numbers to reach the thousands, and we have the ability to train up to 10,000 over each 120-day period. This training programme started on 27 June 2022", stated UK MoD officials.

"So far, the UK has trained more than 10,000 Ukrainian personnel in the UK under the training programme. This programme has now been extended with aim of training up to 20,000 troops in 2023. The UK-led training programme is for new volunteer recruits into the Armed Forces of Ukraine with little to no previous military experience and will teach them the skills required to survive and be effective in frontline combat", further stated officials.

Based on the UK's basic soldier training, each course lasts for several weeks and the course aims to teach weapon handling, range activity, marksmanship, fieldcraft basics, field tactics, battle casualty drills, counter explosives, law of armed conflict, medical training and cyber security awareness.

"We are already seeing this training make a difference to the combat effectiveness of Ukraine, and we are in close communication with Ukraine to ensure we are evolving the course based on the skills most needed on the battlefield. The UK has commitment £2.3bn for the provision of military aid and support to Ukraine. Each trainee has equipment for use once they have returned to Ukraine", stated the officer in charge of the training unit.

Around 195,000 items have been donated to date, including personal

protective equipment including helmets, body armour, eye protectors, ear protectors, pelvic protection, and individual first aid kits; field uniforms and boots; cold and wet weather clothing, bergens, day sacks and webbing plus additional equipment required for field conditions including ponchos, sleeping bags and entrenching tools.

"There are nine other partner forces that have already joined the initiative are making an invaluable contribution to the programme. These are Canada, New Zealand, Australia, Norway, Denmark, Finland, Sweden, Lithuania and The Netherlands", stated the officer in charge.

This ambitious training programme is part of the UK's commitment to support Ukraine which so far amounts to more than £2.3 billion in military aid, weapons and equipment. UK and a coalition of key allies and partners agreed at the Copenhagen Conference to expand long-term military support for Ukraine's defence. Britain will place £250 million of the £1 billion announced at the recent NATO conference into the International Fund for Ukraine (IFU). The IFU is a flexible low-bureaucracy fund that will ensure a steady flow of money for the provision of vital new weapons, essential maintenance and repair of existing kit and training. 🇬🇧



# As of May 2023, the UK has supplied Ukraine with:

- A squadron of 14 Challenger 2 tanks
- AS90 self propelled guns
- Hundreds of armoured and protected vehicles, including Bulldog and CVR(T)
- a manoeuvre support package, including minefield breaching and bridging capabilities
- More than 10,000 anti-tank missiles (including NLAW, Javelin, Brimstone, and other anti-tank weapons)
- Multiple Launch Rocket Systems
- Almost 200 other armoured vehicles
- 6 Stormer vehicles fitted with Starstreak launchers, along with hundreds of missiles
- Maritime Brimstone missiles
- AMRAAM missiles, which can shoot down cruise missiles, for use with the US NASAMS air defence system
- 200,000 rounds of artillery ammunition, nearly 3 million rounds of small arms ammunition, 2,600 anti-structure munitions and 4.5 tonnes of plastic explosive
- More than 82,000 helmets, 8,450 sets of body armour, medical supplies and more than 5,000 night-vision devices.
- More than 28 M109 155mm self-propelled guns
- 36 L119 105mm artillery guns and ammunition
- Over 2,000 unmanned aerial systems (including hundreds of loitering aerial munitions)
- Six autonomous underwater mine-hunting vehicles
- Counter-battery radar systems
- Communications equipment
- Electronic warfare equipment
- Medical equipment
- 25,000 sets of winter clothing
- Dozens of high power, industrial strength generators
- More than 120 logistics vehicles
- Additional 1,000 surface to air missiles
- Sea king helicopters for search and rescue
- 125 anti-aircraft guns
- Counter-drone capabilities
- An equipment support package of spares to refurbish up to a hundred Ukrainian tanks and infantry fighting vehicles
- Over 80 high power generators





# 25

## Years Back From Vayu Aerospace Review Issue III/1998

### “Indian Armed Forces Will Have N-Weapons”

India’s Minister for Defence George Fernandes has said that missiles used by the Indian armed forces will now be equipped with nuclear warheads and the “weaponisation process will not be affected by the country’s unilateral moratorium on nuclear tests”. He revealed that scientists were of the view that the tests had given them “sufficient material for weaponisation.”

