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Cover : Italian Navy F–35B and IAF Su–30MKI at Exercise Pitch Black 2024. Photo and report by Gian Carlo Vecchi.

Regular features:

Opinion, Viewpoint, Aviation & Defence in India, World Aviation & Defence News, I learnt more than flying from them, Vayu 25 Years Back, Tale Spin.

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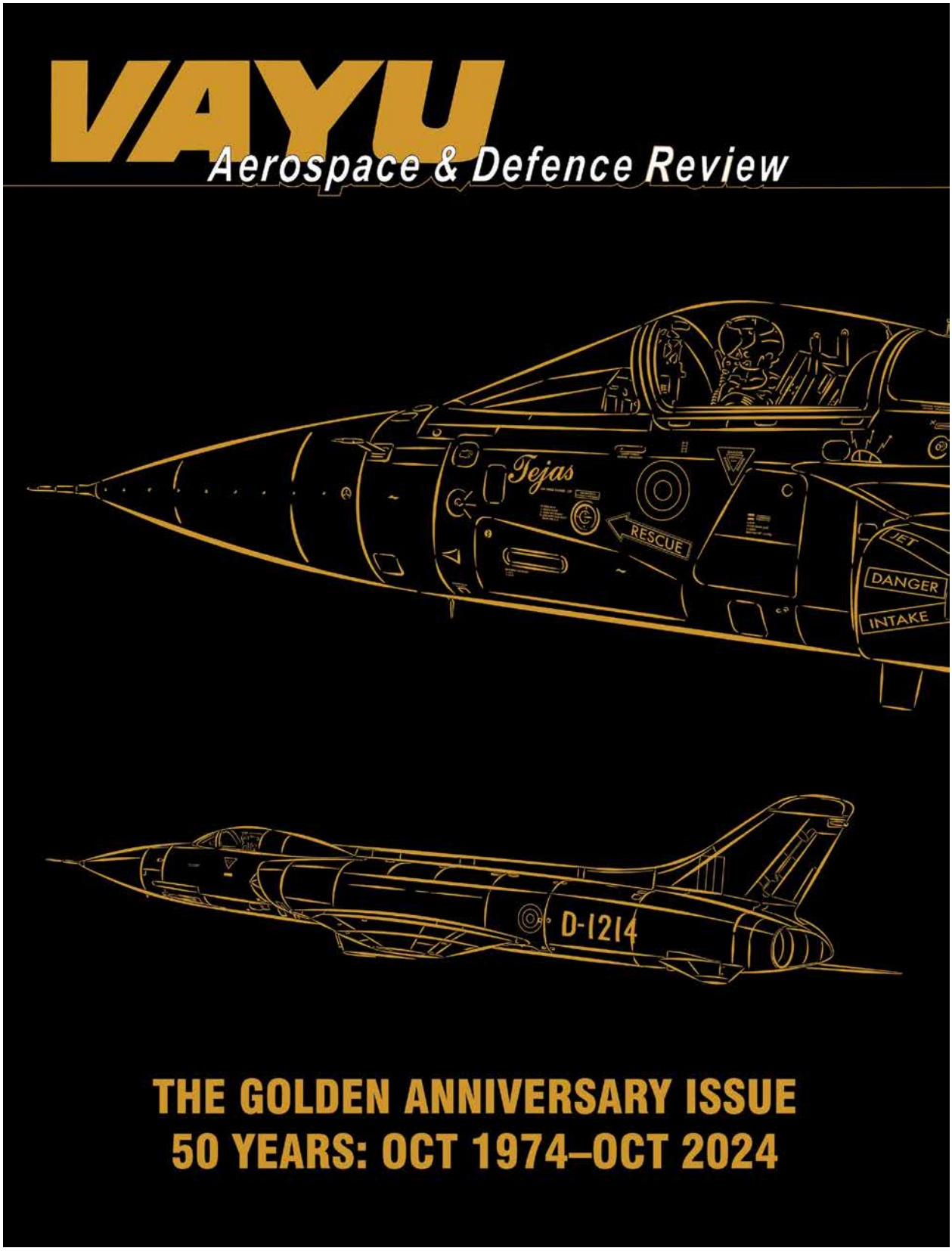

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Our 50th Anniversary Special Issue is out!
October 1974–October 2024

Dear Readers, Subscribers and Friends,

It was 50 full years in October 2024! Founded by the late Pushpindar Singh Chopra in October 1974, the first edition was launched as Issue 1 Nov/Dec 1974 with the name Vayuyan. A few years later the name changed to Vayu Aerospace Review and then much later to the current day name of Vayu Aerospace & Defence Review to correctly capture what was being written about in the magazine—not just aviation as the previous names would suggest but also all matters defence including the going ons with the Indian Navy, Indian Army, paramilitary forces, events and airshows, new technologies, space developments, etc.

Pushpindar S. Chopra's relentless passion ensured that there was never a break in the printing and bringing out every edition without fail. He tried to cover every aspect in the world of aviation and defence in India and the latest developments worldwide. This discipline is something that is continuing to this day with a great team in place!

It has been a monumental task to select articles from all our past issues starting from November 1974 for this Special Edition—our Golden Anniversary. FUN FACT: From the day of inception of the journal, over 50 years, we have brought out every 2 months (we are a bi–monthly magazine), a total of 50 X 6= 300 issues! Or a total of approximately 35,000 pages spread out over the 300 issues. This is not to mention bringing out Show Dailies at every Aero India and Defexpo and occasionally at international shows. If one would add up all the Show Daily pages, we are talking about another 32 years of this or rather 3 dailies per event X 32 years X approx 75 pages per daily = that's another 7200 pages. Total unique Vayu pages printed over its existence is about 42,200!! Therefore, it was difficult to select these 344 pages out of the 42.2K I just mentioned earlier.

Some more fun statistics: Since joining Twitter/X in August 2018, we now have 43K+ followers and have sent out approximately 27.2K tweets. Our average website hits is approx 1.6 million a month; during Aero India and Defexpo times, our hits touch approx. 3.5 million for that particular month! Plus, on the website, we have uploaded 1100+ long read articles.

The whole idea of this 'exercise' is to bring out the genesis and start/end of programmes in the Indian defence realm so that one can trace all the developments and important eras, dates and timelines—to fit in one single magazine.

But please also note, we have carefully extracted selected articles from the very first issue of 1974 all the way till 2010. The reason for not putting up articles from 2011 till 2024 is that they are all available on our website (www.vayuaerospace.in) for free download. Plus adding these would just make this Special Issue way too big!

Most photos are from the archives of Vayu Aerospace & Defence Review, The Society for Aerospace Studies, Indian Air Force, Indian Navy, Simon Watson/Phil Camp and from the private collections of many veterans. While most photos can be credited and attributed to various individuals and organisations, the source of many are unaccounted for or lost over time. However, we have tried our best to locate the original photos from the authors but in many cases it has not been possible as the extracts for this Special Issue have been taken over the past 50 years and keeping records of this has not been easy or to retrieve. So apologies if some photos have been used without due credit– it has been unintentional.

Another important point is that we have retained the quality of the photos almost as they were printed in magazine from 1970s and 1980s. We could have substituted them with their original photos for clarity and crispness but then it would have taken away from the 'original' look of the articles and era! In places where the quality of photo was very poor or blurred, we have substituted them selectively.

Yet another point—all articles in this issue are in sequence starting November 1974 so it will be easier for the reader to understand timelines. Numerous articles have been scanned as per their original "look", thus one will notice many faded or poor quality of photos initially—that is due to old printing techniques and technology but also the fact that over time, older issues have faded in the storing conditions, humidity etc. But as a consolation for us, every single edition is accounted for and there is nothing missing!

So, we hope you enjoy going through this Special Issue just as we have had fun putting this together!

Warm regards,
Vikramjit S. Chopra, Editor

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Lt Gen Kamal Davar says…

…..How to harmonise the troubled neighbourhood in 2025

At a time when the world is in a state of political turmoil, India's neighbourhood is not witnessing as much violence as some other regions. But in recent times this region too has degenerated to discernible levels of political instability and diplomatic chasms among nations which constitute the South Asian and East Asian landmasses.

Among India's South Asian neighbours, barring the tiny kingdom of Bhutan, others including Afghanistan, Pakistan, Sri Lanka, Nepal and lately Bangladesh are afflicted internally, with some levels of political instability and/or antagonism with neighbours. Even Bhutan, whose orientation is peaceful and inward looking, has its territorial borders being eyed by an expansionist China, which is in occupation of some Bhutanese territory where it is building villages and other infrastructure close to Bhutan's borders. As regards East Asia, the Chinese are working overtime to influence Myanmar and its military junta while substantially expanding its business ties with Thailand, Malaysia, Cambodia, Indonesia, Singapore, and even Japan and Philippines that are not politically close to China. China's intention is to make these nations economically dependent.

The overly ambitious China, with its imperial leanings, is carving out diverse areas of influence in the nations of South and East Asia. Equally, China's intent to marginalise India has been more than evident since the last many decades. Somewhere India is seen by a few strategic analysts as not being equally firm to counter Chinese assertiveness. Though India does not covet an inch of Tibetan/Chinese territory, the same cannot be said of the Chinese. It is hoped that the meeting of the Special Representatives of both nations last year to resolve the boundary issue, Indian NSA Ajit Doval and Chinese Foreign Minister Wang Yi in Beijing will reach a mutually acceptable solution and India's rightful position will not be sacrificed at the altar of Chinese bullying tactics. The nation must be firm while dealing with the Chinese for our Armed Forces are fully capable of thwarting any further Chinese incursions which the Chinese are more than aware of.

Commencing with the Taliban–ruled Afghanistan, India has done well to carve out a fresh approach. The Taliban too, like rest of the Afghan people, respect India for its policy of non–interference in Afghanistan's internal affairs and generous no–strings attached aid to the Kabul administration since many decades. Afghanistan will now not allow Pakistan to use its territory for terror activities against India. We must accordingly continue to assist Afghanistan in its developmental activities.

As regards Pakistan, successive governments and all Indian PMs, to date, have made efforts to establish good neighbourly relations with Pakistan but to no avail. Thus as India, being the largest and most powerful nation in South Asia, tries to drill some sense into Pakistan, it must ensure its security preparedness of a high order as India does face a credible two–front threat from Pakistan and China in collusion. Pakistan, in particular, has to be made more than aware of India's geopolitical red lines. It must be conveyed to Pakistan that so far India has not exploited many of Pakistan's faultlines and Pakistan too better learn to reciprocate.

Since last August, in a surprising and totally unexpected development, the pro–India PM of Bangladesh, Sheikh Hasina, and her Awami League government were unceremoniously ousted by their army and ostensibly by some form of a students' revolution. Within hours of her expulsion from

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Dhaka to New Delhi, Nobel Prize winner economist, Muhammad Yunus took over as the Interim Adviser of the government in Dhaka and is virtually now ruling the nation. Meanwhile, massive uncalled for violence against the minorities, particularly Hindus is going on in Bangladesh, which Dhaka refuses to acknowledge. India so far has maintained a reasonably soft attitude towards the Bangladesh apart from a couple of statements from the Indian government. However, just last fortnight, the Indian Foreign Secretary, Vikram Misri was dispatched to Dhaka to convey India's concerns to the Bangladesh government where he met his counterparts and also called upon Dhaka's head of government, Yunus. Hopefully, a firm message would have reached the Dhaka government.

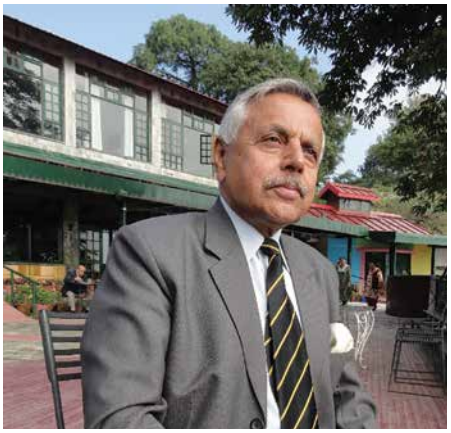
India and Bangladesh have wide ranging economic ties and the latter depends a fair amount on India for its power needs, apart from importing many essential food items. Thus India does have the option of economically squeezing Bangladesh in case it does not change its attitude towards its minorities and if the threat of mass migration to India remains. Pakistan naturally sees an opportunity now to create fresh trouble for India through Bangladesh on India's eastern border. India will now have to employ all its genius and resources to get back vital Indo–Bangladesh relations on an even keel.

In Nepal, with whom India has cultural and religious links, apart from lakhs of Nepalis having served in the Indian Army since over a century and continuing now, China has been on an overdrive to vitiate Indo–Nepalese relations. Somewhere India has also faltered with its Agniveer scheme in which the Nepalese recruitment for our Army has ceased. This problem should be speedily resolved, for the Chinese would love to have the Nepalese serving in their Army. And the Gurkhas thus one day may end up facing each other in case of an India–China confrontation.

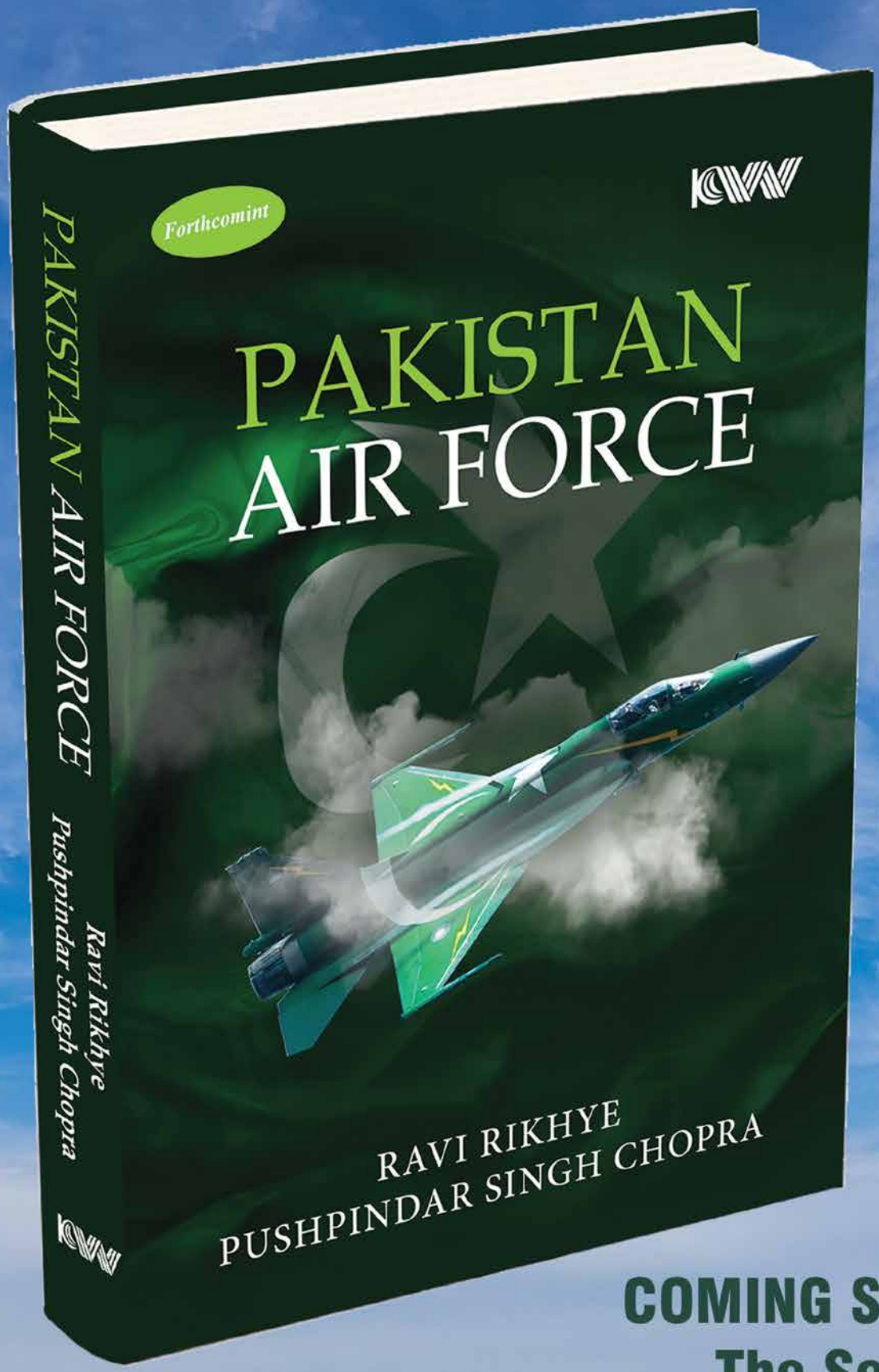
In tiny Sri Lanka, with a change in government, its newly elected President Anura Dissanayake on his first visit to New Delhi has assured our government about Sri Lanka not allowing anyone to use its territory for anti–India agendas, which is welcome.

Myanmar which borders some of India's restive northeastern states cannot be ignored. Myanmar has been in a state of chaos since the military coup in 2021. There are too many power centres in this continually strife–stricken country like the ruling military junta, various ethnic armed organisations (EAOs) in the Shan, Chin and Rakhine states. To ensure no migration of refugees or drug trafficking from Myanmar, India must establish contacts with the major stake–holders in Myanmar. The current turmoil in Bangladesh also impacts India's Northeast in more ways than one.

Notwithstanding the challenges to India in harmonising the nations of South Asia to develop fraternal and mutually cooperative ties with each other, India, as the largest and most powerful nation in South Asia, has its role cut out. The currently sluggish SAARC and the Bay of Bengal Initiative for Multi–Sectoral Technical and Economic Cooperation (BIMSTEC) will have to be revived towards this end notwithstanding machinations of Pakistan and to some extent China. Let India truly strive to harmonise South Asia in 2025. Economic interdependence among all the nations of South Asia will be the key apart from India's diplomatic genius and political astuteness.



The writer, a retired lieutenant–general, was the first head of India's Defence Intelligence Agency, is a long–time Pakistan watcher and has been involved in Track–2 diplomacy.



COMING SOON!
The Sequel.
(In Mar/Apr 2025)

Admiral Arun Prakash says...

.....Why defence industry needs an urgent rehaul

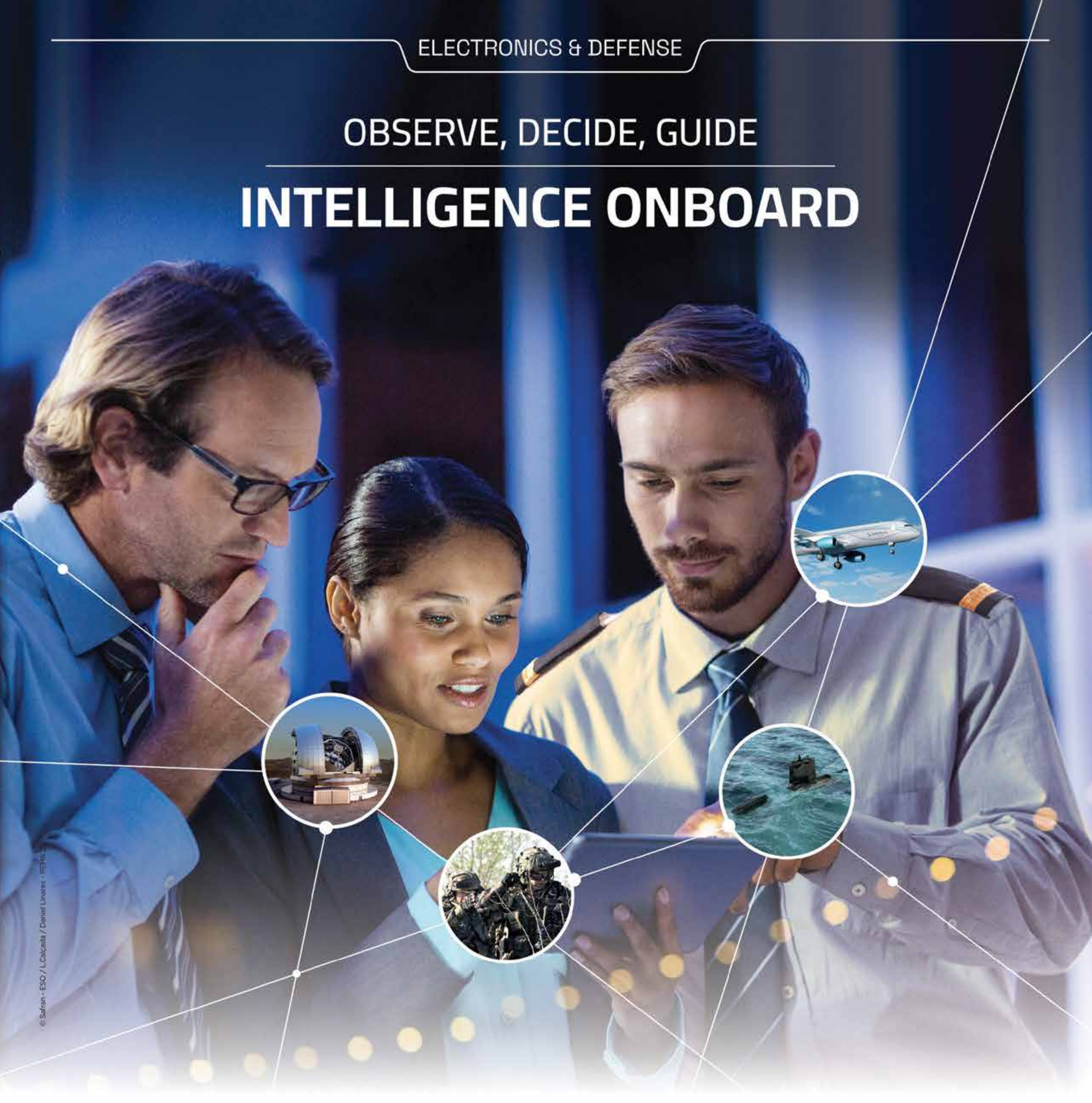
The commissioning of three frontline naval platforms on 15 January 2025 — the first Project–17A frigate, Nilgiri; the last of four Project–15B destroyers, Surat; and the sixth and last Scorpene–class submarine Vagsheer — is of considerable consequence for the Navy and the nation. While these long awaited accretions will bolster India's maritime warfare capabilities, they are also, a reassuring demonstration of the diverse competencies acquired by our warship building industry in the 53 years since the first Indian built warship (also named Nilgiri) was delivered in 1972.