### ATR-42 To Be India’s 50-Seater

After nearly a decade of deliberation, evaluation and negotiation, the Franco-Italian ATR-42/72 turboprop has been finally selected (as India’s new regional airliner) by the Joint Committee set up for the purpose.

### Air India Fleet Expansion On Hold

Air India has decided to keep its fleet expansion plans on hold, pending a full-fledged financial and organisation restructuring. While the plan to acquire MCLR (Medium Capacity Long Range) airliners is not even being considered currently, the national carrier is also going slow on addition of three more 200-seater aircraft to its fleet.

### US Sanctions Directly Affect LCA Project

Although cynical remarks abound within the industry as to how US sanctions have got the Aeronautical Development Agency (ADA) “off the hook”, with reference to protracted delays in this fighter’s development, the fact is that the Light Combat Aircraft project will certainly be hardest hit by the US Administration decision to impose strict sanctions on India.

### “LCA Will Be Costlier—And Later”

Aerospace industry analysts have observed that whatever measures are now taken, the LCA project will far exceed its development cost estimates of Rs. 2,500 crore. It is understood that officials of the Aeronautical Development Agency (ADA) are trying to persuade the Defence Ministry to allocate additional funds accommodate a revised development schedule.

### Naval Trishul Tested

The naval version of the Trishul surface-to-air missile was tested from an Indian naval establishment near Cochin on 3 June. The missile was test-fired at 1520 hours from INS “Dronacharya”. “The missile was in user configuration”, according to MOD sources. This is the first development flight test of the missile in a series before it is offered for user trials.

### Dedicated Military Reconnaissance Satellites

The use of satellites for intelligence-gathering missions is under the serious consideration of the Indian defence services. “We have already laid down the qualitative requirements for this project”, according to Air Chief Marshal Sareen who went on to state that if the final go-ahead was given for the project, it would be implemented in collaboration with the Indian Space Research Organisation (ISRO).

### The Dhanush Missile

According to sources in the Defence Ministry, a new version of the Prithvi SSM, developed by the Defence Research and Development Organisation (DRDO) under its Integrated Guided Missile Development Programme (IGMDP) has a range of about 350 km. and is much superior to the earlier versions developed for the Indian Army and Air Force. Called the Dhanush, this version of the Prithvi

has been approved for launch trials in December 1998.

### SWAC Headquarters Shifts

On 1 May 1998, headquarters of the IAF’s South Western Air Command were formally moved from Jodhpur in Rajasthan to Gandhinagar (near Ahmedabad) in Gujarat State. The area of SWAC’s responsibility extends from Rajasthan southwards to Gujarat, Maharashtra and upto Goa and includes offshore maritime assets, particularly Bombay High.

### IAF Considers A310 MRTT

It is understood that Airbus Industrie may offer the multi-role tanker transport version of the Airbus A310 aircraft to the Indian Air Force. The MRTT is a modified A310 for air-to-air refueling and troop or cargo transportation over long distances. It is learnt that the IAF is keen to procure such capability to enhance the radius-of-action of its frontline fighter aircraft, including the Mirage 2000 and Jaguars.