Amidst the euphoria, it is important to take note of a recent reality check, provided by China. On 27 December 2024, Shanghai's Hudong Shipyard launched a 40,000 tonne warship of radical design, described as China's first "super–sized amphibious assault ship". Built in just four years, this vessel features an electromagnetic catapult as well as arresting gear to enable fixed wing aircraft operations and carries a complement of unmanned combat air vehicles. A day earlier, China displayed two new aircraft acclaimed by aviation experts as the world's first and second "sixth generation" fighters, designated the Chengdu J–36 and Shenyang J–50. Both are powered by Chinese designed and manufactured WS–15 jet engines.

Comparisons may seem odious, but many in India are not aware, that in 1949, when the People's Republic of China came into being, India was industrially ahead of it. The World War II had spawned of a vast defence industrial complex to supply to the Allied war effort. Apart from numerous government ordnance factories, it included the privately owned Hindustan Aircraft Ltd and Scindia Shipyard. China, however, launched a national campaign to undertake reverse engineering of Soviet weapon systems in the mid–1960s. Six decades later, this resolute quest for technology acquisition has made it a leading arms producing nation.

India, on the other hand, is the world's second largest arms importer, and herein lies deep irony because it also happens to possess one of the world's largest defence technology and industrial bases (DTIB). Comprising 50 Defence Research and Development Organisation (DRDO) laboratories, backed by 16 Defence Public Sector Undertakings (DPSUs) and 41 ordnance factories (recently "corporatised" into seven units), India's DTIB has, so far, failed to significantly reduce import dependence.

An issue of concern is the proclivity to declare premature attainment of atmanirbharta, and to specify the "percentage of indigenisation" achieved in platforms/systems. While good for public morale, such pronouncements are misleading and engender a sense of complacency that can impede the march to self–reliance. The attainment of 70–80% indigenisation in a platform should remind us that the remaining 20–30%, constituting vital systems like engines, machinery, weapons and sensors, are still imported from the United States, Russia, Ukraine, France, Israel, Italy, Finland and Germany. Aiming for 100%

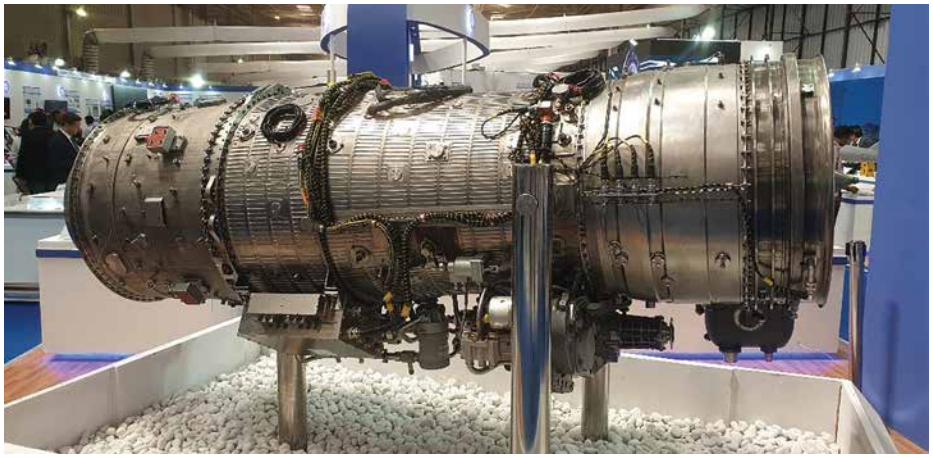


technological autonomy is a Utopian quest, but atmanirbharta must be claimed only when our scientists have indigenised key components at the heart of weapon systems.

India's dismal performance in the defence industrial sphere can be attributed to acts of omission and commission by institutional stakeholders. At the political level, unlike nuclear power and space, there has never been a vision for self–reliance in defence production. Lacking comprehension of military–technology, both politicians and bureaucrats have failed to provide direction to, and exercise oversight over, vital indigenisation projects.

The armed forces (with exception of the Navy) have resented the blunting of their combat capability by unending delays and performance shortfalls and kept a distance from the DRDO. There is a feeling that scientists focus on "technology demonstrators" and self–assigned projects, while the soldier waits in vain for weapon systems that would bolster combat capabilities. The scientists blame the military for setting "unrealistic staff requirements", "shifting goalposts" and favouring imports.

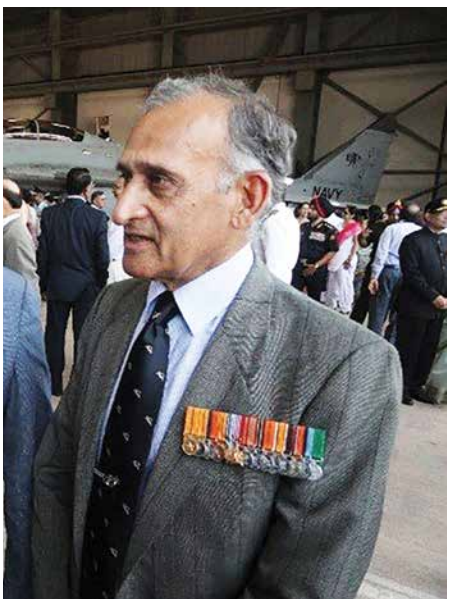
Against this backdrop, vital defence projects have suffered from indecision, drift and delay. Two examples best illustrate such gridlocks. The saga of the indigenously designed Light



Combat Aircraft, Tejas — now under production at Hindustan Aeronautics Limited (HAL) — is best summed up by a 2015 report of the Comptroller and Auditor General that reads: "LCA was required to be inducted into IAF by 1994 ... the programme was riddled with delays right from the sanction of 1983, and even after three decades, it is yet to be inducted into IAF." It adds, "Though ADA claimed achievement of 70% indigenisation, half of these sub–systems are developed with imported electronic components and accessories etc." Tejas was notionally inducted into IAF service in 2016, but the Air chief's recent remark, "Today, we are in 2024, and I do not have even the first 40 aircraft … so this is the production capability," tells a sad story about HAL.

A bold decision was taken in 1986 to assign the development of an indigenous power plant for the LCA to the Gas Turbine Research Establishment (GTRE). A turbofan design, designated GTX–35VS or Kaveri, was taken up for full scale development at a cost of $55 million in 1989. The first prototype Kaveri began tests in 1996, and over the past 39 years, it has made halting progress, as GTRE struggles with serious technological challenges. The DRDO has discussed consultancy options with numerous foreign aeroengine manufacturers for the development of Kaveri, but the negotiations have reportedly stalled on cost considerations. In 2014, it was reported that this project was shut down by DRDO, only to be subsequently revived. The fate of Kaveri is known neither to Parliament nor to the taxpayer.

Given the parlous state of India's national security, the inertia of its DTIB is most worrisome. Seeing the financial profligacy on display in other domains, it is hard to believe that funds are a constraint for defence R&D and production. The prevailing stasis can, therefore, be ascribed only to indifference and/or indecisiveness. Making a clean break with the past, it is imperative to constitute a new ministry of defence technology and production, which will subsume the departments of defence production and defence R&D and implement a time–bound strategy for the rejuvenation of India's DTIB.



In the photo above is Admiral (Retd) Arun Prakash

Lt Gen Kamal Davar says...

....Why reforms in defence sector are crucial for protecting India

Early in January 2025, Defence Minister Mr. Rajnath Singh announced at a press conference that the defence ministry had decided to make 2025 the "Year of Reforms". This is indeed a welcome declaration as reforms and transformation to fight the wars of the future cannot be left to stagnate. It is vital to comprehend that not only is the induction of newer weaponry, platforms and arsenals necessary, but also the introduction of newer doctrines and military structures to successfully face future challenges.

Since Independence, India faced many challenges to its security and fought wars in 1947–48, 1962, 1965, 1971 and 1999, besides facing border clashes and weathering serious terror attacks. Inheriting a Higher Defence Organisation (HDO) bequeathed to it by the departing British rulers, the Indian Army's principal structures, organisation of its units and formations and even military doctrines never underwent any radical changes, only minor transformations. These were also primarily reactive in nature, to meet immediate shortfalls in its arsenal and also some newer outfits were raised as required which the country could afford.

India's restive Northeast region, the turmoil and political instability in neighbouring Myanmar and recently the totally unexpected political changes in Bangladesh, with its current anti–India stance, also pose security threats to India. We must also factor in that Pakistan and China will also be fishing in troubled waters on India's eastern and northeastern flanks.

Though India has, as mentioned earlier, introduced some reforms in defence, primarily in knee–jerk reactions, the most comprehensive exercise was carried out only after the Kargil War in 1999. The then Atal Behari Vajpayee government had constituted the Kargil Review Committee under former bureaucrat K. Subramanyam whose committee, by all standards, carried out a magnificent review of India's HDO. Its recommendations were endorsed by the government's Group of Ministers (GOM), and many suggestions were implemented like the establishment of the office of Chief of Defence Staff (CDS), Strategic Forces Command, Defence Intelligence Agency and National Technical Research Organisation. A far greater emphasis was laid on "jointness" and the integration of the operational doctrines and structures of the three services. Till recently, reports suggest that out of 75 recommendations, about 63 recommendations, big and small, had been implemented. However, one of the significant recommendations for creating optimal "jointness" and integration, namely, the establishment of Integrated Theatre Commands, has not been implemented yet, primarily due to differences in professional opinion between the three services.

The defence minister, who spelt out the nuances of the "Year of Reforms" at his New Year press conference, said "unprecedented advances" would ensue as a result of these reforms "bolstering India's security and sovereignty in defence of 21st century challenges", and it would be a historic step in the modernisation of India's armed forces. He also stressed upon the significance of jointness and integration in facilitating the establishment of the Theatre Commands, which would ensure synergy of the operational capabilities of the three services. The mission was to transform the armed forces from a manpower–intensive force into a technologically robust combat ready force. The Theatre Commands, long delayed, will now be given full attention to ensure their emergence. However, it must be understood that professional differences among the three services will need to be resolved before the implementation of this transformation.

The Theatre Commands must be configured keeping in view the Indian context and not simply follow any Western model. But, as this entire exercise aims at the "unity of effort", clarity on the division of responsibilities between the CDS and the defence secretary, and between the CDS and the three service chiefs needs to addressed. The defence minister also emphasised on vastly increasing our exports in defence equipment by synergising the efforts and resources of Indian industry, our defence public sector units and in partnership with foreign manufacturers. However, till the government does not ensure the pruning of bureaucratic hurdles in India, this will remain a pipedream. He, however, stated that from a mere Rs 2,000 crores of defence exports in 2014, India was now exporting defence equipment worth Rs 21,000 crores and the government had set a target of Rs 50,000 crores for such exports by 2029. The minister rightly prioritised the nation's efforts to acquire proficiency in emerging technologies like artificial intelligence, robotics and machine learning.

Though he did not touch upon the current wars in progress like the Russia and Ukraine conflict or the Israeli and Hamas, Israeli and Hezbollah or the Israeli–Iranian long range missiles exchanges, it will be prudent to analyse the employment of certain weaponry in use in these kinetic conflicts, as amazingly, many of the well established concepts of war fighting so far have met their Waterloo in these battles. Important lessons will emerge even for the Indian armed forces, including the fact that smaller nations and non–state actors can create major problems for nations with large armies with the spread of lethal and easily available technologies. The era of unmanned weaponised platforms has also dawned.

The year ahead will present an array of challenges for India, and it will now be the duty of its highly professional armed forces, with the unqualified support of the government, to be fully prepared for multi–spectrum warfare across all domains.

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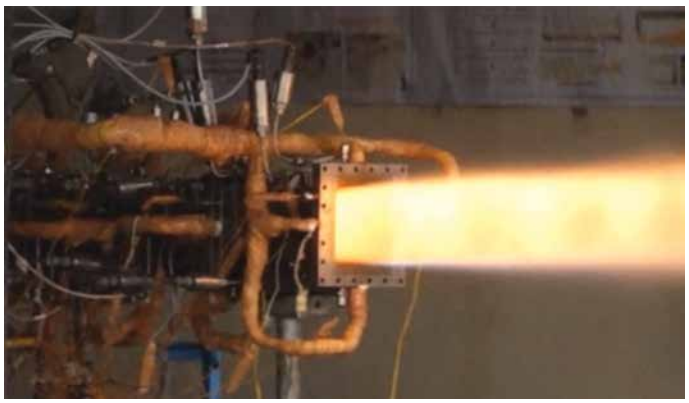
DRDO conducts scramjet engine ground test

Defence Research & Development Laboratory (DRDL), a Hyderabad based laboratory of Defence Research and Development Organisation (DRDO) has taken the initiative in developing a long duration Supersonic Combustion Ramjet or scramjet powered hypersonic technology. DRDL recently developed these technologies and demonstrated a cutting edge Active Cooled Scramjet Combustor ground test for 120 seconds for the first time in India. The successful ground test marks a crucial milestone in developing next–generation hypersonic missiles.



DRDO conducts LRLACM test

Defence Research and Development Organisation (DRDO) conducted the maiden test of Long Range Land Attack Cruise Missile (LRLACM) from the Integrated Test Range (ITR), Chandipur off the coast of Odisha on 12 November 2024 from a mobile articulated launcher.

DRDO's long–range hypersonic missile tested

Defence Research and Development Organisation (DRDO) conducted a successful flight trial of India's first long range hypersonic missile from Dr APJ Abdul Kalam Island off the coast of Odisha late on 16 November 2024. This hypersonic missile is designed to carry various payloads for ranges greater than 1,500 kms for the Armed Forces.

DRDO completes tests of Guided Pinaka

DRDO, on 14 November 2024, successfully completed the Flight Tests of Guided Pinaka Weapon System as part of Provisional Staff Qualitative Requirements (PSQR) Validation Trials. Twelve rockets from each production agency from two in–service Pinaka launchers upgraded by the launcher production agencies have been tested.

TECHNOLOGY AND CAPABILITY CO-CREATED IN INDIA, FOR THE WORLD

Delivery of 6th Scorpene 'Vaghsheer'

Vaghsheer, the sixth submarine of the Project 75 class, was delivered to Indian Navy on 9 January 2025 after successful completion of mandatory sea trials. The submarine was launched in April 2022 and commenced her sea trials in December 2023. The submarine has been constructed by the Mazagaon Dock Shipbuilders Limited, Mumbai in collaboration with Naval Group, France.

Field evaluation trials of Nag Mk.2

On 13 January 2025, field evaluation trials of indigenously developed Nag Mk.2, the third generation anti–tank fire–and–forget guided missile, was successfully conducted at Pokhran Field Range in the presence of senior officers of the Indian Army. During the three field trials, the missile systems destroyed precisely all the targets – maximum and minimum range, thus validating its firing range. The Nag Missile Carrier version–2 was also field evaluated. With this, the entire weapon system is now ready for induction into the Indian Army.

AVNL contracted for 47 T–72 Bridge Laying Tanks

Ministry of Defence (MoD) has signed a contract with Heavy Vehicles Factory, a unit of Armoured Vehicle Nigam Limited, for the procurement of 47 Tank–72 Bridge Laying Tanks (BLT) for the Indian Army at a total cost of Rs 1,560.52 crore.

MoD contract with BDL for MRSAM

Ministry of Defence (MoD) has signed a contract with Bharat Dynamics Limited (BDL) for the supply of Medium–Range Surface–to–Air Missiles (MRSAM) for the Indian Navy at a cost of approximately Rs 2,960 crore. The MRSAM system is a standard fit, onboard multiple Indian naval ships and is planned to be fitted on the majority of the future platforms planned for acquisition.

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DAC approves proposals worth Rs. 21,772 crores

The Defence Acquisition Council (DAC) accorded Acceptance of Necessity (AoN) for 5 capital acquisition proposals amounting to over Rs. 21,772 Crores. This includes procurement of 31 Water Jet Fast Attack Crafts, 120 Fast Interceptor Craft, Electronic Warfare Suite (EWS), Next Generation Radar Warning Receiver and Advanced Light Helicopters for surveillance in coastal areas. AoN for procurement of Electronic Warfare Suite (EWS) comprising external airborne self protection jammer pods, next generation radar warning receiver and associated equipment for Su–30MKI aircraft was accorded by DAC. It has also accorded approval for the overhaul of T–72 and T–90 tanks, BMP and engines of Sukhoi fighter aircraft which will enhance the service life of these assets.

MoD contract with MDL, DRDO and Naval Group

Ministry of Defence has signed two contracts, worth approx. Rs 2,867 crore, for the construction of Air Independent Propulsion (AIP) Plug for DRDO–AIP system and its integration onboard Indian submarines, and the integration of Electronic Heavy Weight Torpedo (EHWT) onboard the Kalvari class submarines. The contract for construction of AIP Plug and its integration was inked with Mazagon Dock Shipbuilders Limited, Mumbai worth around Rs 1,990 crore, while the contract for integration of EHWT, being developed by DRDO, was signed with Naval Group, France at a cost of Rs 877 crore.

MoD contract with HAL for 12 Su–30MKIs

A contract for procurement of 12 Su–30MKI aircraft along with associated equipment was signed between Ministry of Defence and Hindustan Aeronautics Limited (HAL) on 12 December 2024, at an approximate cost of 13,500 crore inclusive of taxes and duties. The aircraft would have an indigenous content of 62.6%, enhanced due to indiginisation of many components to be manufactured by Indian defence industry.

Contract for K9 VAJRA–T's

Ministry of Defence has signed a contract with Larsen & Toubro Limited for procurement of 155 mm/52 calibre K9 VAJRA–T self–propelled tracked artillery guns for the Indian Army under Buy (Indian) category at a total cost of Rs 7,628 crore.

HAL CATS progress

The flagship programme of HAL, Combat Air Teaming System achieved a significant milestone on 11 January 2025 by successfully conducting the engine ground run of a full scale demonstrator, CATS–Warrior.

Image of first reveal in 2021 vs the modified version can be seen clearly. (Photo courtesy: X/ @lca_tejas_)

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DRDO hands over AHSP of P–7

The Authority Holding Sealed Particulars (AHSP) of P–7 Parachute System was handed over to the Directorate General of Quality Assurance (DGQA) by the Aerial Delivery Research and Development Establishment (ADRDE), Agra, a DRDO laboratory on 12 November 2024.

Indian Light Tank (ILT) Zorawar progresses in Leh trials

On 12 December 2024, Indian Light Tank (ILT) achieved a major milestone by firing a number of rounds at different ranges at an altitude of more than 4200m, at a high altitude location with consistently accurate results. This was subsequent to the Phase I trial in desert environment in September 2024.

India joins Eurodrone programme as observer

The Government of India (GoI) has officially become the newest Observer State in the OCCAR–managed MALE RPAS (Eurodrone) programme – led by Airbus Defence and Space as the industrial prime. India's interest follows the Government of Japan (GoJ), which was recognised as the first official OCCAR Observer State in the MALE RPAS (Eurodrone) Programme in November 2023. The Eurodrone is a Remotely Piloted Aircraft System (RPAS) designed to carry–out various long endurance missions ranging from Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) and Attack to, for example, Maritime Surveillance, Anti–Submarine Warfare and Airborne Early Warning missions in the future.

Handing over two interceptors to Mozambique

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As part of its capacity building engagements with friendly foreign nations of the Indian Ocean Region (IOR), the Government of India gifted two water–jet propelled Fast Interceptor Craft (FIC) to the Government of Mozambique on 8 November 2024. The FICs were transshipped from India by INS Gharial. These water jet propelled boats have a top speed of 45 knots and a range of 200 nautical miles at 12 knots.

MoI with Japan for Unicorn masts

A Memorandum of Implementation was signed at the Embassy of India, Tokyo on 15 November 2024 between Govt of India and Govt of Japan, for co–development of UNICORN mast for fitment onboard ships of Indian Navy. The Unified Complex Radio Antenna (UNICORN) is a mast with Integrated Communication systems which will help improve the stealth characteristics of naval platforms. The Indian Navy is pursuing the induction of these advanced systems which will be co–developed by Bharat Electronics Limited in India with Japanese collaboration.

MH–60R multi–mission equipment

India has requested to buy thirty (30) Multifunctional Information Distribution System–Joint Tactical Radio Systems (MIDS–JTRS). The following non–MDE items will also be included: advanced data transfer systems; external fuel tanks; AN/AAS 44C(V) forward looking infrared (FLIR) systems; an operator machine interface assistant; spare containers; software development, delivery and support, including Joint Mission Planning System (JMPS); Identification Friend or Foe (IFF) equipment etc. The estimated total programme cost is $1.17 billion.

MoD contract with CSL for docking of R33

The Ministry of Defence signed a contract with Cochin Shipyard Limited on 30 November 2024 for Short Refit and Dry Docking (SRDD) of INS Vikramaditya at an overall cost of Rs. 1207 Cr. This project is an important step towards development of Cochin Shipyard Limited as Maintenance, Repair & Overhaul (MRO) hub for supporting the industrial ecosystem of India.

President's Colours for four battalions of MI

General Upendra Dwivedi, Chief of the Army Staff (COAS), presented the prestigious President's Colours to four battalions of the Mechanised Infantry during a solemn ceremony at the Mechanised Infantry Centre and School (MIC&S), Ahilyanagar. The event, held on 27 November 2024, was a recognition of their exemplary and meritorious service to the Nation. The President's Colours were awarded to the 26th and 27th Battalions of Mechanised Infantry Regiment and 20th and 22nd Battalions of Brigade of The Guards, marking a proud moment for the youngest battalions of the Arm.

Destroyer (Surat) and a frigate (Nilgiri) delivered

In a historic milestone for the country's Aatmanirbharta, journey, two warships, a destroyer (Surat) and a frigate (Nilgiri) were delivered to the Indian Navy on 20 December

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2024. Yard 12707 (Surat), the fourth and final Project 15B stealth guided missile destroyer, follows in the wake of her predecessors IN Ships Visakhapatnam, Mormugao and Imphal commissioned in the past three years. Yard 12651 (Nilgiri), the first Project 17A stealth frigate is a follow–on of the Shivalik class (Project 17) frigates active in service. Nilgiri is first among the seven P17A frigates under construction and MDL, Mumbai and GRSE, Kolkata.