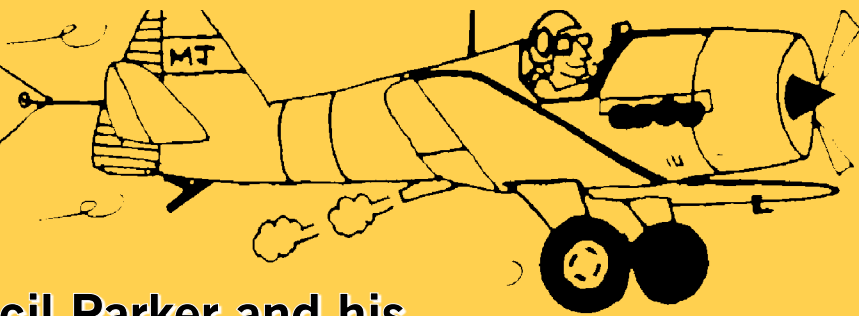
### Boeing’s India Business Relations Intact

“For more than 40 years, Boeing has had a strong business relationship with India, its airlines, and its aviation industry, and that relationship should not suffer as a result of issues today between the US and India”, said Boeing India President Dinesh Keskar on 19 May in New Delhi.

### Lufthansa In Consortium To Build New Mumbai Airport

Sources in New Delhi have indicated that Lufthansa’s airport development wing is interested in joining an international consortium for building the Rs.17,000 crore New Mumbai airport, to supplement the present Sahar international airport. It is understood that the Maharashtra government has offered up to 74 per cent stake to private and foreign investment. ✈

## Ancient Aviator Anecdotes



Air Vice Marshal (R) Cecil Parker and his...

# The Caterpillar Club



### Membership

28 October 1952 was another bright day at the Indian Air Force (IAF) air base at Hakimpet (15 km north of Hyderabad) where, as a newly-graduated pilot, I was undergoing my applied phase of flying training on the last of the piston-engined fighter aircraft in the IAF — Spitfire and Tempest of World War II vintage. Navroze Lalkaka, my erstwhile flying instructor at the Air Force Academy (then at nearby Begumpet) happened to be visiting and listened quietly while Umesh Hosali, my then instructor, briefed me for a routine practice sortie to be flown in Tempest IIA HA596 which, at that moment, was airborne on a similar training sortie flown by a co-pupil of mine. This was to be my thirteenth flight in this single-engined single-seater fighter bomber, which quite dwarfed in size and performance the tiny little fabric-covered Tiger moth trainer aircraft and the ubiquitous Harvard trainer aircraft which together represented the (then) sum-total of my 180 hours of flying

experience during basic and advanced phases of flying training.

He taxied the Tempest onto the change-over dispersal, gave me the 'thumbs-up' sign to indicate that the aircraft was fully serviceable and, while the engine was kept running, helped me to strap into the aircraft. Conscious of the fact that my old instructor was watching me from the Flying control, I taxied out very carefully, lined up on the runway, made a final check of instruments and took off (as straight as I could) to climb into our local flying area. Fifteen minutes later and 3,000 feet up in the air, without any warning, my (hitherto) safe world exploded dangerously. The engine had caught fire, its covering panels burst open right in front of my disbelieving eyes, smoke and flames engulfed me inside the cockpit. Gasping for air and almost blinded, I managed to transmit a hasty and feeble 'May Day' call on the radio to indicate a grave emergency, while simultaneously trying to undo my straps, disconnect myself from the various attachments to the aircraft, and

jettison the canopy to bale out of the aircraft which was now rapidly losing height and getting out of my control. In India we were still in the pre auto-ejection seat era when pilots had to physically get out of an aircraft during dire emergencies such as fire in the air. After two desperate but unsuccessful attempts I finally succeeded in inverting the aircraft and dropping out. After the mandatory (but I suspect rather hurried) count of 10, I pulled the rip-cord to deploy the emergency parachute which opened and jerked me into an upright position.

Suddenly I found myself drifting gently earthwards under the canopy of a parachute for the first time in my life while Tempest HA596 exploded in mid-air somewhere just below me. I glanced down at the brown earth below (closing in a bit too rapidly for comfort!) and was aghast to discover that I was in my socks — my shoes having been 'sucked off' some time during the bale-out. (This was prior to the introduction of flying boots as mandatory equipment for aircrew). I tried to recollect all the lessons we had been given on how to 'touch down' in a parachute but none had covered 'landing' in bare feet! Unknown to me at that moment 50 years ago, I had just become eligible for membership in the world's most exclusive organisation — the Caterpillar Club.