Keel laying of first Fleet Support Ship

'Keel Laying' ceremony of first of the five Fleet Support Ships (FSS) was held at Hindustan Shipyard, Limited, Visakhapatnam on 14 November 2024. Indian Navy had signed a contract with HSL for acquisition of five Fleet Support Ships in Aug 2023. The ships are scheduled to be delivered to Indian Navy commencing mid–2027.

Steel cutting of first NGMV

'Steel Cutting' ceremony of the first ship of Next Generation Missile Vessel (NGMV), was held at Cochin Shipyard Limited (CSL) on 16 December 2024. Contract for construction of six NGMVs was concluded with CSL in March 2023 with induction of the ships in the Indian Navy planned from 2027 onwards.

Keel laying of 6th ASW SWC Project

Keel laying of the sixth ship (BY 528, Magdala) of the Anti–Submarine Warfare Shallow Water Craft (ASW SWC) project was undertaken on 17 December 2024. Senior officials of Indian Navy and CSL were present for the ceremony.

Plate cutting for FPV and NGOPV for ICG

A major milestone in the development of India's maritime defence capabilities was achieved on 19 December 2024 with the Plate Cutting Ceremony for the first of the 14 Fast Patrol Vessels (FPV) and 6 Next Gen Offshore Patrol Vessels (NGOPV) being constructed for the Indian Coast Guard (ICG).

Launch of 8th ACTCM barge

Launch ceremony of 8th ACTCM Barge, LSAM 22 (Yard 132) was held on 28 November 2024 at Suryadipta Projects Pvt Ltd, Thane. The ceremony was presided over by Cmde VA Giriprasad, AWPS WOT(Mbi).

Launch of 'Utkarsh', 2nd MPV

The second of the two Multi Purpose Vessels, being built by L&T Shipyard for the Indian Navy, was launched in the presence of Rajesh Kumar Singh, Defence Secretary on 13 January 2025 at L&T, Kattupalli, Chennai.

Keel laying of Training Ship for ICG

The keel laying ceremony of a Training Ship (Yard 16101) for Indian Coast Guard (ICG) was held at Mazagon Dock Shipbuilders Ltd (MDL), Mumbai on 13 January 2025. With a range of 7,500 nautical miles, the ship will be equipped with specialised facilities such as a training bridge for cadets, a chart house, and dedicated classrooms to ensure a high quality learning experience at sea.

It will also play a crucial role in the training of 70 under–trainee officers, including women officers, after their basic training ashore.

Induction of two bollard pull tugs

Induction ceremony for 25T Bollard Pull (BP) Tug Bhishm and Bahubali was held on 28 November 2024 at NSRY (SVP).

The contract for construction and delivery of six 25T BP Tugs was concluded with Titagarh Rail Systems Limited (TRSL), Kolkata, on 12 November 2021. The shipyard has indigenously designed these tugs in collaboration with an Indian ship designing firm.

Launching of two FPVs for ICG

Goa Shipyard Ltd (GSL) achieved yet another milestone with the concurrent launch of two indigenously designed and constructed Fast Patrol Vessels (FPVs) for the Indian Coast Guard. Earlier, GSL had launched two vessels of the same series in the month of October 2024.

Steel cutting for 2nd FSS

'Steel Cutting' ceremony of second of the five Fleet Support Ships (FSS) was held at L&T Shipyard, Kattupalli on 11 December 2024. The Indian Navy had signed a contract with HSL for acquisition of Five Fleet Support Ships (FSS) in August 2023, with delivery commencing mid–2027.

HSL selects Kongsberg's Replenishment–at–sea Technology

Kongsberg Maritime has signed a contract with Hindustan Shipbuilding Limited to supply its electric

replenishment–at–sea equipment for its Fleet Support Ships programme. The Indian Navy's Fleet Support Ships (FSS) are a new class of five large replenishment vessels designed to enhance the operational capabilities of the Indian Navy.

Commissioning of Nirdeshak

The Indian Navy commissioned its latest survey ship, Nirdeshak, at Naval Dockyard, Visakhapatnam, on 18 December 2024. The ship was built at GRSE Kolkata and is 110 metre long with a displacement of approximately 3800 tons. It is powered by two diesel engines and is equipped with hydrographic and oceanographic survey equipment.

BEML Ltd and MDL in partnership

BEML Ltd and Mazagon Dock Shipbuilders Ltd (MDL) have entered into a strategic Memorandum of Understanding (MoU) to jointly advance research and development in cutting edge technologies for marine applications. The signing ceremony was held at BEML's Delhi office, attended by the CMD of BEML, the Director (Shipbuilding) of MDL, and senior officials from both organisations.

TASL Tactical Access Switch for Indian Army

Tata Advanced Systems Limited (TASL) announced the successful delivery of the first batch of 40 Tactical Access Switch (TAS) systems to the Indian Army. This significant milestone is part of a larger contract for 100 systems, aimed at enhancing the Army's communication network and modernising its defence capabilities under the Buy (India) initiative.

ISRO's PSLV–C59/PROBA–3 mission successful

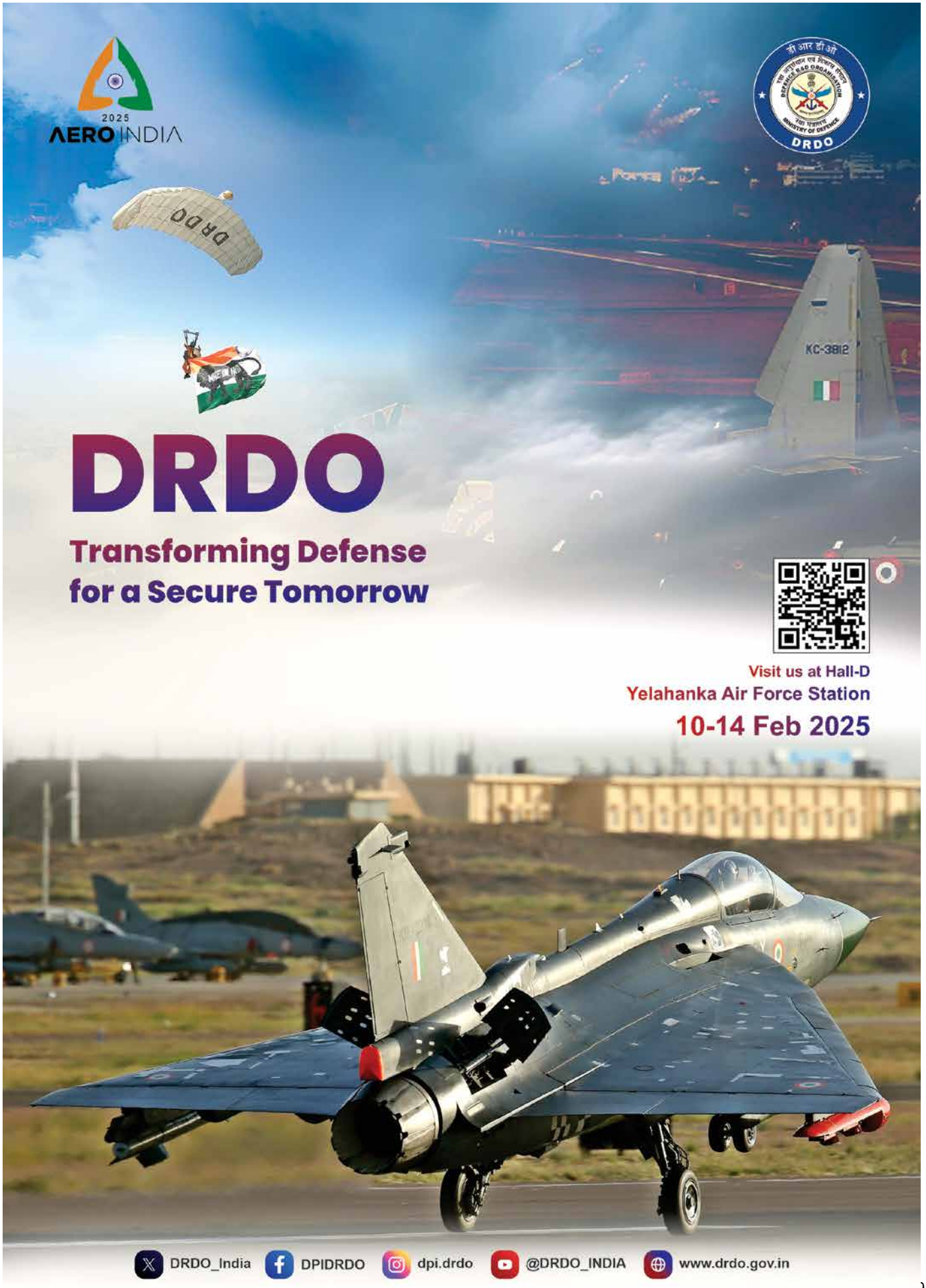
PSLV–C59 vehicle carried Proba–3 spacecraft into a highly elliptical orbit as a dedicated commercial mission of NewSpace India Limited (NSIL) on 5 December 2024. Proba–3 is an In–Orbit Demonstration (IOD) mission of the European Space Agency and the mission goal was to demonstrate precise formation flying. It consisted of 2 spacecraft viz. the Coronagraph Spacecraft (CSC) and the Occulter Spacecraft (OSC) and was launched together in a stacked configuration. Launch took place from First Launch Pad (FLP), Satish Dhawan Space Centre (SDSC–SHAR), Sriharikota.

JSW Defence to manufacture UAS

The Government of Telangana has entered into a Memorandum of Understanding (MoU) with JSW UAV Limited, a wholly–owned subsidiary of JSW Defence, to establish a state–of–the–art manufacturing facility to make Unmanned Aerial Systems (UAS) in the state. As part of this strategic initiative, JSW UAV is set to invest approximately Rs. 800 crores in the project, through a technology arrangement with a leading US–based defence technology company.

Development of Silicon Carbide Wafers and GaN HEMT

Solid State Physics Laboratory, a DRDO laboratory, has successfully developed indigenous processes for growing and manufacturing 4–inch diameter Silicon Carbide (SiC) wafers and fabricating Gallium Nitride (GaN) High Electron Mobility Transistors (HEMTs) upto 150W &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Sig Sauer and Nibe Defence in JV

Sig Sauer announced a joint venture with Nibe Defence and Aerospace Limited to advance small arms and ammunition manufacturing operations in India. This new partnership will support India's 'Make in India' initiative, underscore both entities commitment to the region and bolster Sig Sauer's role as the primary provider for India's defence needs. The Government of India, Ministry of Defence first awarded Sig Sauer a contract for the SIG716 in 2019 for 72,400 rifles.

Inauguration of C–295 simulator

Air Marshal Ashutosh Dixit, AOC–in–C CAC inaugurated the IAF C–295 Full Motion Simulator (FMS) facility on 11 November 2024 at Air Force Station Agra. A significant proportion of the pilot's training can be undertaken in the simulator thereby saving precious flying hours on the aircraft. The induction of C–295 aircraft into IAF will give a fillip to the aerospace ecosystem of the country, marking the beginning of "Atmanirbhar Bharat" in private sector production of transport aircraft in India.

JSW Defence and Shield AI in partnership

JSW Defence Pvt Ltd, part of the $24 billion JSW Group and Shield AI, Inc, a leading US defence technology company, announced a strategic partnership to indigenise and manufacture Shield AI's "V–BAT," a Group 3 Unmanned Aerial System (UAS). The V–BAT is a fixed wing, vertical take–off and landing (VTOL), long endurance intelligence, surveillance, reconnaissance (ISR) platform.

Paras Defence unveils new facility

Paras Defence & Space Technologies Ltd inaugurated of its optical systems testing facility in Navi Mumbai end November 2024. This cutting edge facility, inaugurated by Mr. S. Somnath, Chairman of ISRO, represents "a pivotal advancement in India's capability to develop and test high precision optical systems".

EndureAir Systems 'Sabal' for Indian Army

EndureAir (a drone manufacturer) has announced the successful delivery of its Sabal 20 Logistics Drone to the Indian Army in the Eastern theatre, marking "a significant milestone in enhancing logistics capabilities for defence forces operating in challenging terrains". Sabal 20 is an electric VTOL based on variable pitch technology, designed specifically for aerial logistics, capable of carrying payloads of up to 20 kgs, long range deliveries, high altitude operations and precision logistics. EndureAir Systems is an unmanned aviation technology company and incubated in the corridors of IIT Kanpur in 2018.

Dynamatic Technologies and Aequs in supply of A220 components

Dynamatic Technologies Limited and Aequs Private Limited announced a contract for the supply of complex structural parts for the Airbus A220 Door Programme. As part of the contract, awarded by Dynamatic Technologies for the manufacture and supply of components, Aequs will leverage its capabilities to manufacture and deliver over 200 detailed parts requiring complex tool design, forgings, machining and surface treatment.

BITS Pilani unveils Nalini Kurra Wind Tunnel Facility

BITS Pilani–Hyderabad Campus inaugurated the Nalini Kurra Wind Tunnel Facility, a research facility designed to propel advancements in aerospace, automotive and structural engineering. The facility has been completely designed internally, and would help drive research and innovation in aerodynamics, renewable energy, and advanced engineering. It would also provide a platform for startups to test prototypes for drones, wind turbines and electric vehicles, while strengthening hands–on learning and interdisciplinary projects for students.

Cyient partnership with Deutsche Aircraft

Cyient, a global Intelligent Engineering services company, announced that it had expanded its strategic partnership with Deutsche Aircraft, a leading German regional aircraft manufacturer. Cyient has been awarded a multi–year contract to manage the advanced technical documentation to support the product lifecycle of safety critical aviation systems for the 40 seater regional turboprop the D328eco.

Eve Air Mobility and JetSetGo to explore urban ATM implementation

Eve Air Mobility and JetSetGo, a private aircraft charter and fractional ownership company, headquartered in New Delhi, India, have entered into an agreement to explore and advance the use of Vector, Eve's Urban ATM (air traffic management) software solution in India.

Tata Elxsi and NAL in partnership

Tata Elxsi and CSIR–National Aerospace Laboratories (CSIR–NAL) have signed a Memorandum of Understanding (MoU) to establish a Strategic Partnership for Advanced

Air Mobility. This collaboration is focused on driving innovation in emerging areas such as Unmanned Aerial Vehicles (UAVs), Urban Air Mobility (UAM), and electric vertical take–off and landing (eVTOL) aircraft. The partnership combines NAL's expertise and Tata Elxsi's technological capabilities in electrification, AI/ML, sensor fusion, and certification processes to support global and Indian markets.

India's Chipsan Aviation grows

GDHF announced it had delivered the first of two Airbus H160 Helicopters on lease to Chipsan Aviation. These will be the first H160s to operate in India and Chipsan will operate the H160 onshore, servicing government and corporate missions. In 2022, Chipsan added two helicopters, India's first two Airbus H145D3 on a dry lease. They operate two Airbus H130 and an Airbus H135T2 on a wet lease. In addition, they have a separately managed Airbus H145D2.

Air India discloses 100 Airbus aircraft order

The Tata Group owned Air India has officially disclosed orders it placed earlier for 10 A350 widebody and 90 single–aisle A320 Family aircraft. The latest aircraft order, which is already included in Airbus' 2024 orderbook, comes on top of the 40 A350 and 210 A320 Family aircraft ordered by Air India in 2023. Air India's total orderbook for Airbus aircraft now stands at 344 with six A350–900s having already been delivered.

Aviation sector sees new high

The Indian aviation sector achieved a historic milestone on 17 November 2024, with 5,05,412 domestic passengers departing across the country in a single day.

This marks the first time domestic passenger numbers have surpassed the 5 lakh mark, showcasing India's growing prominence in the global aviation landscape. More than 3,100 planes took off taking more than five lakh passengers.

Noida International Airport conducts validation flight

Noida International Airport (NIA) has achieved a significant milestone with the successful completion of its validation flight on 9 December 2024, a vital element of the aerodrome licensing process.

Following the validation flight, NIA will finalise the required documentation for aerodrome certification and submit it to the Directorate General of Civil Aviation (DGCA).

BLR Airport in record passenger traffic in 2024

Kempegowda International Airport Bengaluru (BLR Airport), witnessed robust growth in both passenger and cargo traffic during Calendar Year (CY) 2024.

For the first time, the airport surpassed the milestone of welcoming over 40 million passengers in a single calendar year, elevating its status to a 'Large Airport' globally, in line with ACI's (>40 mppa) categorisation.

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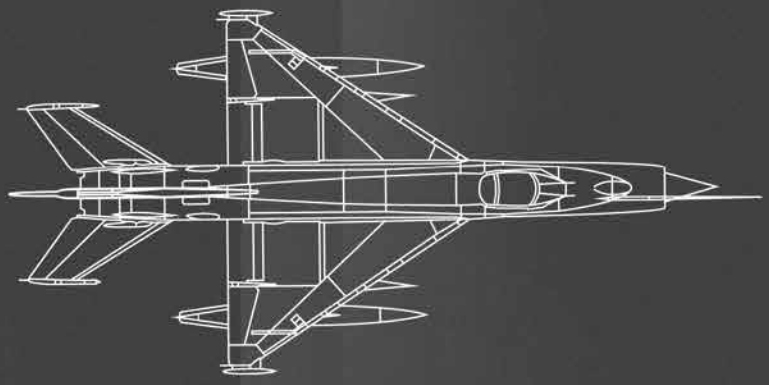
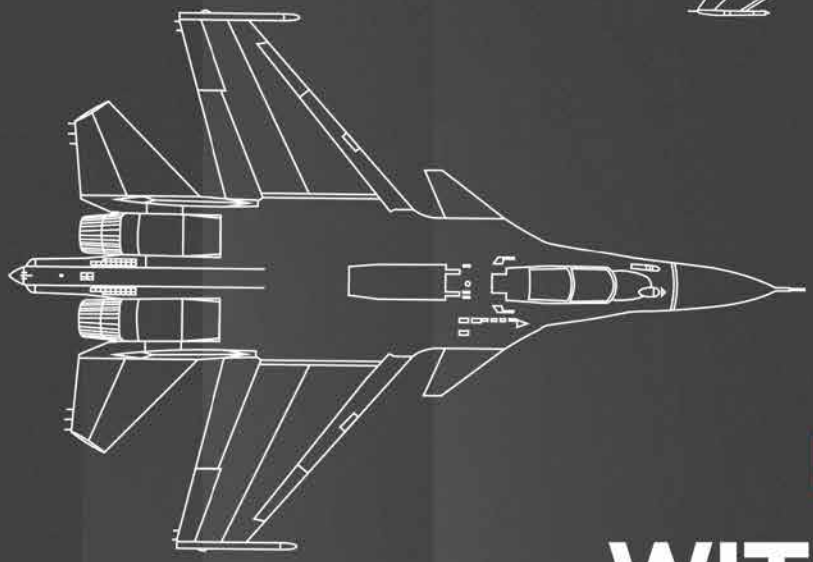


4th generation



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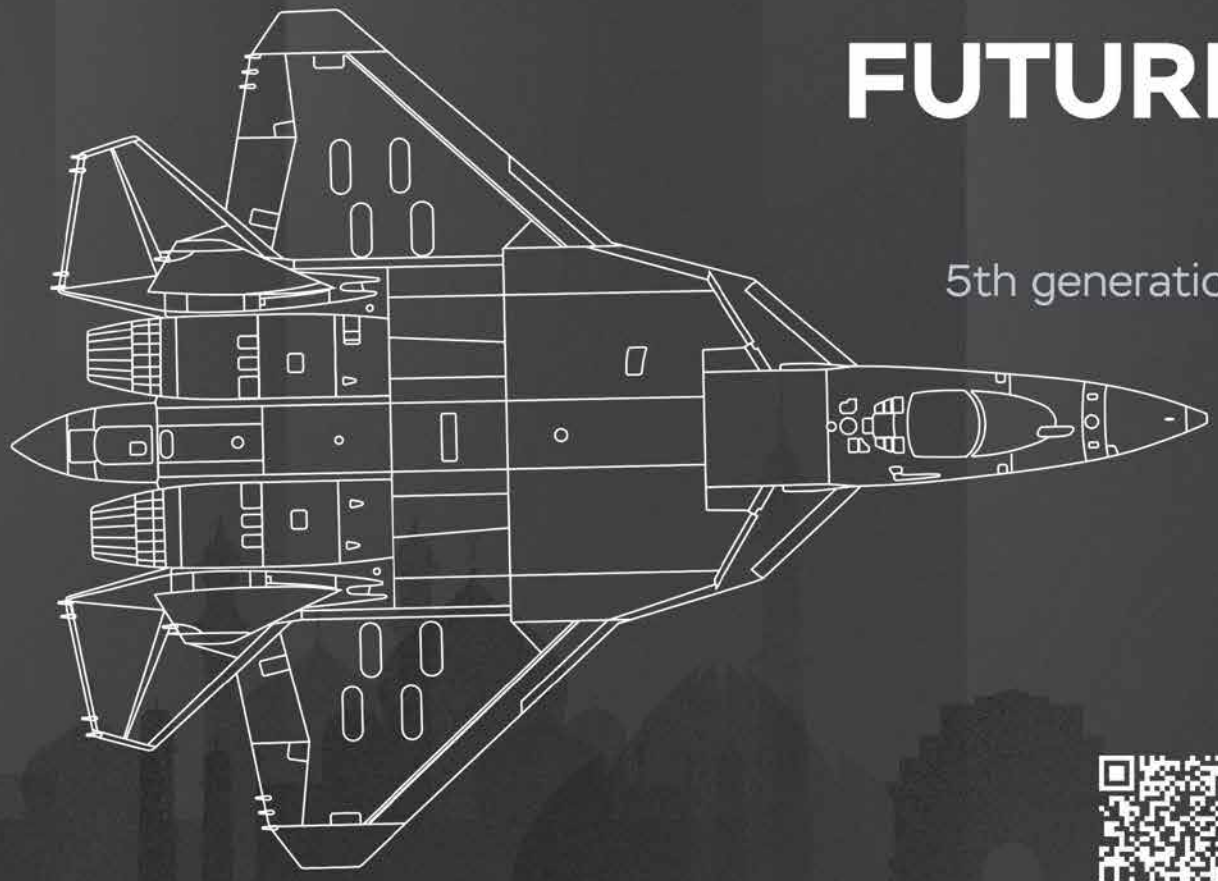

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CSMIA traffic at 54.8 million pax in CY2024

Closing 2024 on a high note, Chhatrapati Shivaji Maharaj International Airport (CSMIA) welcomed approximately 54.8 million passengers over the year. This marked a notable growth of 6.3% compared to CY 2023 and 19.41% compared to pre–pandemic CY 2019. CSMIA also recorded 346,617 Air Traffic Movements (ATMs), marking a 3.2% increase over the previous year.

IndiGo solidifies presence in Sri Lanka

IndiGo is officially the largest foreign carrier out of Sri Lanka. IndiGo currently operates 54 weekly flights to 2 cities in Sri Lanka – Colombo and Jaffna from 4 cities in India; Bangalore, Chennai, Hyderabad and Mumbai. These direct flights between India and Sri Lanka are "integral to IndiGo's long term growth strategy, underlining its commitment to expanding its global presence".

APPOINTMENTS

Air Marshal Jeetendra Mishra assumes command of IAF's WAC

Air Marshal Jeetendra Mishra assumed command of the Indian Air Force's Western Air Command on 1 January 2025. The Air Marshal was commissioned into the Indian Air Force as a fighter pilot on 6 December 1986.

He is an alumnus of National Defence Academy Pune, Air Force Test Pilots School, Bangalore, Air Command and Staff College, USA and Royal College of Defence Studies, UK.

A Fighter Combat Leader and an experimental Test Pilot, Air Marshal Mishra has more than 3000 hours of flying experience.

AVM Manmeet Singh is Senior Officer–in–Charge Administration, WAC

On 1 January 2025, Air Vice Marshal Manmeet Singh took over as Senior Officer–in–Charge Administration, Headquarters Western Air Command, New Delhi. Air Vice Marshal Manmeet Singh was commissioned in the Administration Branch of Indian Air Force on 13 June 1992 and is an alumnus of the National Defence College, Defence Services Staff College (DSSC), Wellington and holds a Master's Degree in Defence Studies and a Post Graduate Diploma in Financial Management from NIFM, Faridabad.

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Interview with Admiral Dinesh K Tripathi, Chief of the Naval Staff, Indian Navy

***VAYU**: We know the Indian Navy currently leases the Predator UAS and the MQ–9B variant has been ordered. However, could you update us on UAVs manufactured in India like the Drishti/Hermes 900 and other possible domestically produced UAVs that the IN currently uses or plans to operate with?*

CNS: The indigenous version of the Hermes 900 MALE RPA has been named as Drishti 10. Presently two systems of Drishti 10 have been procured by Indian Navy. Since induction they have been seamlessly integrated into our surveillance set–up. With extended reach, satellite controls and endurance exceeding 12 hours, they have bolstered our persistent surveillance capabilities.

We are making efforts on multiple fronts to ensure indigenous manufacturing and procurement of UAVs. We are supporting the DRDO Technology Demonstrator (TD) project by progressing case for procurement of four Indian Unmanned Aerial System (IUAS). This RPA system is an indigenously developed MALE RPA (TAPAS in pre–operational role) developed by DRDO/ADE.

We are also supporting Indian Start–Ups by progressing Multi Utility Long Endurance (MULE) RPA and Monorotor Drone (iDEX Project). The Rotary wing RPAs are being developed to operate from our ships for undertaking ISR missions and build maritime domain awareness. These platforms will be equipped with EO/IR, COMINT and various other surveillance payloads.

Another iDEX project, High Altitude Pseudo–Satellite (HAPS) Mk.I, which is a first of its kind project, is being progressed by Indian Start–Up. HAPS are completely solar powered unmanned airplanes positioned as pseudo satellites 18–20 km above the Earth in the stratosphere with capability to maintain station for days and emulate satellite performance at a local scale.

Hermes 900 MALE RPA/Drishti 10.

High Altitude Pseudo–Satellite (HAPS) Mk.I

***VAYU**: What is the status on helicopter upgrades for the Ka–28 and 31 AEW and when do you expect all 24 MH–60Rs to be with the IN?*

CNS: Overhaul and Mid–Life Upgrade (MLU) of IN's Kamov–28 helicopters are in progress. As regards MH–60R, first nine of these helicopters have been inducted and operationalised into IN ships. In fact, these helicopters are now actively participating in various exercises, weapon firings and training of IN personnel. We are on track to receive the remaining helicopters as per envisaged timeline. These multi–role helicopters have significantly enhanced the combat capability of our fleet units.

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Ka–28

Ka–31 AEW

MH–60R

***VAYU**: How many ALHs do you currently operate and how many more are on order? That leads us to ask the status of the LUH for the Indian Navy?*

CNS: Indian Navy is operating eight ALH Mk.I and 16 ALH Mk.III. We are progressing cases for Deck–Based Multi–Role Helicopters (DBMRH) and the Utility Helicopter–Maritime (UH–M) as part of our future IN fleets. While the DBMRH proposal is being actively pursued along with other Services, the UH–M has already been accorded AoN in March last year. UH–M is being pursued with HAL IAW Chapter IV of DAP 2020, and the first prototype flight is tentatively scheduled in 2025.

ALH Mk.III

***VAYU**: What sort of close co–operation does the IN have with HAL for the DBMRH?*

CNS: A joint case is being progressed by services for D&D of Medium Lift Helicopters for services (IMRH for IAF, DBMRH for IN) by HAL. Since this is the first time that HAL would be undertaking D&D for the Naval Medium Lift category of helicopter in India, IN has positioned a dedicated team of aircrew and technical officers at HAL to associate from the design phase itself. This team has been supporting HAL with exposure to Indian Navy operational environment for dovetailing into the D&D process from nascent stage itself. As we reach closer to the fructification of the prototype, an additional team of experimental test pilots, flight test NAOs and flight test engineers will also be positioned at HAL to start with the integrated testing and flight trials towards fulfilling the project in a time bound manner.

IMRH for IAF/DBMRH for IN

***VAYU**: Similarly, for carrier based operations, where is the IN with procurement of the Rafale–M and the future TEDBF?*

CNS: The case for the procurement of 26 Rafale–Marine aircraft has been progressed for sanction of the Cabinet Committee on Security or the CCS. The Inter–Governmental Agreement would be signed with French Government post accord of CCS sanction. The first Rafale would be delivered three and half years from signing of contract with one aircraft delivered per month thereafter. Parallelly, operational training of IN personnel would also be undertaken with the French Navy, giving IN first–hand experience to operate Rafale M from an aircraft

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RAFAEL

carrier. Therefore, comprehensive package which includes aircraft, weapons, simulator, training and performance based logistics (PBL) along with operations training would ensure commencement of Day One Operations of Rafale–M from IN aircraft carrier.

The French Govt/OEM has committed to set up MRO facility in India post signing of IGA in partnership with a suitable Indian entity towards making India a global and regional hub for Rafale aircraft. This would involve establishment of facilities to undertake maintenance of airframe, radar and EW components, M–88 engine modules as well as MICA missiles. It is pertinent to note here that the induction of Rafale along with setting up of MRO facility, would not only enhance our operational capabilities but also enhance our indigenous industrial capabilities.

Indian Navy is expected to purchase 26 Rafale–M (Photo by French Navy)

The proposed TEDBF

TEDBF a 4++ generation carrier borne fighter aircraft being developed by Aeronautical Development Agency (ADA), Hindustan Aeronautics Limited (HAL) and Indian Navy. The programme has challenging timelines with the first flight scheduled in 2028 and induction into Service commencing 2032. Towards this, design and development activities are in full swing.

Most of the system Preliminary Design Reviews (PDRs) have been completed and soon the Critical Design Reviews (CDRs) would be undertaken. We are also concurrently progressing the administrative actions for accord of CCS approval for this programme. Once proven, IN intends to replace its fleet of MiG–29Ks as well as meet its future requirement through TEDBFs–indigenous aircraft flying off our indigenous aircraft carriers!

TEDBF is a naval fighter being developed by HAL and ADA.

Rafale–M at Exercise Varuna.

Year End Review 2024

Achievements of the Ministry of Civil Aviation

The Bharatiya Vayuyan Adhiniyam 2024, introduced by the Minister of Civil Aviation Mr. Ram Mohan Naidu, was passed by Lok Sabha on 9.08.2024 and by Rajya Sabha on 5.12.2024. The Bill, after receiving assent from the President, the Central Government hereby appoints the 1st day of January 2025 as the date on which the provisions of the said Act, shall come into force. The Bharatiya Vayuyan Adhiniyam, 2024 is a legislative reform aimed at modernising India's aviation sector by re–enacting the Aircraft Act 1934, in alignment with contemporary needs and global standards. In line with the Prime Minister's call to remove colonial era influences, this Adhiniyam addresses the need for clarity, efficiency and ease of doing business in the aviation industry.

The new legislation will foster indigenous manufacturing under Make in India and Atmanirbhar Bharat initiatives, align with international conventions like the Chicago Convention and ICAO, and streamline regulatory processes, such as simplifying the issuance of licenses. The Adhiniyam removes redundancies and provides provisions for appeals. Ultimately, the Bharatiya Vayuyan Adhiniyam 2024 aims to revolutionise India's aviation sector, enhancing safety, innovation, growth and global compliance.

Under the chairmanship of Union Minister of Civil Aviation Ram Mohan Naidu, Ministry successfully organised the 2nd APAC–MC on 11 and 12 September 2024 in New Delhi. As a major achievement, Delhi Declaration was proclaimed by Prime Minister of India Mr. Narendra Modi during the conference.

The conference was attended by Ministers and high level dignitaries from twenty nine Asia Pacific countries. Further, the conference was also attended by other aviation related International Organisations such as IATA, ACI, etc and representatives from ICAO.

Expansion of airports and terminals

Significant infrastructure development included laying the foundation for new terminals at Varanasi, Agra, Darbhanga, and Bagdogra. The Prime Minister Narendra Modi also inaugurated airports in Sarsawa, Rewa and Ambikapur, strengthening regional connectivity.

Inauguration of airports in UP

PM Narendra Modi inaugurated new airports at Aligarh, Azamgarh, Chitrakoot, Moradabad and Shravasti, further expanding air connectivity across the state.

Record Passenger Traffic

Domestic Routes: During the year 2024 (January–November), scheduled domestic airlines operated a total number of 1.02 million scheduled flights carrying a total of 146.4 million scheduled passengers as against 0.97 million scheduled flights carrying total of 138.2 million scheduled passengers during the previous year 2023 (January–November). The number of domestic passengers carried by scheduled domestic Indian Carriers has witnessed a growth of 5.9% in the year 2024 as compared to the previous year 2023 during the same period (Jan to Nov). Marking a new record, domestic air passenger traffic crossed 5 lakhs for the first time in a single day on 17 November 2024.

International Routes: During the period January to November 2024 a total of 64.5 million passengers were carried on international routes by scheduled Indian and foreign operators as against 58.0 million in the corresponding period in 2023, thereby witnessing a growth

of 11.4%. Out of the 64.5 million passengers, 29.8 million passengers were carried by scheduled Indian carriers while 34.7 million passengers were carried by scheduled foreign carriers during the period January to November 2024.

Setting up of Greenfield Airports

Government of India has so far accorded 'in–principle' approval for setting up of 21 Greenfield Airports across the country namely, Mopa in Goa, Navi Mumbai, Shirdi and Sindhudurg in Maharashtra, Kalaburagi, Vijayapura, Hassan and Shivamogga in Karnataka, Dabra (Gwalior) in Madhya Pradesh, Kushinagar and Noida (Jewar) in Uttar Pradesh, Dholera and Rajkot in Gujarat, Karaikal in Puducherry, Dagadarthi, Bhogapuram and Oravakal (kurnool) in Andhra Pradesh, Durgapur in West Bengal, Pakyong in Sikkim, Kannur in Kerala and Itanagar in Arunachal Pradesh. Out of these, 12 Greenfield airports, namely Durgapur, Shirdi, Sindhudurg, Pakyong, Kannur, Kalaburagi, Oravakal (Kurnool), Kushinagar, Itanagar, Mopa, Shivammogga and Rajkot have been operationalised.

Further, development works at two major airport projects i.e. Noida (Jewar) and Navi Mumbai International Airports are at advance stage of completion and these airports are targeted for operationalisation by first quarter of FY 2025–26. Besides, GoI has also granted 'Site Clearance' for construction of 9 Greenfield airports namely Alwar in Rajasthan, Singrauli in Madhya Pradesh, Mandi in Himachal Pradesh, Kottayam in Kerala, Puri in Odisha, Doloo in Assam, Parandur in Tamil Nadu, Kota in Rajashtan and Raichur in Karnataka. Among these, 'Site Clearance' to 4 Greenfield Airport projects viz. Doloo, Parandur, Kota and Raichur has been granted during 2024.

CAPEX on infrastructure development

Under National Infrastructure Pipeline (NIP), CAPEX of more than Rs. 91,000 crore is envisaged for airport infrastructure development during the period FY 2019–20 to FY 2024–25, where the share of AAI is approximately Rs. 25,000 crore and remaining expenditure is to be borne by airport developers under PPP mode. Expenditure of Rs. 82600 crores have been incurred under NIP from FY 2019–20 till November 2024.

RCS–UDAN: 8 Years of regional connectivity

RCS–UDAN celebrated its 8th anniversary, with 619 routes and 88 airports operationalised since the launch of the scheme, exemplifying the government's commitment to affordable air travel. RCS–UDAN was launched on 21 October 2016 to enable air operations on unserved/underserved routes connecting different regions, promote balanced regional growth and make flying affordable for the masses.

102 New RCS routes commenced in the year 2024 of which 20 new RCS routes commenced in the North Eastern States of the country. 12 Aerodromes were also operationalised which included 4 Heliports.

Expansion of Digi Yatra Services

Minister Ram Mohan Naidu launched Digi Yatra at 9 more airports this year. It has transformed passenger

experiences with seamless, contactless travel. Digi Yatra is now operational at 24 airports namely Delhi, Bangalore, Varanasi, Pune, Kolkata, Vijayawada, Hyderabad, Mumbai, Ahmedabad, Jaipur, Guwahati, Lucknow, Cochin, Chennai, Bagdogra, Bhubaneswar, Coimbatore, Dabolim, Indore, MoPA Goa, Patna, Raipur, Ranchi and Vishakhapatnam. Since its launch, 80+ lakh users downloaded the app and 4+ crore journeys have been completed with Digi Yatra facility. Digi Yatra App is available on android as well as iOS platform. Eventually, all the airports will be covered with Digi Yatra in a phased manner.

Guidelines for seaplane operations

The Minister of Civil Aviaiton Ram Mohan Naidu launched Guidelines for Seaplane Operations in India on 22.08.2024. These guidelines prioritise the safety and security of operations and define the responsibilities of all stakeholders, ensuring a seamless and efficient seaplane operation across the nation. The adoption of the Non–Scheduled Operator Permit (NSOP) framework for seaplanes is a significant step forward in the Government's commitment to enhancing regional connectivity with a focus to allow expeditious commencement of seaplane operations in the country. UDAN Round 5.5 has been launched to invite bids for seaplane operations from more than 50 water–bodies across the country.

MRO sector development

The Government has introduced several policies and regulations to bring India's MRO sector at par with global peers and support growth of MRO industry in India. In a major boost to the domestic MRO industry and to the aviation sector, the Government has announced on 12 July 2024 that a uniform rate of 5% IGST will apply to imports of parts components, testing equipment, tools and tool–kits of aircraft, irrespective of their HSN classification subject to specified conditions. Previously, the varying GST rates of 5%, 12%, 18% and 28% on aircraft components created challenges, including an inverted duty structure and GST accumulation in MRO accounts. This new policy eliminates these disparities, simplifies the tax structure and fosters growth in the MRO sector. Further, the period for export of goods imported for repairs has been extended from six months to one year. Also, the time–limit for re–import of goods for repairs under warranty has been extended from three to five years.

Pioneering Green Energy Adoption

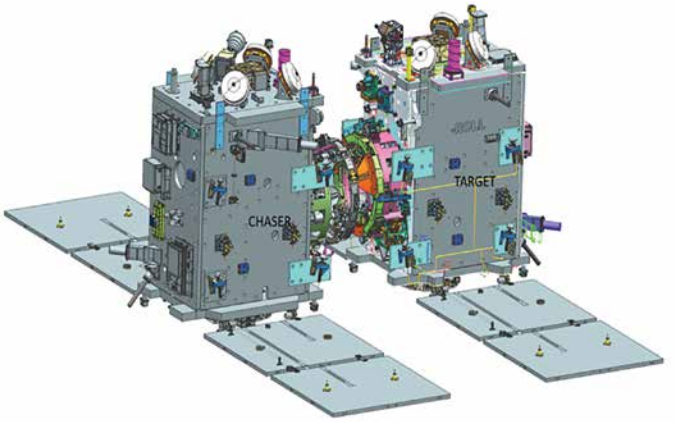
The Minister of Civil Aviation Ram Mohan Naidu has been driving adoption of conventional sources of energy at airports reducing the carbon footprint of operations. 80 airports have switched over to 100% green energy usage with 12 airports making the switch in 2024. Bengaluru Airport has achieved the highest Carbon Accreditation Level 5 of Airports International Council (ACI), whereas Airports viz. Delhi, Mumbai and Hyderabad have achieved Level 4+ ACI accreditation, becoming carbon neutral.

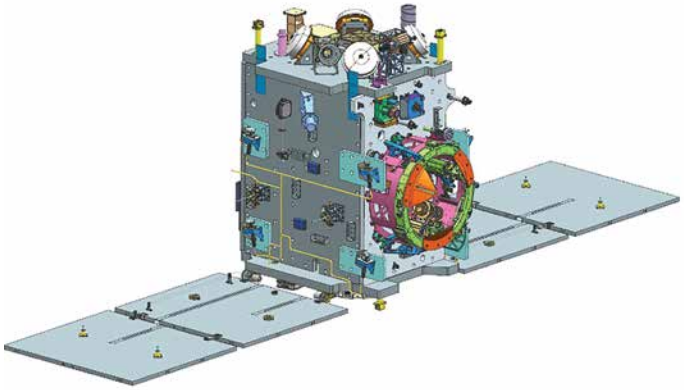
ISRO's PSLV–C60 and SpaDeX Mission

30 December 2024 saw the successful separation of SpaDeX satellites and marked another milestone for ISRO in India's space journey.

SpaDeX mission is a cost–effective technology demonstrator mission for the demonstration of In–Space docking using two small spacecraft launched by PSLV. This technology is essential for India's space ambitions such as Indian on Moon, sample return from the Moon, the building and operation of Bharatiya Antariksh Station (BAS), etc. In–Space docking technology is essential when multiple rocket launches are required to achieve common mission objectives. Through this mission, India is marching towards becoming the fourth country in the world to have space docking technology.

PSLV–C60 SpaDeX mission is the fourth POEM Mission (in short POEM–4) in the series. A total of 24 payloads will be flown in this POEM–4 mission, of which 14 payloads are from ISRO/DOS centres and 10 payloads are from various Non–Government Entities (NGEs) comprising academia and start–ups that have been received through IN–SPACe. This is a significant three–fold increase in the capacity of POEM as compared with the previous POEM–3 platform, wherein it had hosted only eight payloads.





French carrier strike group in India

Deployed in the Indian Ocean as part of Mission CLEMENCEAU 25, the French carrier strike group (CSG), comprising the aircraft carrier FNS Charles De Gaulle, its embarked air fleet and its escort vessels (frigates and supply ships), made stopovers at Goa and Kochi from 4–6 January 2025.

The CSG is deployed in the Indian Ocean, where it conducted joint training sessions with its regional partners and allies, notably India, before it moved on to the Indonesian zone for Exercise La Perouse, and then to the Pacific Ocean for Exercise Pacific Steller.

India has been France's foremost strategic partner since 1998, and the excellent Indo–French military cooperation is characterised by numerous bilateral exercises such as Shakti on land, Varuna at sea and Garuda in air. India also plays host for numerous operational stopovers made by French Navy vessels, accounting for 16 port calls since 2022.

During Mission CLEMENCEAU 25, the Charles de Gaulle CSG and Indian Navy ships took part in the 42nd annual Varuna bilateral exercise. The aim of this aero–naval training was to develop interoperability between the two navies, and to prepare crews to deal with a multi–milieu threat (air, surface, submarine) as part of a coalition.

As resident nations of the Indian Ocean, France and India regularly cooperate to contribute to maritime safety in the region. Since 2008, France has been a member of the Indian Ocean Naval Symposium (IONS), which was initiated by India, and brings together 25 navies from countries of the Indian Ocean. The aim of this forum is to increase collective effectiveness in tackling a range of maritime issues, including illegal trafficking, illegal fishing, search and rescue at sea, and pollution. France took over the presidency of this forum from 2021 to 2023.

In the Indian Ocean, France is actively involved in a number of missions: the European ATALANTA operation to combat piracy and drug trafficking, the international naval coalition Combined Task Force (CTF) 150 to combat illicit trafficking, and more recently the European Union's ASPIDES operation to ensure maritime safety and freedom of navigation from Suez to Hormuz.

All photos: French Navy and French Embassy in India

INS Tushil commissioned into Indian Navy

INS Tushil (F–70), the latest multi–role stealth–guided missile frigate, was commissioned into the Indian Navy in the presence of Raksha Mantri Rajnath Singh at the Yantar Shipyard in Kaliningrad, Russia on 9 December 2024. Raksha Mantri, in his address, described the commissioning as a proud testament to India's growing maritime strength and a significant milestone in the long standing friendship between India and Russia, which are bound together by shared values, mutual trust, and special & strategic privileged partnership.

Mr. Rajnath Singh termed Russia's support to India's vision of 'Aatmanirbhar Bharat' as another important example of deep friendship between India and Russia. "Made in India content is continuously increasing in many ships including INS Tushil. The ship is a big proof of the collaborative prowess of Russian and Indian industries. It exemplifies India's journey towards technological excellence through jointmanship," he added.

Speaking on the occasion, Chief of the Naval Staff Admiral Dinesh K Tripathi congratulated all those involved in the project, especially the shipyard workers and all Russian and Indian Original Equipment Manufacturers for their exceptional work, flawless integration of Indian systems with Russian systems and contribution to the quality capability upgrades achieved in this project.