### Origins

In 1919 a young American named Leslie Leroy Irwin demonstrated for the first time that it was possible to fall freely through the air without losing consciousness, open a parachute manually, and survive. He joined hands with a silk garment manufacturer to form the Irwin Air Chute Company which began manufacturing safety parachutes for customers in the USA and overseas. In 1922 the Caterpillar Club was formed by Irwin and its membership is still limited to those people, no matter what nationality, race, creed or gender, whose lives have been saved in an emergency by an Irwin parachute. The name 'Caterpillar' was chosen by

Leslie Irwin himself in conjunction with Lieutenants Harris and Tyndall of the United States Army Air Corps (USAAC) who were in fact the first two people to owe their lives to an Irwin parachute. There were two reasons for the choice of the club's name: the silken threads from which parachutes of the time were woven were produced by the caterpillar, and the caterpillar lets itself down to earth by a silken thread it has spun. These facts also give the club its slogan, 'Life depends upon a silken thread'. Each member on being accepted to the club is presented with a membership card and a gold pin in the shape of a caterpillar on the back of which is engraved the name and rank of the member.

In the first year there were only two members (Harris and Tyndall), but by 1939 (i.e. outbreak of World War II) the total membership was about 4,000. The present UK roll, since computerised, now exceeds 32,000. Obviously a large proportion of this total represents Service personnel who were forced to bale out during WW II. The overall world membership today stands at over one hundred thousand and includes many names famous in aviation such as Geoffrey de Havilland, Douglas Bader, John Cunningham, Jimmy Doolittle (member thrice over), Charles Lindbergh (member four times over!) and Ernst Udet, the German air ace of WW I fame, who became a member in 1934. Among the many messages endorsed on their applications for membership, are two reproduced below from the back of POW (Prisoner of War) cards:-

"Dear Leslie, I'd like to thank you for the sweetest moments in all my life, when my parachute opened and I realised I was not going to die. Your parachutes are so good that I'm going to name my son (when I have one) Irwin as it was due to one in particular that I am alive enough to woo, marry and get me a son".

"God bless you brother Leslie on behalf of my wife and children- as yet unknown."

## Indian Chapter

Initial aircraft acquisition of the (R) IAF was of American or British origin and therefore ancillary military aviation equipment invariably included Irwin safety parachutes. The IAF completed 80 years in 2012 and there are today just over 50 Indian aircrew who, as members of the Caterpillar Club, owe their lives to an Irwin parachute. The actual number of Indians who have baled out or ejected from aircraft during emergencies is of

course very much more, but our subsequent acquisitions, purchases or manufacture did not necessarily entail or include parachutes from the Irwin Chute Coy.

The first recorded member of the Caterpillar Club in India is (the late) Jamshed Dordi. He was in No. 7 Squadron in Burma in 1944, operating American-built Vultee Vengeance aircraft which carried a two-man crew, a pilot and an Observer-cum-Navigator. On 1 April 1944 while part of a six aircraft attack mission on a Japanese target in Kalieva, Dordi's Vengeance ran into a severe thunderstorm which disabled the aircraft. The pilot Flying Officer Dadhaboy, instructed Dordi to bale out first while he followed. Dordi landed on trees and in the subsequent drop to the ground, lost consciousness for some time. He walked for three days before he managed to reach his squadron on 4 April 1944 to discover that, for unknown reasons, Dadhaboy did not or could not bale out and crashed with the aircraft. No. 7 Squadron is one of the oldest squadrons in the IAF and during Dordi's tenure was commanded by Hem Chaudhari (brother of General J Chaudhari, later COAS Indian army); its two flight commanders were Pratap Lal (later CAS of the IAF) and Erlich Pinto (later AOC-in-C WAC who died in a tragic helicopter accident in 1963).