The event was also attended by Russian Deputy Minister of Defence Mr Alexander Vasilyevich Fomin; Governor of Kaliningrad Mr Alexey Sergeyevich Besprozvannykh; Commander–in–Chief of the Russian Navy Admiral Aleksandr Alekseyevich Moiseyev; Ambassador of India to Russia HE Vinay Kumar, and other senior officials from the Indian and Russian Governments, Navies, and industries.

INS Tushil is an upgraded Krivak III class frigates of the Project 1135.6 of which, six are already in service – three Talwar class ships, built at Baltiysky shipyard, St. Petersburg, and three follow–on Teg class ships, built at Yantar shipyard, Kaliningrad. INS Tushil, the seventh in the series, is the first of the two upgraded additional follow–on ships, the contract for which was signed in October 2016 between JSC Rosoboronexport, Indian Navy and the Government of India.

INS Tushil is designed for blue water operations across the spectrum of naval warfare in all four dimensions air, surface, underwater and electromagnetic. It is armed with a range of advanced weapons, including the jointly developed Brahmos supersonic cruise missiles, vertically launched Shtil surface–to–air missiles with enhanced ranges, upgraded medium range anti–air and surface gun with advanced stealth features, optically controlled close–range rapid fire gun system, anti–submarine torpedoes and rockets and advanced electronic warfare and communication suite.

The ship is also capable of embarking the upgraded anti–submarine and airborne early warning helicopters, the Kamov–28 and Kamov–31, which are formidable force multipliers in themselves. The ship is powered by an advanced gas turbine propulsion plant with state–of–the–art controls and is capable of achieving speeds in excess of 30 knots. High degree of automation and stealth features further enhance its combat capability and survivability. The ship is commanded by Captain Peter Varghese a gunnery and missile specialist.

The ship's keel was laid on 12 July 2013 and was launched in water in October 2021. The ship sailed out for her maiden sea trials on 25 January 2024, and completed an exhaustive schedule of Factory trials followed by State Committee Trials and finally the Delivery Acceptance Trials, both in harbour and at sea, by September 2024.

Text and images: Indian Navy

Indian Navy commissions 3 frontline fleet assets in 1 day!

15 January 2025 was a landmark day in India's history as the Indian Navy commissioned three frontline combatants – Nilgiri, the lead ship of the Project 17A stealth frigate class; Surat, the fourth and final ship of the Project 15B stealth destroyer class; and Vagsheer, the sixth and final submarine of the Scorpene class project – together at Naval Dockyard, Mumbai.

This historic event will provide a significant boost to the Indian Navy's combat potential while underscoring the country's pre–eminent status in indigenous shipbuilding. All three platforms have been designed and constructed entirely at Mazagon Dock Shipbuilders Limited (MDL), Mumbai, a testament to India's growing self–reliance in the critical domain of defence production. The successful commissioning of these advanced warships and submarines highlights the rapid progress made in warship design and construction, cementing "India's position as a global leader in defence manufacturing".

Nilgiri, the lead ship of Project 17A, is a major advancement over the Shivalik class frigates, incorporating significant stealth features and reduced radar signatures through state–of–the–art technology. The Project 15B destroyer, Surat, is the culmination of the follow–on class to the Kolkata–class (Project 15A) destroyers, featuring substantial improvements in design and capabilities. Both ships were designed by the Indian Navy's Warship Design Bureau and are equipped with advanced sensors and weapon packages developed primarily in India or through strategic collaborations with leading global manufacturers.

Prime Minister Mr. N. Modi dedicated three Made–in–India naval combatants–INS Surat (destroyer), INS Nilgiri (frigate) and INS Vagsheer (submarine)–to the nation at Mumbai's Naval Dockyard on 15 January 2025.

Equipped with modern aviation facilities, Nilgiri and Surat can operate a range of helicopters, including Chetak, ALH, Sea King and the newly inducted MH–60R, during both day and night operations. Features such as a Rail–Less Helicopter Traversing System and a Visual Aid and Landing System ensure seamless operations under all conditions. These ships also include specific accommodations to support a sizeable complement of women officers and sailors, aligning with the Navy's progressive steps toward gender inclusion in frontline combat roles.

Vagsheer, the sixth Scorpene class submarine under the Kalvari class Project 75, is one of the most silent and versatile diesel electric submarines in the world. It is designed to undertake a wide range of missions, including anti–surface warfare, anti–submarine warfare, intelligence gathering, area surveillance and special operations. Armed with wire guided torpedoes, anti–ship missiles and advanced sonar systems, the submarine also features modular construction, allowing for future upgrades such as the integration of Air Independent Propulsion (AIP) technology.

The combined commissioning of Nilgiri, Surat and Vagsheer "demonstrates India's unparalleled progress in defence self–reliance and indigenous shipbuilding". The vessels have undergone rigorous trials, including machinery, hull, fire–fighting and damage control assessments, as well as proving all navigation and communication systems at sea, making them fully operational and ready for deployment.

Indian and Oman Navy exercise Naseem Al Bahr

INS Trikand and Dornier Maritime Patrol Aircraft, participated in the Indo–Oman bilateral naval exercise Naseem Al–Bahr with the Royal Navy of Oman Vessel Al Seeb off Goa from 13 to 18 October 2024. The exercise was conducted in two phases: with harbour phase from 13 to 15 October, followed by the sea phase. During the sea phase of the exercise conducted from 16 to 18 October, both ships carried out various evolutions, including gun firings at surface inflatable targets, close–range anti–aircraft firings, manoeuvres and Replenishment at Sea Approaches (RASAPS). The integral helicopter operated from INS Trikand and undertook cross–deck landings and vertical replenishment (VERTREP) with RNOV Al Seeb. Additionally, the Indian Navy's Dornier aircraft provided over–the–horizon targeting (OTHT) data with the participating ships.

MPX with German navy

Indian Navy's destroyer INS Delhi, German Navy's frigate Baden–Wurttemberg and tanker Frankfurt Am Main undertook a Maritime Partnership Exercise (MPX) in the Indian Ocean. The exercises conducted included cross deck flying operations, underway replenishment, weapon firing and tactical manoeuvres. INS Delhi is the lead ship of her class of guided missile destroyers and is part of the Eastern Fleet of the Indian Navy. Baden–Wurttemberg is the lead ship of the F125 class of German Navy frigates. Frankfurt Am Main is the second ship of the Berlin class replenishment ships of the German Navy.

Singapore–India exercise SIMBEX

The 31st edition of Singapore India Maritime Bilateral Exercise (SIMBEX) was conducted from 23 to 29 October 2024. RSS Tenacious of Republic of Singapore Navy along with Indian Navy's INS Shivalik of Eastern Fleet and

long range maritime patrol aircraft P–8I participated in the exercise. The Harbour phase of the exercise was held at Visakhapatnam from 23–25 October 2024 which included Subject Matter Expert Exchanges (SMEEs), cross–deck visits, sports fixtures and pre–sail discussions. The Sea Phase was held on 28–29 October 2024, in the Bay of Bengal. The exercise saw advanced anti–air, anti–surface and anti–submarine exercises, seamanship drills and tactical manoeuvres "further enhancing the interoperability between the two navies".

INS Talwar arrives at La Reunion, France

Indian Navy's frontline stealth frigate, INS Talwar, arrived at La Reunion on 27 October 2024 as a part of her ongoing deployment in Indian Ocean Region. The visit to La Reunion aimed to strengthen India–France partnership to tackle regional maritime security challenges, INS Talwar was commissioned on 18 June 2003 and is part of the Indian Navy's Western Fleet under the Western Naval Command. The ship is currently commanded by Captain Jithu George. The ship had recently participated in the IBSAMAR VIII multilateral exercise held in South Africa.

India–Indonesia 'Garud Shakti'

An Indian Army contingent comprising 25 personnel departed for Cijantung, Jakarta, Indonesia to take part in the 9th edition of India–Indonesia Joint Special Forces Exercise Garud Shakti 24. The Exercise was conducted from 1–12 November 2024. The Indian contingent was represented by troops from The Parachute Regiment (Special Forces) and Indonesian contingent comprising 40 personnel was represented by Indonesian Special Forces Kopassus.

The aim of the exercise was to acquaint both the sides with each other's operating procedures, enhance mutual understanding, cooperation and interoperability between the Special Forces of both armies. The Exercise is designed to develop bilateral military cooperation and strengthen bond between two armies through conduct of discussions and rehearsal of tactical military drills.

India–US joint Special Forces 'Vajra Prahar'

An Indian Army contingent departed on 1 November 2024 the 15th edition of India–US joint Special Forces Exercise Vajra Prahar. The exercise was conducted from 2–22 November 2024 at Orchard Combat Training Centre in Idaho, USA. Last edition of the same exercise was conducted at Umroi, Meghalaya in December 2023. This was the second exercise of the year between Indian and the US Army, the previous being Exercise Yudh Abhyas 2024, conducted at Rajasthan in September 2024.

India–Vietnam exercise 'VINBAX'

The 5th Edition of Vietnam Indian bilateral army exercise "VINBAX 2024" took place at Ambala. The exercise was conducted from 4–23 November 2024 at Ambala and Chandimandir. The exercise is a sequel to previously conducted bilateral exercise in Vietnam in

2023 and a major milestone in strengthening the bilateral relations between India and Vietnam.

This edition marked a significant increase in the scope with Bi–Service level participation for the first time by personnel of Army and Air Force from both the countries. The Indian Army contingent comprising 47 personnel was represented by a Regiment of the Corps of Engineers along with personnel from other arms and services. The Vietnamese contingent comprising of similar strength was represented by the troops Vietnam People's Army.

India–Australia exercise "Austrahind"

The 3rd edition of joint military Exercise Austrahind commenced at Foreign Training Node, Pune in Maharashtra on 8 November 2024; the exercise was conducted from 8–21 November 2024. This exercise is an annual event conducted alternatively in India and Australia. Last edition of the same exercise was conducted in Australia in December 2023. The Indian contingent comprising 140 personnel was represented mainly by a battalion of the Dogra Regiment and 14 personnel from the Indian Air Force. The Australian Army contingent comprising 120 personnel was represented by the 13th Light Horse Regiment of the 10th Brigade of 2nd Division.

Tarini arrives at Fremantle, Australia

At approximately 1430h IST (1700 local time) on 9 November 2024 after a challenging 39 day voyage at sea, Indian Naval Sailing Vessel Tarini, which is undertaking a global circumnavigation expedition christened Navika Sagar Parikrama II, arrived at its first port of call in Fremantle, Australia.

Indian Navy conducts exercise 'Sea Vigil'

The Indian Navy conducted the fourth edition of the 'Pan–India' Coastal Defence Exercise 'Sea Vigil–24' on 20 and 21 November 2024. The fourth edition of Ex Sea Vigil spanned an unprecedented scale, both in terms of geographical reach and the magnitude of participation, with involvement of 6 Ministries and 21 Organisations/ agencies. The Coastal Defence & Security Readiness Evaluation (CDSRE) phase of the exercise was conducted by Naval Officer–in–Charges of all coastal states and UTs (including Lakshadweep and A&N Island) since end October 2024, where in thorough audit of complete coastal defence and security infrastructure was carried out. This year, National Security Council Secretariat officials also were a part of Indian Navy led CDSRE teams for the first time, along with personnel from State Marine Police, Coast Guard, Customs, Fisheries, etc.

Indian Army exercises

In November 2024, the Indian Army's Prachand Light Combat Helicopter successfully conducted high altitude firing. Designed for precision in extreme terrains, Prachand's performance "reinforces India's capability in high–altitude operations. This achievement highlights the strength of Make in India and the spirit of AtmaNirbharBharat, marking a new era in combat readiness".

Culmination of coastal defence exercise 'Sea Vigil 24'

The fourth edition of the Pan–India Coastal Defence Exercise Sea Vigil 24 concluded successfully on 21 November 2024. This Exercise, conducted over a 36 hour period, demonstrated India's unwavering commitment to strengthening its maritime security and coastal defence mechanisms. Spanning the entirety of India's 11,098 km coastline and its Exclusive Economic Zone of 2.4 million sq kms, Sea Vigil 24 witnessed the participation of over 21 agencies across six ministries. These included the Indian Navy, Indian Army, Indian Air Force, Indian Coast Guard, State Marine Police, Customs, BSF, CISF, Port Authorities and Fisheries department, among others. The two days of exercise witnessed extensive deployment of more than 550 surface assets from various maritime security agencies and 60 air sorties with flying time of about 200 hours along the entire coastline of the country.

India–Singapore exercise 'Agni Warrior'

The 13th edition of Joint Military Exercise Agni Warrior, a bilateral exercise between the Indian Army and Singapore Armed Forces, concluded at Field Firing Ranges, Devlali (Maharashtra) on 30 November 2024. The three day exercise conducted from 28–30 November 2024, witnessed participation by the Singapore Armed Forces contingent comprising 182 personnel from the Singapore Artillery and the Indian Army contingent comprising 114 personnel from the Regiment of Artillery.

The Exercise involved extensive joint preparation, coordination, understanding of each other's capabilities, procedures and evolution of common interface between Indian and Singapore artillery procedures. It marked the culmination of successful training by Singapore Armed

Forces troops exposing them to intricacies of fire power planning. Both sides utilised niche technologies during the exercise and exchanged best practices as part of the joint training.

India–Cambodia exercise 'CINBAX"

The 1st edition of Joint Table Top Exercise, CINBAX, between the Indian Army and the Cambodian Army took place at Foreign Training Node, Pune on 1 December 2024. The exercise was conducted from 1–8 December 2024. The Cambodian Army contingent comprised 20 personnel and the Indian Army contingent also comprised 20 personnel from an infantry brigade.

Exercise CINBAX is a planning exercise aimed to wargame conduct of joint Counter Terrorism (CT) operations under Chapter VII of the United Nations Charter. The exercise was conducted in three phases. Phase–I focussed on preparations and orientation of participants for CT operations during UN peace keeping missions. Phase–II involved conduct of the Table Top exercises and Phase–III involved finalisation of plans and summing up. The exercise also showcased weapons and equipment of the Indian origin promoting 'Atmanirbharta' and indigenous capabilities in defence production.

India–Malaysia exercise Harimau Shakti

The 4th edition of India–Malaysia Joint Military Exercise Harimau Shakti took place at Bentong camp, Pahang district, Malaysia. The Exercise was conducted from 2–15 December 2024. The Indian contingent comprising of 78 personnel was represented by a battalion of Mahar Regiment. The Malaysian contingent was represented by 123 personnel from The Royal Malaysian Regiment. Joint Exercise Harimau Shakti is an annual training event conducted alternatively in India and Malaysia. Last edition was conducted in November 2023 at Umroi Cantonment in Meghalaya, India.

The exercise was conducted in two phases. The first phase focussed on cross training between both the Armies including lectures, demonstrations, and practices of various drills in jungle terrain. In the final phase both the Armies took active part in a simulated exercise, wherein troops executed various drills including Anti–MT Ambush, Occupation of Harbour, Carrying out Recce Patrol, Ambush and an Attack on area taken over by the terrorists.

Sri Lanka–India SLINEX 24

The bilateral naval exercise between India and Sri Lanka, SLINEX 24 (Sri Lanka–India Exercise 2024) was

conducted from 17–20 December 2024 at Visakhapatnam under the aegis of the Eastern Naval Command in two phases. The harbour phase was held from 17–18 December 2024 and the sea phase from 19–20 December 2024. INS Sumitra of the Eastern Fleet, along with Special Forces team participated from Indian side, whereas, SLNS Sayura, an offshore patrol vessel, along with Special Forces team participated from the Sri Lanka Navy.

INS Sarvekshak arrives at Port Louis

INS Sarvekshak arrived at Port Louis, Mauritius on 26 December 2024 to undertake Joint Hydrographic Survey. On arrival, the ship was received by HE Anurag Srivastava, High Commissioner of India to Mauritius, Capt CG Binoop, Commandant, Mauritius National Coastguard and other military and civil dignitaries. A preliminary survey coordination meeting was held with the Hydrographic Survey Unit of Mauritius.

India– Nepal 'Surya Kiran'

The Indian Army contingent comprising 334 personnel departed for Nepal on 28 December 2024 to participate in 18th edition of Battalion Level Joint Military Exercise Surya Kiran. The Indian Army contingent was led by a Battalion from the 11th Gorkha Rifles. The Nepal Army contingent was represented by Srijung Battalion. The aim of Exercise Surya Kiran was to enhance interoperability in jungle warfare, counter terrorism operations in mountains, and Humanitarian Assistance and Disaster Relief under United Nations Charter.

INS Tushil in London and Casablanca

INS Tushil India's latest guided missile stealth frigate arrived in London, UK on 21 December 2024 on her maiden passage to India marking a significant milestone in the growing naval cooperation between the Indian Navy and Royal Navy. Then later, as part of strengthening the bilateral relations and naval cooperation between India and Morocco, INS Tushil arrived at Casablanca, Morocco on 27 December 2024. It may be noted that in the past 12 months, three Indian Navy ships, ie, Tabar, Tarkash and Sumedha visited Casablanca, significantly elevating mutual trust and interoperability.

Tarang Shakti 2024 Phase II

India's Defence Minister Mr. Rajnath Singh termed Multinational Exercise 'Tarang Shakti' that took place in September 2024 as an effort to strengthen cooperation, coordination and trust with the partner countries. Addressing the gathering at the Distinguished Visitors' Day event in the second phase of the multinational exercise in Jodhpur, Mr. Rajnath Singh said "that through Tarang Shakti, India has further strengthened its defence ties with all partner countries and instills confidence among them that whenever the need arises, we all will stand together. Reiterating India's vision of mutual coexistence and cooperation, our nation believes in all nations marching together holding each others hands. When an exercise of such complexity and large magnitude takes place, soldiers with different work cultures, air combat experiences and war fighting principles learn a lot from each other."

Raksha Mantri further stated, "Today's landmark event is an opportunity to celebrate the grand achievements of the Indian Air Force. We are not only celebrating the achievements of being the fastest growing economy, but also taking pride that our armed forces are now being considered as one of the most powerful in the world. At the time of independence the Indian Air Force had only six squadrons of two types of aircraft. Similarly, the rest of the war equipment was not only old but also limited in number. But today, equipped with the best and modern aircraft from around the world and next generation equipment, the Indian Air Force has transformed itself."

Referring to the recent collaboration of Hindustan Aeronautics Limited with the French company Safran Helicopter Engines, Raksha Mantri said that "we have transformed ourselves from being only an importer of arms and equipment to a nation which today exports arms and equipment to about 90 countries. Domestic defence sector has taken strong steps towards indigenisation in the manufacturing of weapons, platforms, aircraft etc. Today we have become self–reliant to a greater extent in the manufacturing of Light Combat Aircraft, sensors, radars and in executing electronic warfare."

Minister of Culture and Tourism Mr. Gajendra Singh Shekhawat also graced the Distinguished Visitors' Day event at Exercise Tarang Shakti. Chief of Defence Staff (CDS) Gen Anil Chauhan, Chief of Air Staff (CAS) Air Chief Marshal VR Chaudhari, Chief of Army Staff (COAS) Gen Upendra Dwivedi, Chief of Naval Staff (CNS) Adm Dinesh K Tripathi, and senior military leaders from friendly foreign nations attended the event.

The event showcased a display by the Agniveer Vayu Women Air Warrior Drill Team (AWDT) and demonstrations from the LCA Tejas, LCH Prachand, Sarang and SKAT teams.

On the sidelines of Tarang Shakti–II, IAF hosted the Indian Defence Aviation Exposition IDAX–24 which was inaugurated by Raksha Mantri on 12 September 2024. This edition of IDAX at Jodhpur had a grand participation from industry and host a wide range of products, technologies. This was an opportunity for the FFCs and Indian audiences to witness, experience and interact with participants from Indian Aviation Industry including DPSUs, DRDO, Private Industries (Tier–I, Il, III) and top

notch Start–Ups. IDAX aimed to showcase indigenous skills and indomitable spirit of Indian Aviation Industries to a wide spectrum of decision makers and end users from Global Air Forces participating in Tarang Shakti 2024. Participation of Friendly Foreign Countries in the exposition "will help India's Aerospace industry seek export opportunities, integrate into the supply chain of foreign OEMs and ensure collaboration for co–production/ co–development of Indian defence needs".

IAF's Directorate of Aerospace Design (DAD) participated in the exposition with partner startups. These startups showcased niche technologies and products like RF Gun to counter unmanned aerial threat, High Altitude Pseudo Satellite (HAPS), Loitering ammunition, Air–launched Flexible asset, Augmented Reality/Virtual Reality (AR/VR) smart glasses tech tool for training, Expandable Active Decoys, Real–time aircrew health monitoring system and Foldable field mats to mitigate quick runway repair, highlighting the growing strength and potential of India's aerospace sector.

IAF has been playing a pivotal role in nurturing innovators, startups, and MSMEs identifying, developing and implementing innovative solutions. Through dedicated mentoring and guidance, DAD is steering these entities toward developing cutting edge technologies that align with the future requirements of the IAF, thereby strengthening the government's push towards 'Atmanirbharta' (self–reliance).

Text: IAF
Photos: Mayyank Kaul
(Twitter/X: @MayyankK3246)

IAF conducts symposium on 'Air Domain Awareness'

As part of Exercise Tarang Shakti, the Indian Air Force (IAF) organised a multinational symposium on 'Air Domain Awareness' on 11 September 2024, at Jodhpur. The theme of the symposium was "Collaborative Approach to Facilitate Air Domain Awareness Towards Enhancing Regional Security."

The event saw participation from over 50 delegates, representing 27 nations involved in Exercise Tarang Shakti. Air Marshal Surat Singh, Director General Air (Operations), IAF, welcomed the participants and delivered the keynote address. International delegates shared their concepts of air domain awareness and discussed strategies to tackle challenges from both national and regional perspectives. The symposium fostered an open exchange of ideas among subject matter experts on emerging challenges related to air situational awareness and airspace management. Discussions focused on policy matters and technological solutions for effective information sharing.

The closing address was delivered by Air Vice Marshal PV Shivanand, Assistant Chief of Air Staff Operations (Air Defence).

Text and photos in this section: IAF

The Indian SOF rewind: 2024

Navy Chief meeting a MARCOS detachment. Photo by IN on X.

The Indian 'Special Operations' have touched a new height in the past decade, of which the Fiscal Year of 2024 have been very crucial. We saw some major operations, demonstration and joint–exercises, in which both our SF's and SOF's displayed their up to the mark professionalism and operational preparedness.

Before going through the highlights of the operations, demonstrations and joint–exercises showcased by the Indian Special Operations Forces, let me take through a short but brief introduction of our SFs and SOFs.

First of all, what's an SF and what's an SOF? And what's the difference between the two?

The term 'SOF' stands for Special Operations Forces, it is a type of force used for performing only a select few roles and undertake missions which are well defined in the respective mandates.

The term 'SF' stands for Special Forces, a SF is a force which is a highly trained and versatile organisation. It can be used in any kind of environment and can perform all the tasks which a SOF can perform but not vice–versa.

PARA SF operative. Photo from Open Source.

SF typically is used when the SOFs are unable to perform tasks which aren't defined in the mandates.

Now let me take you all through the various SFs and SOFs of the Republic of India!

Special Forces or SFs consist of the PARA SF of the Indian Army, GARUD SF of the Indian Air Force and MARCOS of the Indian Navy.

Special Operation Forces of SOFs consist of NSG under the MoHA, SFF under the DGS, Spl Grps under the DGS and CCDTs of the Indian Navy.

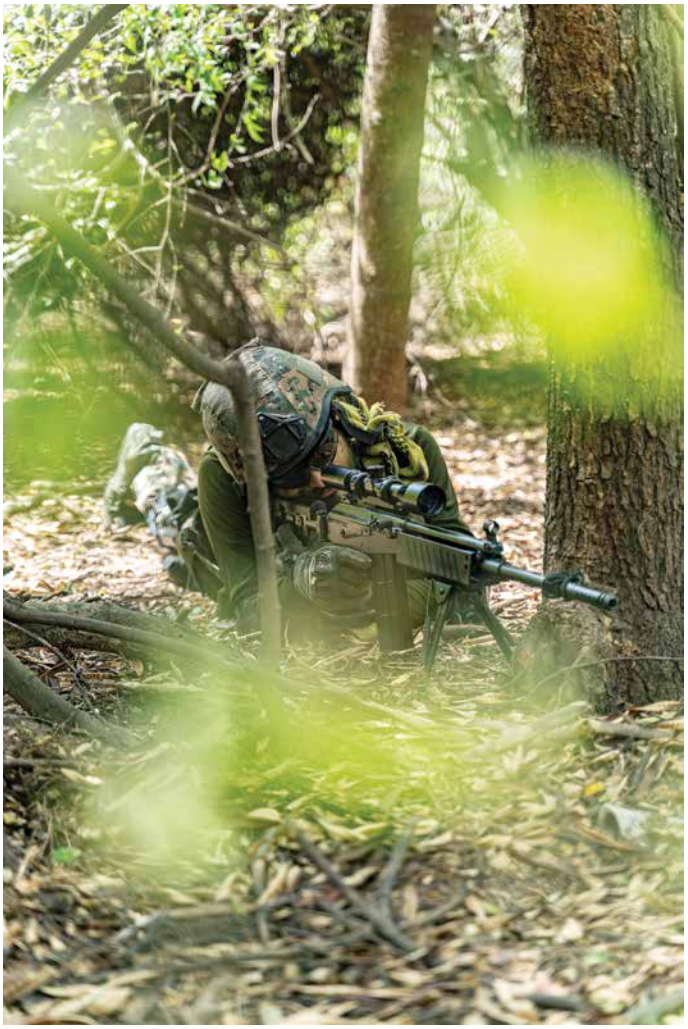
Now let's go back in time to the beginning of year 2024 and have a look on the operations, demonstrations and joint–exercises conducted by our SFs and SOFs.

The PARA SF conducted many successful CI/CT ops in J&K and NE against the Pakistani and Western sponsored terrorists. During the Army Day 2024 in Lucknow, we saw the elite operatives of the PARA SF displaying their might. We saw PARA SF taking part in a joint training exercise with US Green Berets in Oklahoma, USA.

The GARUD SF displayed immense courage and professionalism which was seen in various operations and missions conducted by them; be it rescuing civilians during the Kerala Flash Floods or be it combating terrorism in the Kashmir Valley or the NE Indian region.

The Marine Commandos (abbreviated as MARCOS) as in the name are the Marine Special Forces of the Indian Navy. Be it fighting terrorists in the Wular and surrounding areas or rescuing hostages from the infamous pirates, they have showed their prowess and operational preparedness everywhere. The rescue operations in which the elite MARCOS freed the hostages of the MV Ruen and MV Lila Norfolk in two different hostage rescue operations were the main highlights of the year 2024.

The NSG or better known as the 'Black Cats' were seen getting into various joint exercises with other organisations



GARUD SF. Photo by Mayyank Kaul.

NSG during a CT exercise. Photo by NSG on X.

under the MoD (i.e. the MARCOS and CCDTs). NSG were also spotted during the major Counter Terrorists Operation in Akhnoor Sector of IB in Punjab, during which three Pakistani terrorists were neutralised and a large cache of arms and ammunitions were recovered.

The Special Frontier Force or the 'Two Twos' is a SOF under the DGS. The operations conducted by this elite force are very less likely to be made public and only if the GoI wishes to do so. But we did see the "Vikasis" deployed on the LAC in pictures posted by the Indian Army.

GARUD SF.
Photo by Mayyank Kaul.

CCDT memento. Photo from Open Source.

CFF Badge. Artwork by Abhinav Negi

Chakrata Badge Artwork by Abhinav Negi.

GARUD Memento.
Photo by Abhinav Negi.

Indian Navy diving badge

MARCOS Badge

SFF Logo. Artwork by Mrityunjay Raghuvanshi

SGs Badge.
Artwork by Abhinav Negi.

The Special Groups or SGs are the SOF units under the DGS which operates under the aegis of SFF. The Ops conducted by these units are never made public due to the highly classified nature of the missions conducted by these groups. But we did saw the CI/CT team of one of the SG during a CT Op in the Kashmir Valley.

The CCDTs or the Command Clearance Diving Teams are the least know SOF units in my honest opinion. The CCDTs are diving teams under the three Command HQs of the Indian Navy, tasked with clearance diving and EOD tasks. They were seen in many joint exercises alongside the MARCOS, even with the NSG during Ex–Sangam.

At last, to conclude the article I would say that we went through the basic definition of what SFs and SOFs are, the Indian SFs and SOFs and a short but brief recap of each of the mentioned forces highlighting the major operations and exercises conducted by them.

The selfless service and sacrifice of the operatives part of the various SFs and SOFs are a reminder of the bravery and heroism that defines our nation's true special operations capabilities, and we here at Vayu Aerospace & Defence Review are grateful for their service. Hoping to see many more such successful Ops and Exercises and wishing our Spec Ops 'Boiz' a very happy hunting!

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What's next? The MiG–21 story

It is easy to vilify, but hard to criticise, and agonising to witness unfortunate demise of sky warriors—the warrior, the legend, the MiG–21 which is unnecessarily maligned.

After having a charismatic career of more than 60 years, some of the last of the remaining MiG–21 fleet were relocated in 2023 to the Nal Air Force Base in Bikaner of Rajasthan. These are scheduled to be replaced by India's indigenous Tejas Mk.1A. Unfortunately, everything is not green on its side. Once a mainstay of the IAF and a proud witness of an astonishing combat record in services, it has now plunged into dwindling reputation, earning the misnomer "Flying Coffin," plagued by an alarmingly high crash rate in the past several decades.

The MiG–21 was envisioned as a delta wing light fighter aircraft in the early fifties, mainly to intercept long range American bombers as the Cold War just started to erect its fangs. Initially mired in limitations, it gradually proved itself as one of the most successful designs of its time. It bears the legacy of being the most produced supersonic jet fighter and the longest serving fighter jet with a history of more than sixty years! Out of a total production of around 12,000, 1200 have seen services with IAF, of which 840 subjects were license produced by HAL.

In India it entered into service in 1963, just four years after induction by the Soviets when F–13 (Type74) equipped

the newly raised No. 28 Squadron, "First Supersonics." It was quickly followed by Type–75, which, however, had little contribution in the Indo–Pakistani War of 1965. Post–war saw the induction of newer models on a war footing, paving the way for HAL to start manufacturing

on Indian soil in 1971. The 1971 war saw extensive action by Fishbed, with at least eight air victories and just one loss (two more victories and one loss in later years). The magnificent performance of the MiG–21FL (Type–77) against the US made F–104A Starfighter made a special place in the hearts of IAF pilots, which is still undented. In fact, many other nations sought help from India to train their pilots in MiG–21. Post the war, gradually Type–96, Type–88, and ultimately 'Bis' succeeded the production line. Though a large number of two seat trainer versions of the Mongol (Type–66 and 69) have also seen service.

In the early eighties, as India took the initiative for an indigenous light combat aircraft (the future Tejas), it was also indoctrinated for extensive modernisation of the MiG–21 fleet to face the rapidly changing combat environment. The 'Bis' fleet was exclusively new at that time. So this version was selected for the extension of the Total Technical Life (TTL) under the MiG–21–93 programme. An award of contract at a total cost of US $626 million was given to MiG–MAPO in 1996 for modernisation of avionics, much capable armaments and incorporation of indigenous components. Finally, in 2001, HAL built an upgraded platform and conducted the first flight, providing the much needed oxygen to the old birds. They got a better cockpit view, a conformal ECM dispensing system, a new RWR, a Kopyo multi–mode radar system, a Totem 221G ring–laser gyro–aiming navigation system, and a new helmet mounted sighting system. Initially known as UPG, the upgraded model became popular as BUG (Bis Up Grade) by the pilots, and ultimately, in 2002, it was officially designated as "Bison". The No. 3 Squadron (Cobras) became the first to be equipped with Bisons. A total of 125 Bis were upgraded to the Bison variant.

Despite such a bright career, its charisma has been blemished by a large number of crashes and accidents involving the platform. Since induction, according to reports, more than 400 MiG–21s have been lost, taking the lives of over 200 pilots and another 60 civilians. In the last ten years, the MiG–21 has faced more than twenty unfortunate incidents. For decades there has been a vehement demand for a quick replacement with a better and safer platform, particularly with the LCA Tejas. But despite all the enthusiasm, no immediate replacement could be arranged due to continuous delays in the LCA programme for various reasons.

While retired sky warriors and some aviation experts alike agree on the replacement of the MiG–21, they vehemently discard obloquy as mere misinterpretation. They have pointed out that the MiG–21, being the backbone of the IAF for several decades for obvious reasons, faced mishaps in larger numbers than others. As days passed and electronic media witnessed a rapid rise in terms of mass appeal, the public became much more aware of the subjects than ever. Besides in the past, many different types of aircraft of the MiG family (e.g., MiG–23) were erroneously reported as MiG–21 after crashes to the chagrin of IAF personnel, veterans and aviation experts. All of these together besmirched the reputation of the aircraft.

The reasons behind the accidents and crashes have been ascribed to various reasons ranging from human error to technical defects, bird strikes and even lack of a supersonic jet trainer. But most of these are common reasons behind crashes of any air platform around the world; it always has been. Unfortunately, in the future too we will witness contretemps; it's inevitable. But simultaneously it also can't be denied that all those old platforms should have gone by now. In fact, it was the late seventies when the IAF projected a need for the MiG–21 replacement. In 1982, the Air Staff Target (AST) 201 was issued for such, and a team was formed under Dr. Valluri. Prolonged usage of these is stultifying IAF to explore the full potential. The planned retirement of the MiG–21 has been delayed on several occasions. One can be surprised to know that the induction of new replacements was once planned for 1995! But Tejas achieved initial operational clearance only in 2011. The decommissioning of the MiG–21 was planned for 2017, delayed later to 2019, and now cannot be clearly stated amidst global supply chain issues affecting production of the Tejas Mk.1A (as of January 2025). There has been an argument that without a proper replacement, these platforms couldn't be retired, especially when many of the airframes had considerable TTL left. In the last several decades, from defence minister to chief of air staff, has taken sorties to dispel apprehensions about its safety.

In the end, it cannot be denied that the entire MiG–21 fleet should have been retired a long time ago. Whatever be the reasons, the lack of a viable replacement in time has forced the IAF to continue with the old warrior to keep the squadron strength from plummeting. But now, as the LCA Tejas Mk.1 is a reality and the Mk.1A too has already conducted the first flight, the much needed relief is in sight. One thing should not be forgotten: all existing squadrons operating MiG–21s will not necessarily be replaced by only Tejas, as the IAF will deploy platforms according to the needs. Needs will keep changing amidst a rapidly evolving, multi–domain combat environment. So not by the role but as a platform, Tejas will replace MiG–21 in the air force. One thing is certain: the indigenous LCA Tejas will rule the sky as an accredited successor to the Fishbed.

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All photos: Simon Watson

Voronezh radar system for India?

India and Russia are in advanced discussions on a $4 billion defence deal to strengthen India's air defence infrastructure. The deal focuses on the acquisition of the state–of–the–art Voronezh radar system, which is expected to significantly enhance India's ability to detect and respond to aerial threats across an extensive region, as reported by 'Russia Today'. The agreement reflects the enduring defence cooperation between New Delhi and Moscow, a partnership that Defence Minister Rajnath Singh reinforced during his recent visit to Russia. In Russian service, the first radar, a Voronezh–M, was built in Lekhtusi near St Petersburg. It entered testing in 2005 and was declared "combat ready" in 2012.

The centrepiece of the proposed deal is the Voronezh radar system, developed by Russia's Almaz–Antey Corporation, known for its expertise in missile systems and radar technology. With a vertical range exceeding 8,000 km and a horizontal reach of over 6,000 km, the radar can detect and track multiple threats, including stealth aircraft and Inter Continental Ballistic Missiles (ICBM). According to Russian claims, the system can monitor more than 500 objects simultaneously and even track near–Earth objects in space. The radar is likely to fit seamlessly with India's layered air and missile defence system, including the Russian origin S–400. According to the Bureau of Military–Political Analysis's Alexander Mikhailov, the Voronezh could enhance the S–400's detection range over 10 times from 600 kilometres. Upon detection of a hostile launch, the satellites alerts the Voronezh radar, which then confirms or refutes the threat. The key role of these radar systems is to verify the presence of a threat, such as a mass launch of ICBMs, and provide crucial information for interception.

There are four different variants in the Voronezh radar series. They include Voronezh–M (VHF band) radars optimised for long range detection of medium and long range ballistic missiles and can cover vast areas. Voronezh–DM (UHF band) provides improved resolution and tracking accuracy for smaller targets, enhancing the effectiveness of the radar against various aerial threats. Designed by NPK NIIDAR, it has a range of up to 10,000 km and is capable of simultaneously tracking 500 objects. Its horizon range is 6000 km and vertical range is 8000 km. Russia claims the radar can detect targets the size of a "football" at a distance of 8000 km. Voronezh–CM (L–band) offers enhanced precision tracking and clutter rejection capabilities. And Voronezh–VP refers to the planned upgrades that combine VHF and UHF capabilities for comprehensive threat detection. Also the Voronezh radars are described as highly prefabricated meaning that they have a set up time of months rather than years and need fewer personnel than previous generations. They are also modular so that the radar can be brought into partial operation whilst being incomplete.

The advanced radar is expected to provide a strategic advantage to India by enhancing its situational awareness over critical regions, including China, South Asia, and the Indian Ocean. This capability will address India's evolving security needs amid regional and global challenges. As reported by 'The Sunday Guardian', in line with India's 'Make in India' initiative, the deal includes a provision for at least 60% of the radar system to be manufactured domestically. A team from Almaz–Antey recently visited India to meet with potential offset partners, as reported by 'Russia Today'. The system, once acquired, will likely be stationed in Karnataka's Chitradurga district, which is already home to several advanced defence and aerospace facilities. The location has reportedly been surveyed, ensuring readiness for installation and would allow it to keep an eye on the Indian Ocean Region (IOR) and across both its northern and western borders with China and Pakistan.

Article by
Sayan Majumdar

PGMs and development in India

"Fast is fine, accuracy is everything," said Wyatt Earp (an American lawman in the American West). The deadly package of speed, accuracy, and agility is precision guided munitions (PGMs), which have proven their mettle since WW2 and are still being used in various forms, revolutionising warfare! So, integrating these into countries' arsenals is not just beneficial; it is essential for future readiness. PGMs are smart munitions that can carry out precision strikes on intended targets, minimising collateral damage using an onboard guidance system.

Understanding PGMs

Historically, armed conflicts around the globe used large amounts of unguided bombs to take on enemy targets. However, as technology progressed, the introduction of PGMs changed the game. These munitions use various guidance systems like GPS, laser or infrared to hit targets with pinpoint accuracy, thereby significantly increasing the probability of a successful strike while minimising unintended effects on surrounding areas. This also reduces the number of ordnance a platform needs to carry to destroy a target.

The strategic implementation of PGMs offers numerous tactical advantages. Foremost among these is the ability to engage high value critical targets without the need for large scale deployments. This is particularly relevant for countries like India, which faces a multi–front security environment involving both conventional and asymmetric threats.

PGM development in India

The country's premier defence research organisation, the Defence Research and Development Organisation (DRDO), has made significant strides in developing PGMs. Various projects have been initiated to fulfil the needs of the Indian Air Force. Recently private players have shown great interest in this field, coming up with solutions for drone based PGM, guidance kits and the production of systems developed by DRDO.

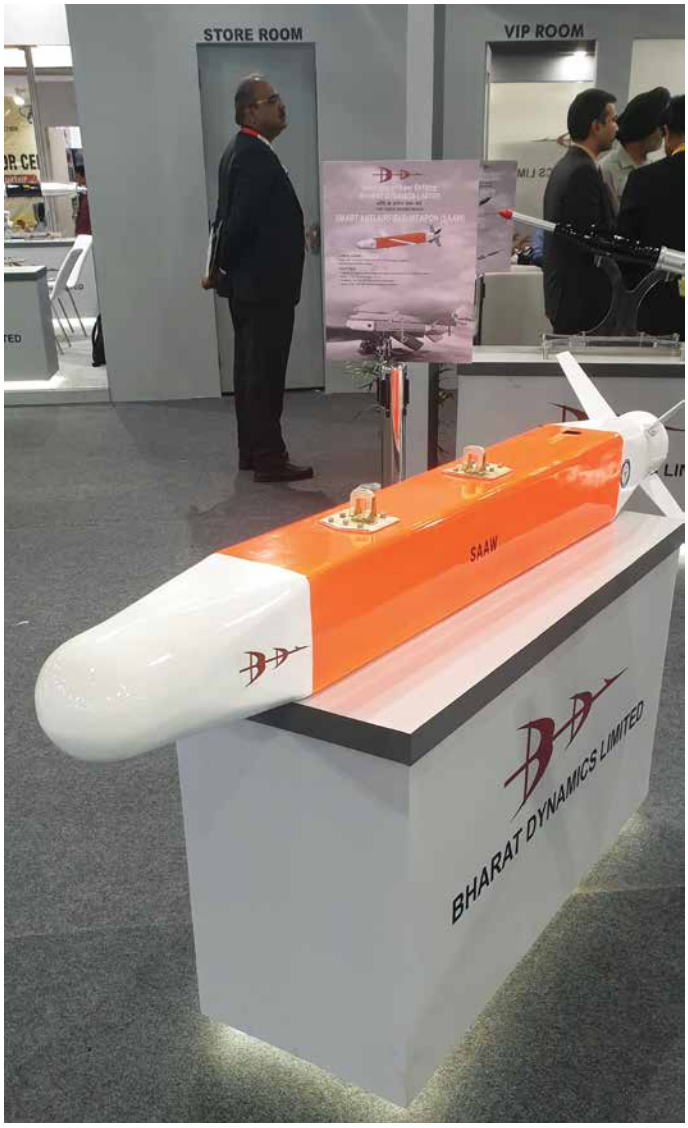
Furthermore, PGMs from other nations, such as the United States, Russia, Israel and France have bolstered India's capabilities. One such significant example is the usage of the "Spice–2000" guided bomb developed by Rafael Advanced System, Israel was used by IAF in the Balakot airstrike.

Key projects

–Sudharshan, a 450 kg laser guide bomb developed by DRDO labs. IAF inducted it in a limited quantity.

–PGHSLD is an add–on GPS/INS guidance kit for High–Speed Low Drag (HSLD) bombs. Currently, the kit can be retrofitted to the existing unguided 450 kg bomb available with IAF inventory to convert it to a smart guided bomb. This increases the forward throw of the bomb from 10 km (unguided bomb) to 30 km when released from 10 km altitude at 0.85 Mach with an accuracy of 30m (only GPS–INS) and 3 m (with laser seeker).

–Gaurav, a 1000 kg glide bomb developed by DRDO lab ARDE, has a standoff precision strike capability and a range exceeding 80km. It is currently undergoing trial and will be mass produced by private players.



–Smart Anti–airfield weapon (SAAW) is an air–launched smart glide bomb developed by DRDO lab RCI. It has an engagement range of up to 100 km and capable of destroying enemy airfield assets like radars, bunkers, taxi tracks, runways and fuel depots with pin–point accuracy. The weapon system is under induction by Armed Forces and is being mass produced by BDL.

–ULPGM is a UAV launched air–to–ground missile, capable of destroying static and moving targets. It is equipped with an imaging infrared seeker for guidance. This system has currently received an LSP order which will be executed by BDL and Adani Defence.

Many such projects are under active development, with little information available to the public.

Future prospects

Evolving battlefields and technological breakthroughs have made PGMs evolve from guided munitions to key elements in network centric warfare. The integration of datalink onboard has changed the use case scenario, which raised the system's niche capability to operate in a physical environment while being operated virtually and to change the target mid–course.

Future PGMs will be deployed from unmanned platforms which are coordinated by various manned and unmanned systems in the surrounding, which will drastically reduce the target identification, tracking and engagement time. This includes a network enabled precision guided munition that interfaces with battlefield systems. Effective information exchange among delivery and ISR platforms, satellite assets and C2 structures will be vital for accurate and precise mission execution. Meanwhile, growth in electronic warfare systems has made avionics onboard PGMs capable of withstanding electronic attacks.