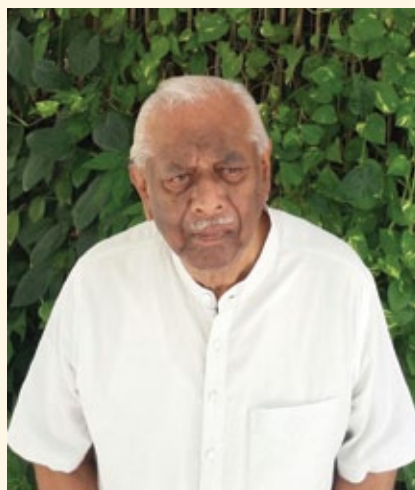
## Conclusion

My touchdown in a dried paddy field was less of a 'hard arrival' than feared; apart from a twisted ankle and minor burn injuries, I had escaped lightly and was able to discover that the small auxiliary chute had ripped off at some point of time. The main canopy had large holes in it being acid burns from the aircraft battery located very close to the pilot's seat in the Tempest. After about 25 minutes I was picked up in a jeep and was delighted to be reunited with my fellow students and receive a welcome bear-hug from my instructor who quite made my day with his "I'm proud of you laddie" comment. The subsequent Court of Inquiry established that the fire in the air had been caused by the failure of the connecting rod in the engine, a not infrequent occurrence in the Tempest aircraft which led soon to its grounding and being phased out of the IAF. Marshal of the Indian Air Force Arjan Singh, DFC (Retd) who preceded ACM PC Lal as CAS of the IAF, had this to write in a letter to me: "...you were lucky to get away with it in a Tempest, a difficult



aircraft to fly and land and much worse to bale out from...". He had led the first (and last) flypast of 12 Tempest aircraft over the Red Fort while Pandit Nehru unfurled the National Flag on 15 August 1947.

It was a tradition in the IAF (probably inherited from the RAF) that any aircrew baling out gave Rs. 50 to the Safety Equipment Worker (SEW) who had re(packed) the parachute during its last inspection plus a tea party to the Parachute Section of the air base. I was happy to comply with the tradition but was even more delighted to meet up with the erstwhile Corporal (now a prosperous-looking Warrant Officer) when I returned to command Air Force Station Hakimpet in the mid-seventies. The most important privilege of membership in the Caterpillar club continues to be the 'Continued Enjoyment of Life', and no member ever forgets it, least of all the approximately 30 applicants who continue to qualify for membership every year world-wide even today. 🦋



## IAF International



Seen here in this photo is the IAF participating in Greece at Exercise Iniochos'23. We are hardly at the halfway mark in 2023 and the IAF has been extremely busy taking part at some major exercises around the world/India including Iniochos, Cope India, Desert Flag VIII, Orion'23, Cobra Warrior, Veer Guardian, Varuna (air component), AMPHEX, TROPEX, Shinyuu Maitri, many other smaller exercises etc. Heartening and good going!

## Stunning!



NASA's Curiosity viewed the first 'Sun Rays' on Mars taken in March 2023. The veteran rover captured a dazzling sunset at start of a new cloud-imaging campaign. Martian sunsets are uniquely moody, but Curiosity captured one; as the Sun descended over the horizon, rays of light illuminated a bank of clouds. (Courtesy: NASA)

## More Mars!



NASA is embarking on one of the most difficult missions humanity has ever undertaken: bringing samples from another planet to study on Earth. To maximise the probability of success, NASA will convene a Mars Sample Return mission independent review board. (Courtesy: NASA)

## Grounded and ready to serve



If eating while flying is not your thing, then head to Murthal (outside Delhi) and board either of the two aircraft for a hearty meal without worrying about turbulence. Unlike the current airlines, the food is just brilliant! The eatery is aptly named "Hawai Adda" or "airport". ✈️

Say no more. We all have done this. Repeatedly.



**Afterburner**

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**Paris  
18th June 2023**



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