Conclusion

In conclusion, precision guided munitions are significantly influencing the future of military operations in recent global conflicts. However, given India's unique geographical challenges, these munitions may not be a universally effective solution in all scenarios. Growth in AI and machine learning might help train the onboard computer to understand and work precisely in these complex terrains. A substantial advancement in this area would enhance Indian military's relevance on the global stage while maintaining strategic balance in the area!

Article by: D. Rethik (Twitter/X: @Rethik_D)
Photos: Vayu Aerospace Review

Challenging times ahead for the Indian Air Force

As we all know, the Indian Air Force celebrated its 92nd year of formation on 8 October 2024 and each passing year is bringing new challenges as our adversaries are modernising at a rapid pace, even our western adversary is doing quite well towards their modernisation even after facing financial issues due to poor economical performance, but Indian Air Force, on the other hand, is facing serious capability issues even after India's rapid economic growth.

Most of this capability issue is due to poor acquisition planning and execution. We are riding on two boats simultaneously, one is sailing towards Atmanirbharta and the second one is sailing towards capability build–up, ultimately they will meet at a common destination as Atmanirbharta (Self–Reliance) will lead to serious capability buildup which will have a strong base. But till it happens it's also important that both of these boats sail together. Unfortunately, this is not happening.

While there is an important push for Atmanirbharta, which is very much necessary, we are compromising on capability build–up as we are trying to ignore imports over indigenous systems. We need to understand, that modern technologies are very sophisticated, with the current base we have, it will take time to develop the capability to make these modern types of equipment, for many systems we don't even have proper testing facilities, although we are doing an impressive job. Still, it is taking time and we are missing on important timelines. Our adversaries are building capabilities, while we are lagging dangerously.

It is very important to have a parallel approach, to sail both boats together. The solution is expensive but we can afford it. We cannot stop importing in one day as we were the biggest arms importer for decades, we must maintain fighting capabilities while ensuring that our imports are reduced. The sanctioned IAF fighter squadron strength is 42 for two front scenarios, and with the retiring MiGs it's reaching just 30, which will further go down with the retirement of MiG–29s, Jaguars and Mirage 2000.

Right now, as a replacement case for these aircraft, we are relying on the indigenous fighter development

programme for MWF (Tejas Mk.2) and AMCA. In both of these programmes, we had multiple developmental timelines till now, sometimes due to external factors and sometimes due to internal ones, but the reality is it's still a sophisticated work in progress. No timeline can be certain since these platforms are not 100% indigenous from the start, so external factors can always create problems, still we are optimistic and for Tejas Mk.2, final rollout timeline is 2025 end or 2026 start, where the first flight can take place in the very same year or at the beginning of 2027. Even if we consider that we stick to this timeline, the testing period will take its own sweet time, we are considering 3 years for that with 2030 production, but that seems too optimistic. So, we will have to upgrade these old aircraft to make sure they remain relevant for a decade more, which is itself a stretch as most of these aircraft were acquired in the 80's so we are really pushing the airframe and they already had one upgrade which was a costly one.

Although we are getting Tejas Mk.1A, we will have more than 200 Tejas Mk.1A in a decade, but these aircraft are mostly the replacement for the MiG–21s. The stop–gap solution here is the MRFA programme under which we were supposed to acquire almost 114 aircraft but till now we don't have any clarity on this. It was expected that we could have some progress in this case by the end of this year, but till we are writing this article nothing is certain. Originally under MMRCA, we were supposed to acquire 126 aircraft (almost two decade old requirement) out of which we only acquired 36 Rafale, so the requirement for

medium–weight fighters remains, which is more than 100 aircraft which is almost two decades old. If we are planning to fulfil this requirement with our own MWF, then it will be almost three decades when we will be able to add these fighters for our original requirement, a brand new aircraft would have completed more than half of its airframe life in service if we got those aircraft when it was required.

So, from the discussion we had so far it is clear that the situation is not so good and we don't even have a clear road map to reach the required fighter squadron numbers. We are pushing for atmnirbharta which is very much necessary, but we are doing it at the cost of our fighting capabilities. The situation gets worse when we discuss our

support fleet i.e. AWACS, air tankers and EW aircraft, in some of the cases requirements are many decades old, and even countries like Pakistan are doing far better than India in this regard. In modern combat these support aircraft have very important roles to play, they are even referred to as decisive factors in many scenarios. Some delays in these cases are due to indigenisation push which is a good thing but at the same time, it came very late.

Let's start with AEW&C. IAF today operates around 6 AEW&C in which 3 are small DRDO AEW&C known as Netra Mk1, based on Embraer ERJ–145 platform and 3 are big Phalcon AWACS carrying Israeli Elta EL/W 2090 Phalcon Radar on a Russian Beriev A–50. Our actual requirement is projected to be somewhere close to 18 such platforms and we don't even operate half of them as of today. Now, to speed up the acquisition process we went in a smart direction in which we are supposed to acquire around 6 Netra Mk1A AEW&C, unfortunately in this smart move we were again late and the platform on which these AEW&C are based i.e ERJ–145 are out of production. That means we will have to look for the second hand aircraft first before we move towards production.

Now coming to the second option which is going smoothly, is to acquire proposed Netra Mk.2 AEW&C, again 6 in numbers. These AEW&C are based on Airbus's A–319 platform which is already acquired from Air India, now CABS is modifying them, to convert them into a more potent AEW&CS with a coverage of 300 degrees while scanning in longer ranges at the same time in comparison to Netra Mk.1 & Mk.1A.

Now coming to tankers, this one is depressing and that's why we will not go too much deeper into it. We are trying to acquire these platforms for over two decades now, most of the time we made Airbus A330 MRTT as our choice but due to various factors (mostly cost) we didn't go ahead with them. We even came up with an interim solution which included leasing some of these platforms which again didn't go anywhere. Now one more proven solution is there in which we can convert old Boeing 767s into air–to–air refuellers with the help of Israel's IAI as they have done for the Columbian Air Force. HAL signed an MoU with IAI regarding the same in 2022 but till now we don't have any update on it, we don't even have any news on the acquisition of these old platforms, so any timelines can't be predicted as of now.

Lastly the EW platform we are supposed to get around 6 ISTAR platforms which were supposed to be made with the collaboration of the Americans but till now there is no significant progress.

The new IAF leadership is optimistic towards the Atmanirbharta goal but there is too much to achieve. The main objective of the leadership is to make sure that these public and private firms along with IAF move forward in sync so that the common goal of Atmanirbharta can be achieved that too before it gets too late. This thing sounds pretty simple, but in reality, it is way more complicated. Hopefully, we move forward and these important capability issues get sorted as soon as possible.

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All photos: Vayu Aerospace Review

Riyadh Air for 60 A321neo's

Riyadh Air, the new premium international airline based in Saudi Arabia, has placed a firm order for 60 A321neo Family aircraft. The agreement was signed at the Future Investment Initiative (FII) in Riyadh, marking a significant milestone for Riyadh Air.

Emirates receives first of 65 A350–900s

Emirates has taken delivery of its first A350–900 aircraft, marking an important step in Emirates' fleet growth strategy. Emirates has ordered a total of 65 A350–900s as part of the airline's broader plans to support Dubai's Economic Agenda, which aims to add 400 cities to Dubai's foreign trade map over the next decade.

Airbus/OCCAR in A400M Contractual Framework Update

Airbus has signed two strategic contracts with the Organisation for Joint Armament Cooperation (OCCAR), an international organisation based in Bonn, Germany, which manages the A400M programme on behalf of the Launch Customer Nations Germany, France, the United Kingdom, Spain, Turkey, Belgium and Luxembourg. These new contracts are the so–called A400M Global Support Services (GSS3) and Block Upgrade 0 to enhance the aircraft's scope of capabilities.

Spain orders 25 more Eurofighters

The Spanish government has signed a contract with Munich based, Germany, NATO Eurofighter and Tornado Management Agency (NETMA) for the acquisition of 25 Eurofighter aircraft. Known as the Halcon II programme, the order will cover the delivery of 21 latest–generation single seat and four twin seat Eurofighter aircraft to replace part of the F–18 fleet operated by the Spanish Air and Space Force. The agreement, which follows a previous contract signed in 2022 for a batch of 20 fighter jets, will see the Spanish Eurofighter fleet grow to 115 aircraft.

Italy for up to 24 Eurofighters

The leaders of Eurofighter and NETMA (the NATO Eurofighter and Tornado Management Agency) signed the contract for up to 24 Italian Air Force Eurofighters in Rome. The announcement comes at a strategically important time for the Eurofighter programme and follows the contract signingof for 25 Eurofighters for the Spanish Air Force. The new Italian Eurofighter Typhoon jets will replace Italian Tranche 1 versions that are currently in service.

NGC's LITENING in USN F/A–18 testing

Northrop Grumman LITENING targeting pod has completed initial flight testing on the US Navy F/A–18 E/F Super Hornet aircraft, a critical step on the path to fleet operations. The tests put the electro–optical/ infrared pod through a set of demanding

maneuvers representative of operational scenarios. LITENING's daylight and infrared sensors provide high definition video in multiple wavelengths to deliver a decisive advantage in surveillance and targeting missions.

Bombardier's 100th Challenger 3500 delivery

Bombardier celebrated the delivery of the 100th Challenger 3500 aircraft, the latest addition to its portfolio of aircraft. Since entering service in 2022, the Challenger 3500 aircraft has delivered "unmatched versatility, the lowest direct operating costs in its class and rock solid reliability".

Austal Australia delivers the 8th ECCPB

Austal Australia has delivered the eighth of ten Evolved Cape–class Patrol Boats (ECCPB's) under contract to the Royal Australian Navy. The vessel, ADV Cape Schanck (313), is the eighth ECCPB to be constructed at Austal's Henderson, Western Australia shipyard in four and half years.

Bombardier Defense delivers 8th Global to USAF

Bombardier Defense has announced the delivery of the eighth Bombardier Global jet to the United States Air Force's (USAF) Battlefield Airborne Communications Node (BACN) programme, which is part of a previously announced multi–year contract between Bombardier and the USAF. This deal represents a potential total value of close to US$465 million.

Bombardier delivers 1st Global 6500 for HADES

Bombardier Defense has celebrated the delivery of the first Bombardier Global 6500 aircraft to the United States Army in support of the High Accuracy Detection and Exploitation System (HADES) programme.

GA–ASI and BAE collaborate

General Atomics has collaborated with BAE Systems to demonstrate unique electronic warfare (EW)

capabilities remotely controlled via a secure, jam–resistant Link 16 network on an MQ–20 Avenger unmanned aircraft system (UAS). The Avenger is a jet powered platform used extensively as a test bed for autonomous UAS development and the Collaborative Combat Aircraft (CCA) programme.

Gulfstream G500/G600 programme in 300th delivery

Gulfstream Aerospace announced the 300th customer delivery in the Gulfstream G500 and Gulfstream G600 fleet, a signal of continued worldwide demand.

New Gulfstream G400 completes 1st flight

Gulfstream Aerospace announced the all–new Gulfstream G400 successfully completed its first flight, officially launching the flight test programme and further "expanding Gulfstream's ultramodern, high–technology family of next–generation aircraft".

Kongsberg secures new JSM contract from Japan

Kongsberg Defence & Aerospace has entered a fourth follow–on contract with Japan to supply the Joint Strike Missile (JSM) for the country's fleet of F–35A fighter aircraft. The contract is valued at NOK 1.9 billion. The JSM is a 5th generation stealth air–to surface missile developed to fill F–35A anti–surface warfare (ASuW) and land attack capability gaps.

BAE in contract for 40Mk4 systems

BAE Systems has signed a contract with the Dutch Materiel and IT Command (COMMIT) for eight Bofors 40Mk4 naval gun systems for the Royal Netherlands and Belgian Navies. The contract is part of the anti–submarine warfare frigates programme, a joint venture between the Netherlands and Belgian Navies, and provides both countries with two frigates each and two naval gun systems per frigate.

Korea for 4 E–7's

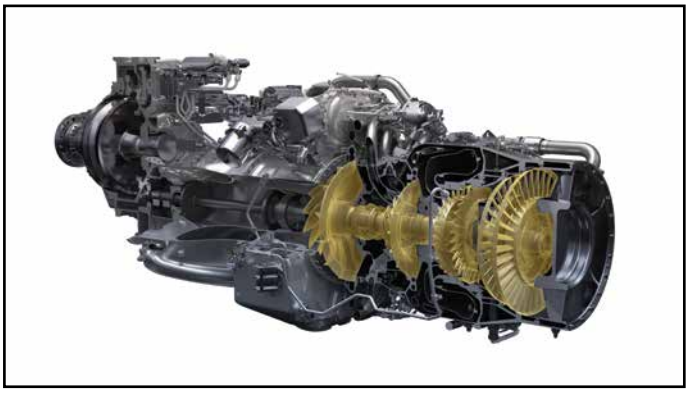
Korea has requested to buy four E–7 Airborne Early Warning & Control (AEW&C) aircraft; ten (10) CFM56 jet engines (8 installed, 2 spares); seven (7) Guardian Laser Transmitter Assemblies (GLTA) (4 installed, 3 spares); eight (8) AN/AAR–57 AN/AAQ 24(V)N Large Aircraft Infrared Countermeasures (LAIRCM) System Processor Replacements (LSPR) (4 installed, 4 spares), etc.

Navantia: AIP on S–83 submarine

The Navantia shipyard in Cartagena has begun to embark on the S–83 submarine the equipment that makes up the innovative Air Independent Propulsion (AIP) system, a technology that makes the S80 class one of the most advanced conventional submarine models on the market. This AIP system is capable of operating at any depth and in all operational conditions, allowing it to adapt to "any navy mission and making it the most advanced AIP system on the market".

Deutsche Aircraft and P&WC collaborate

Deutsche Aircraft and Pratt & Whitney Canada announced the conclusion of a series of five emission and contrail measurement flights on a D328 UpLift research aircraft using a fully synthetic Fischer–Tropsch fuel, preparing for the use of future sustainable aviation fuels (SAF) produced using Power–to–Liquid technology.



Egyptian Navy choses Safran

The Egyptian Navy has chosen Safran to equip 10 Offshore Patrol Vessels (OPVs) with advanced optronic and navigation systems. NVL Egypt, a joint venture between Lurssen and the Government of Egypt (GOE), has selected Safran's VIGY 4 optronic sights and Argonyx inertial navigation systems to significantly bolster Egypt's naval defence technology.

Airbus to provide 19 H135 to RCAF

Airbus Helicopters has signed a contract with SkyAlyne, a joint venture between Canadian defence leaders CAE and KF Aerospace, to provide the Royal Canadian Air Force (RCAF) with 19 Airbus H135 helicopters to train the next generation of RCAF Pilots. The contract is part of Canada's Future Aircrew Training (FAcT) Programme and marks the first time that Airbus helicopters will fly as part of the Canadian Armed Forces.

MBDA tests new Teseo MK2/E

The Teseo MK2/E evolved missile system was successfully test fired for the first time as part of the multi–year development programme for the Italian Navy.

Teseo MK2/E is a new generation missile that brings a substantial improvement in the anti–ship capabilities of the Teseo missile family, known abroad as OTOMAT.

Leonardo to supply 10 AW189s

The "world's most successful super–medium category helicopter is set to further expand its presence in the world market, particularly for offshore transport supporting the energy industry".

Leonardo and helicopter leasing company GDHF have signed a Framework Agreement to introduce ten more AW189s in the energy support market, with deliveries expected in the 2027–2029 period.

GMR orders 28 Airbus Helicopters

Global Medical Response (GMR) has placed an order for 28 Airbus helicopters, including six H125s, five H130s, 14 H135s and three H145s, as it continues expanding its air medical fleet. Following GMR's order of five Airbus helicopters earlier in 2024, the company will operate a fleet of nearly 200 Airbus helicopters, reinforcing its position as one of the largest operators of Airbus helicopters in North America.

UK's 1st autonomous submarine

A team of British engineers based in Portsmouth has successfully demonstrated a new type of autonomous submarine, developed specifically for military use, off the south coast of England.

The vessel, called Herne, is what is known as an extra large autonomous underwater vehicle (XLAUV) and has been configured by BAE Systems to enable militaries to

monitor and help protect underwater infrastructure across the vast expanses of the seabed, support anti–submarine warfare and provide another means for them to undertake covert surveillance missions.

Netherlands orders 12 H225M helicopters

The Dutch Ministry of Defence has awarded a contract to Airbus Helicopters for 12 H225Ms. The contract also includes an initial batch of support and services.

GA–ASI and US Navy fly MQ–20 Avenger

General Atomics used its MQ–20 Avenger Unmanned Aircraft System to perform commanded autonomy maneuvers as part of a demonstration with the US Navy.

The USN used its MD–5 Ground Control Station (GCS) with Lockheed Martin's MDCX autonomy platform to command and control the jet powered UAS.

USN contracts with NGC

The US Navy has awarded Northrop Grumman Cor. a $3.5 billion contract to conduct the mission–systems integration for the E–130J, which will be the successor to the E–6B Mercury for the Take Charge and Move Out (TACAMO) mission.

UAC's Sukhoi Su–57 Russia's crown jewel soars to global prominence

(Photo: Vayu)

Making its debut on Indian soil at Aero India 2025, the Su–57, flagship of Sukhoi and Russia's combat aviation engineering, is set to capture the spotlight at one of the world's most prestigious airshows. The aircraft's arrival marks a historic moment, as it will be the first time the type will perform live demonstrations in India. Already gaining attention for its aerobatics and combat capabilities, the Su–57 earned recognition with a standout performance at the Zhuhai Air Show 2024 in China. These milestones signal Russia's intention to cement its position in the global defence industry, showcasing the Su–57's growing potential. As the aircraft continues to evolve with cutting edge technological upgrades and operational successes, let's explore how each development contributes to its increasing potential as a formidable fighter on the global stage.

The international debut

It was no less than a historic moment when Sukhoi's Chief Test Pilot, Sergey Bogdan flew the T–50–4, the fourth prototype of the Su–57, to Zhuhai in November 2024. This captured the attention of not just the spotters but also the military watchers around the world. The aircraft made its maiden international appearance for an aerial demonstration, 14 years after its first flight, instantly elevating its status to that of a "celebrity" throughout the entire event. Previously, the aircraft had regularly

New flat nozzle of the Su–57 (Source: X/Russia)

participated in Russia's own International Aviation and Space Show (MAKS), last held in 2021.

Beyond its impressive aerial performance, the Su–57 was a highlight in the static displays, giving attendees an opportunity to closely examine its design features. This historic appearance was also symbolic, signalling Russia's intent to maintain its foothold in the global defence industry despite facing significant economic and geopolitical challenges.

The Su–57 in combat: Lessons from Ukraine

It is well known that Moscow has dedicated significant resources to its "Special Military Operations" in Ukraine. The air wing has also been actively engaged in a wide range of missions, utilising nearly all available aircraft, including the Su–57. Both the Russian and Ukrainian sides have confirmed the involvement of the fifth generation fighter in multiple air–to–air and air–to–ground strikes against Kyiv's strategic assets. In 2022, one media report indicated that the aircraft used an R–37M air–to–air missile to shoot down a Ukrainian Su–27 over the Poltava region, at a range exceeding 200 kilometres. Such an engagement would mark the longest air–to–air kill ever recorded in the history of warfare and the first ever kill achieved by a fifth generation fighter. Successful execution of missions is instrumental in promoting the platform as a capable battle system, adept at conducting standoff missions and deploying advanced weapons like the R–37 for air–to–air engagements and the KH–59MK2 (exclusive to the Su–57) for air–to–ground strikes, which are included in its diverse range of armament.

Russia–Ukraine theatre is one of the most contested airspaces in the world today, with high risks of being painted by sophisticated air defence systems. Employing a sensitive platform like a fifth generation fighter without incurring a single loss is remarkable. However, in June 2024, a Su–57 airframe sustained minor damage while on the ground from a Ukrainian drone strike at Akhtubinsk State Flight Test Centre in southern Russia. Visuals confirmed a crater near the ramp where the aircraft was parked, indicating the damage was limited, likely from shrapnel. However, there has been no visual confirmation of any Su–57 lost in combat as of December 2024. The aircraft continues to play a pivotal role in Russian Air Force (VVS), with ongoing efforts to expand production and meet increasing demand.

The Komsomolsk–on–Amur Aviation Plant (KnAAZ) is in the process of delivering fresh batches of aircraft amid the war. In 2024, three batches have reportedly been delivered, with batch sizes undisclosed. A contract to acquire a total of 76 aircraft was signed in 2019, with deliveries aimed to be completed by 2027. Taking account of the last delivery that occurred in December 2024, 25 aircraft have been reportedly added to the fleet of VVS. The country is actively ramping up Su–57 production to meet increasing domestic and international demand. In August 2024, KnAAZ expanded itself with a fuel systems production centre and avionics testing hangars. These efforts aim to address production challenges and ensure timely delivery of the fifth generation fighter, bolstering the VVS capabilities while meeting procurement goals.

(Photo: Vayu)

Export success: A new chapter for Russia

Unlike the US and China, who chose to limit the export of their first fifth generation fighters (F–22 and J–20 respectively), Russia has taken a more inclusive approach by offering Su–57 to allies in export configurations. Interestingly, it also achieved its first success! The official announcement was made during the Zhuhai Air Show, but without disclosing the identity of the buyer. It has long been believed that Algeria could be the first foreign client to acquire the Su–57E, however, it is still unconfirmed. With this, Russia has become the third country, after the US and China, to secure an international customer for a fifth generation fighter. America's Lockheed Martin F–35 has so far secured 20 customers, while in January 2024, the Pakistan Air Force announced plans to acquire China's Shenyang J–35.

Helmet of the Future (Source: X/Russia)

Technological advancements and sub–system upgrades

Sukhoi has introduced major upgrades to the Su–57, featuring its new engine design and advanced technologies. These developments were highlighted for the very first time in a December 2024 documentary by Russia 1 media, celebrating 85 years of the Sukhoi and MiG Design Bureaus, showcasing the fighter's progress and innovation.

Firstly, introduction of flat nozzles on the T–50–2, the second Su–57 prototype and testbed for the AL–51

(Izdeliye–30) engines. The flat nozzles enable a reduced radar signature while maintaining highly agile (or super–manoeuvrable) flight characteristics. Unlike the vertical movement of flat nozzles on the Lockheed Martin F–22's P&W F119 engines, the Su–57's diagonal movement offers superior agility, potentially outmanoeuvring its US counterpart. The development also heavily relied on additive manufacturing like 3D printing, with reportedly 90% of its components being created using this technique. Interestingly, this nozzle configuration would be equipped on other fighter aircraft in the future as well, potentially including platforms like the Su–35 and Su–30. The flat nozzles, a long anticipated feature of the Su–57, will be fitted to Saturn's AL–51F turbofan engines. Currently undergoing flight testing, these engines will power next–generation Russian aircraft, starting with the Su–57M upon certification.

Next is the Helmet–Mounted Display (HMD), another much anticipated system. Referred to as the "helmet of the future," is also under tests, both on the ground and in the air. The HMD is designed to function like its Western counterparts, projecting all flight and combat–related details such as airspeed, altitude, target location, weapon information and more—directly onto the pilot's visor. This system allows pilots to make quicker, better decisions in minimal time.

The Su–57's advanced AI integration supports flight and combat operations by assisting the pilot with decision making. It provides visual and vocal alerts for system failures, suggesting safe resolutions. In combat, AI prioritises targets and advises the pilot for suitable positioning for effective weapon deployment, enhancing situational awareness and combat effectiveness as a "second pilot."

Future prospects in India

The announcement of the Su–57's participation in Aero India took the analysts by storm. While it used to be showcased as scaled down models by UAC and Rosoboronexport, this marks the first time an actual airframe has been brought to Yelahanka for the airshow. This event opens a new window of opportunity for Russia to further market the Felon to India and other potential buyers.

In 2001, the Indian Air Force (IAF) planned to acquire 126 Multi–Role Combat Aircraft (MRCA), later replaced by a 2016 deal for 36 Rafales, which didn't fulfil requirements. A new plan for 114 aircraft awaits the government's Acceptance of Necessity (AoN), allowing manufacturers additional time to present refined options, such as the Su–57, to meet evolving requirements.

In 2010, India partnered with Russia and Sukhoi to jointly develop the Fifth Generation Fighter Aircraft (FGFA)/Perspective Multirole Fighter (PMF), based on the PAK FA (Su–57/T–50), and oriented for the Indian and export market. However, after eight years of design

(Photo: Vayu)

reviews, cost overruns and sustainability concerns, it was decided to call off the programme.

Despite this, in 2019, the then CAS Air Chief Marshal BS Dhanoa stated that the Su–57 could be reconsidered once it enters service. Now that it is operational with the VVS and has even seen success in combat, this presents a favourable opportunity for Moscow to reignite Indian interest in the aircraft. However, critical factors such as production timelines, after–sales support, and alignment with India's indigenous AMCA programme will play a key role in evaluating the Su–57's suitability for the MRCA competition. Balancing the acquisition of advanced foreign platforms with the ongoing development of a domestic fighter in the same class will be essential for shaping India's strategic and technological trajectory.

Conclusion

The Su–57, from the overall technical aspect, is a cutting edge fifth generation fighter. It is equipped with an array of six radar systems including a primary AESA radar mounted in the nose, side–facing radars on the wings and a rearward looking radar. This enables a comprehensive 360 degree coverage, ensuring superior situational awareness. The aircraft leverages Manned–UnManned Teaming (MUM–T) and boasts an extensive array of precision guided munitions for both air–to–air and air–to–ground engagements. Additionally, its integration of a Directed Infrared Countermeasure (DIRCM) system enhances survivability by neutralising incoming missile threats. These capabilities collectively elevate the Su–57's stealth, agility, and combat effectiveness, positioning it as a formidable force in modern aerial warfare. Whether at a personal or industry level, excellence is never achieved overnight. It requires a steady and consistent approach, with each step contributing toward the ultimate goal. Russia, Sukhoi, and their engineering divisions exemplify this philosophy. Despite initial setbacks, the progress made on the Su–57 is nothing short of remarkable. With further advancements on the horizon, this platform is poised to become the cornerstone of Russia's aerospace capabilities, showcasing its engineering prowess and determination to remain at the forefront of aviation technology.

(Photo: UAC)

By: Rishav Gupta (Twitter/X: @ connect_rishav)

(Photo: Russian MoD)

Rubin Design Bureau: Celebrating 124 years and 1072 submarines

667 BDRM Credit Oleg Kuleshov

Rubin Design Bureau (an affiliate of the United Shipbuilding Corporation) celebrated 124 years of its work on 22 December 2024. More than a hundred of years of professional designing have ensured construction of 1072 submarines including 956 ones that have been built for the USSR and the Russian Navy.

Rubin is providing full life cycle support for submarines and other marine objects. The Bureau is undertaking research and development, elaborating design documents for construction, repair and modernisation. The company is developing and manufacturing large displacement uncrewed underwater vehicles (LDUUVs) for conducting research at the depths of the World Ocean up to 12 km water depth. To cater for this, state–of–the–art engineering solutions including those in the field of electronics and structural materials have been developed and continue

Pr. 941 Credit Oleg Kuleshov

Pr. 949A Credit Oleg Kuleshov

Pr. 955A Credit Oleg Kuleshov

being developed. A number of innovations were tested on uncrewed vehicle Vityaz–D that accomplished a first–in–the–world autonomous mission in the Mariana trench on 9 May 2020.

The first Russian design unit oriented for underwater shipbuilding was established on 22 December 1900 under the name of Submarine Construction Commission. It took Submarine Construction Commission three years to successfully complete construction and trials of the first combat submarine Delfin of the Russian Navy by 1903.

The entire USSR and Russian nuclear submarine fleet armed with ballistic missiles has been built under the projects of Rubin Design Bureau. In 1950s Rubin initiated the employment of submarine launched cruise missiles, providing support for construction of firstly nuclear and then conventional submarines armed with missile weapon. In 1960s the Bureau for the first time developed the design of a submarine with due consideration of requirements of the foreign customer, the Republic of India. In late 20th and early 21st century one of the most successful series of the world submarine fleet was realised under Rubin designs:

Pr.955A Credit Rubin Design Bureau

75 diesel electric submarines were built to Projects 877 and 636.

Today Rubin is providing support for series construction of nuclear and conventional submarines of the fourth generation, undertaking work on the fifth generation and fulfilling contractual obligations towards the foreign customers.

Pr.636 Credit Rubin Design Bureau

Rubin Design Bureau is among world leaders in the design of nuclear and conventional submarines and the largest marine engineering company offering design services in Russia. More than 1000 submarines in 124 years of our work have been built to Rubin designs, including more than 900 submarines commissioned by the Russian Navy. Totally 116 submarines designed by Rubin have been exported to 16 countries. Rubin also develops marine robotic systems and designs the facilities for offshore oil and gas field development. The company is a subsidiary of the state owned United Shipbuilding Corporation.

Courtesy: RDB

The Dragon and The Thunder
The new phase of the PAF

PAF JF–17 at the Paris Airshow (Photos: Vayu).

In recent years the Pakistan Air Force (PAF) has inducted two advanced fighter jets, enhancing their air operational capabilities: the Chinese–built J–10C and the JF–17 Block 3. The J–10 was inducted on 11 March 2022. China officially designates this platform as J–10CE, which was unveiled for the first time, as FC–20E, at the Dubai Air Show 2019. The PAF base Minhas houses the 15 Squadron, dubbed "Cobras," which becomes the first PAF squadron to be equipped with these. As of 2024, there is an order of 36 of these. The JF–17 Block 3 joined the 16 Squadron, the Black Panther, of the same air base on 4 December 2023.

The J–10C is the most advanced single engine fighter jet in China, which conducted the first flight in December 2013. But its history dates back to early 80s when then Chairman of the Central Military Commission, Deng Xiaoping had announced development of a new generation indigenous combat aircraft. China was working on multiple projects simultaneously. While J–8 was being upgraded to J–8II, a newer platform for replacement of older J–6, J–7 and eventually J–8 was needed. The Soviet Union was flying MiG–23s, and the induction of the MiG–29 was imminent. On the other hand, the US introduced the F–16 and F–18 to the world. So it was necessary for China to counter the potential adversaries on its own. Soon three paramount aircraft design institutes of China—Chengdu, Shenyang and Xi'an—placed three different proposals, which they had been developing for some time. Chengdu proposed a new design that was an improvement to their earlier development—the J–9. Interestingly, J–9 will be improved further, leading to multiple other projects forming the base of modern Chinese aviation strength, including the fifth generation stealth aircraft, J–20! This design would be further matured, and a prototype will conduct the first flight in 1996. Since then, the J–10 has seen continuous modifications leading to the current J–10C. Pakistan became the first export customer of this platform.

The Chinese origin JF–17 was selected by Pakistan to replace the aging Mirage and F–7 fleets as well as a cheaper alternative to American products, which come with no strings attached. JF–17 Block 3 is the latest iteration of the series, which retained the same earlier design but incorporated new upgrades. It has selected NRIET–developed KLJ–7A AESA radar. It is equipped with a wide Aurora EHUD–2 Head–Up Display (HUD) and a new Helmet Mounted Display and Sight (HMD/S). A new hybrid S740 Missile Approaching Warning System (MAWS) has been added, as well as the ALR–400 RWR (radar warning receiver) and a new electronic warfare (EW) system. The KG600 ECM (electronic countermeasure) pod will enhance its capability. Aselson ASELPOD will provide a robust electro–optical reconnaissance, surveillance and targeting capability. Better air–to–air and air–to–surface weapons have been integrated into Block III. It will have a new Beyond Visual Range air–to–air missile (BVRAAM), PL–15E and PL–10E for close–range engagement. For ground strike it will get a new HD–1A supersonic cruise missile. Besides, like its predecessors, it will continue to carry the CM–400AKG, C–802AK and Ra'ad. For a stand–off strike, Pakistan has a range extension kit (REK) enhancing the capability of its general purpose bombs. Additionally, it will carry Pakistan's own developed H series stand–off weapons (SOW). Pakistan uses the Martin Baker developed PK16LE ejection seat for the safety of the pilot during an emergency.

More angles of PAF JF–17s at the Paris Airshow (Photos: Vayu).

While the JF–17 Block 3 comes with several new features that keep it ahead of most of its aging fleet, it has several limitations as well. Initial JF–17 Block 3 platforms are equipped with RD–93MA with a maximum thrust of 93 kN. However, the later batch has better WS–23E (a maximum output of 98 kN). JF–17 Block 3 is reported to have a maximum take–off weight (MTOW) of 13.5T. The much hyped Infrared Searching Tracker (IRST) is not integrated till now (as of 2024). Similarly, the retractable fuel probe is also absent. However, it is also possible that these features will be integrated into later batches. The integrated KLJ–7A AESA is an air cooled version that has a maximum detection of 170 km for targets with an RCS of 5 sq mtr. The Block III will definitely have better armaments than current variants of the series. But hardly these can be compared with what the IAF Tejas Mk.1A is going to have.

The PL–15E has a maximum range of 145 km, which is higher than the SD–10A (the export variant of the PL–12), but in no parallel can be drawn with the two new improved variants of indigenous Astra BVRAAM missiles, which are reported to have ranges of 160 km and around 350 km, respectively. More than the range, the propulsion, the maneuverability, the countermeasures and several other things will be the key factors in establishing the superiority of the Indian side. By the way, till now only PL–12 could be spotted. So, it can be ruled out that the JF–17 Block III will find any kind of advantages during air–to–air engagement against even the Tejas Mk.1A. But it still will remain as a potent adversary.

J–10C will address many of the drawbacks of the JF–17 Block 3. J–10C is a much bigger platform with a maximum take–off weight of 19.2T, which is significantly higher than that of the JF–17. J–10C has a better combat range (as well as a higher service ceiling). The WS–10B engine has a far higher thrust than the RD–93. Though actual output is not known, it is believed to be a maximum of 138–142 kN.

J–10C can carry more weapons than JF–17 Block 3 and has better 'g limits' capability. J–10C is equipped with the mid–air refueling probe absent in the JF–17. J–10C is also equipped with an AESA radar, but designation is unknown. It is believed the new AESA is superior to KLJ–7A in terms of capability, but there is no confirmation regarding this. J–10CE has a new wide, narrow frame HUD as well as HMD/S, which are believed to be the same as in the JF–17 Block 3. The J–10CE has an IRST (infrared search and

track) and laser rangefinder dome in front of the cockpit. IRST will help detect and track the infrared signature of enemy flying objects up to a certain distance. It is equipped with an integrated electronic warfare (EW) suite and sensor fusion capabilities, enhancing the capability by several folds. The J–10CE will also carry the PL–15E and PL–10E for air–to–air operations. Other armaments and pods are not revealed yet but are expected to be similar to the JF–17. There are some clear differences from the basic J–10C as well. The data link antenna is different. Besides, the position of the sensors is also altered in the case of the Pakistani version. J–10CE is carrying different formation lights.

J–10CE now in PAF service (Photo: Wikimedia).

It will be exaggerating to state that the JF–17 Block 3 and J–10CE can have an upper hand against the IAF Rafale, the LCA Mk2 (being developed), or even the Tejas Mk.1A. But they will do the job for what they are being procured. Without any Western strings, Pakistan can deploy these platforms whenever and wherever they want. The open architecture will allow Pakistan to upgrade these platforms according to their needs with the help of China. And moreover, comparatively cheaper costs will allow Pakistan to procure advanced fighter jets in considerable numbers to replenish their aging fleet.

Both these aircraft are equipped with HUD, HMD/S, AESA radar, an advanced EW suite and good enough armaments. The HMD/S and PL–10E will provide the operator with high–off–bore sight (HOBS) capability. PL–15E has a greater range than all of the air–to–air missiles currently in service with the PAF. The HD–1A being lighter will allow both these aircraft to carry multiple of these supersonic cruise missiles, which will work as a force multiplier. On the other hand, India is developing lighter supersonic cruise missiles enabling its fighter jets to carry multiple of these. Both the aircraft have a digital fly–by–wire flight control system as well as HOTAS (hands–on throttle and stick). These will use Pakistan's homegrown data link system, "Link 17," enhancing interoperability. The technologies are rapidly evolving, and close relationship with China enables Pakistan to incorporate upgrades from time to time. These platforms in the near future will work as an essential component of Pakistan's own "Manned Unmanned–Teaming" (MUM–T) project. According to the reports, in future technologies involving AI and virtual reality will be incorporated, enhancing the capability.

PAF J–10CE (Photo: Twitter/X: @Tahirwqs).

While comparison with Rafale is meaningless, these will give Pakistan credible capabilities for various needs. Moreover, with these platforms, Pakistan has successfully escaped Western restrictions limiting the sovereignty of the usage. JF–17 will eventually replace F–7PG and Mirage–III/5 ROSE. While the J–10C will work along with the existing F–16 fleet of Pakistan. It is not clear if Pakistan aims to replace the F–16 fleet too with the J–10C, but it is unlikely, as for a long time they wanted to simultaneously operate both the F–16 and J–10.

Pakistan will manufacture the KLJ–7A AESA under transfer of technology (ToT). Besides, Pakistan is eyeing the development of an indigenous HUD/S. The commonality will increase interoperability, enhancing operational capabilities. While reports suggest that old JF–17 platforms also will be upgraded, Pakistan is looking for a fifth generation fighter aircraft to remain credible in a fast changing combat environment. The procurement of the JF–17 Block 3 and J–10CE are some early steps of their long envisaged transformation towards a world class air force.

Article by: Sankalan Chattopadhyay

(Twitter/X: @vinoddx9)

India's MoD and its review for 2024

The year 2024 witnessed some major achievements and breakthroughs as Ministry of Defence (MoD) marched ahead with "renewed vigour to make India a strong, secure, self–reliant and prosperous nation". Some of the major highlights of 2024 included:

India–China border consensus: India and China achieved a broad consensus to restore the ground situation in certain areas along the LAC. Both countries have been holding talks at diplomatic and military levels to resolve the differences in some areas along the LAC. As a result, a broad consensus was developed on the basis of equal and mutual security. Raksha Mantri, during the Chanakya Defence Dialogue in October 2024, described the consensus as proof that continuous dialogue brings solutions.

Positive Indigenisation List: To boost Aatmanirbharta in defence and minimise imports by DPSUs, Department of Defence Production in July, notified the fifth Positive Indigenisation List (PIL) consisting of 346 items. These included strategically important line replacement units/systems, sub–systems, assemblies, sub–assemblies, spares/components and raw materials. Earlier, four PILs comprising 4,666 items were notified by the DDP for DPSUs, of which 2,972 items, having import substitution value worth Rs 3,400 crore, have already been indigenised. These five lists for DPSUs are in addition to the five PILs of 509 items notified by the Department of Military Affairs. These lists include highly complex systems, sensors, weapons and ammunition.

Record Defence Production: MoD achieved the highest ever growth in indigenous defence production in value terms during Financial Year (FY) 2023–24, on the back of successful implementation of the policies and initiatives of the Government. The defence production went up to a record–high figure of Rs 1,26,887 crore, reflecting a growth of 16.7% over the defence production of the previous financial year. The value of defence production in FY 2022–23 was Rs 1,08,684 crore. Of the total value of production in 2023–24, about 79.2% has been contributed by DPSUs/other PSUs and 20.8% by the private sector. The data shows that in terms of absolute value, both DPSUs/PSUs and private sector have recorded a steady growth in defence production. MoD has set a target to achieve Rs three lakh crore defence production by 2029.

Record Defence Exports: Defence exports touched a record Rs 21,083 crore (approx. US$ 2.63 billion) in the FY 2023–24, a growth of 32.5% over the previous fiscal when the figure was Rs 15,920 crore. The figures indicated that the exports grew by 31 times in the last 10 years as compared to FY 2013–14. The defence industry, including the private sector and DPSUs, have made tremendous efforts in achieving the highest ever exports. The private sector and DPSUs contributed about 60% and 40% respectively. Raksha Mantri has exuded confidence that the target to export defence equipment worth Rs 50,000 crore by 2029 will be met.

C–295 Tata Aircraft Complex: Prime Minister Narendra Modi and his Spanish President Mr Pedro Sanchez jointly inaugurated the Tata Aircraft Complex for manufacturing of C–295 transport aircraft at Tata advanced systems limited Campus in Vadodara, Gujarat in October 2024. In September 2021, MoD had signed a Rs 21,935–crore contract with Airbus Defence and Space SA, Spain for supply of 56 aircraft; 16 to be brought in fly away condition from Spain and 40 to be built in India by TASL. Of the 16 aircraft, six have already been inducted into IAF at 11 Sqn based at Vadodara. The last would be delivered by August 2025. The first Made–in–India C–295 is expected to be rolled out of the Final Assembly Line facility at Vadodara by September 2026 and the remaining by August 2031.

Indian Light Tank: Indian Light Tank (ILT) 'Zorawar' has achieved a major milestone by firing a number of rounds at different ranges at an altitude of more than 4200m (High Altitude Location) with consistently accurate results. This was subsequent to the Phase I trial in desert environment in September 2024. This light tank has been defined, designed and developed by Combat Vehicles Research & Development Establishment, the Chennai based laboratory of DRDO for the Indian Army. It is manufactured by the industry partner Larsen & Toubro Precision Engineering & Systems. During the field trials conducted in the desert terrain, the Light Tank demonstrated "exceptional performance, efficiently meeting all the intended objectives".

MoD: Major acquisitions/contracts/ inductions for 2024

To provide substantial boost to the Indian defence industry and reduce foreign spending significantly, Defence Acquisition Council (DAC) and Defence Procurement Board (DPB), during 2024, accorded Acceptance of Necessity (AoN) for 40 Capital Acquisition proposals amounting to Rs 4,22,129.55 crore. Out of these, AoNs for Rs 3,97,584.34 Crore (i.e. 94.19 %) have been accorded to be procured from indigenous sources. These include:

DAC, in September 2024, accorded AoN for 10 capital acquisition proposals amounting to Rs 1,44,716 crore. These include procurement of Future Ready Combat Vehicles, Air Defence Fire Control Radars, Dornier–228 aircraft, Next Generation Fast Patrol and Offshore Patrol Vessels.

DAC, in February 2024, accorded approval for AoN for various capital acquisition proposals amounting to Rs 84,560 crore. The proposals include new generation anti–tank mines, Air Defence Tactical Control Radar, Heavy Weight Torpedoes, Medium Range Maritime Reconnaissance & Multi–Mission Maritime Aircraft, Flight Refueller Aircraft and Software Defined Radios.

In July 2024, DAC approved capital acquisition proposals including procurement of Advanced Land Navigation System for Armoured Fighting Vehicles of the Indian Army and 22 Interceptor Boats with latest state–of–art system for the Indian Coast Guard.

DAC, in December 2024, accorded AoN for five capital acquisition proposals amounting to over Rs. 21,772 crore. These include procurement of Water Jet Fast Attack Crafts, Fast Interceptor Craft, Electronic Warfare Suite, Next Generation Radar Warning Receiver, Advanced Light Helicopters for surveillance in coastal areas.

MoD inked a contract with the US Government for Tri–Service procurement of 31 MQ–9B Sky/Sea Guardian High Altitude Long Endurance Remotely Piloted Aircraft System (RPAS) in October 2024. Another contract was signed with General Atomics Global India Pvt Ltd for Performance Based Logistics for these RPAS through Depot Level Maintenance, Repair & Overhaul in India.

A contract was signed in February 2024 with Advanced Weapon Equipment India Limited for manufacturing and supply of a total of 463 indigenously manufactured 12.7 mm Stabilised Remote Control Guns for the Indian Navy and Indian Coast Guard at a total cost of Rs 1,752.13 crore, with indigenous content of more than 85%.

In March 2024, a contract was signed with Armoured Vehicles Nigam Limited for the procurement of 693 Armament Upgrades of Infantry Combat Vehicle BMP2 to BMP2M. This upgrade includes Night Enablement, Gunner Main Sight, Commander Panoramic Sight and Fire Control System (FCS) with Automatic Target Tracker under Buy (Indian–IDDM) category.

Two contracts were inked with BrahMos Aerospace Private Limited in March 2024 for procurement of BrahMos missiles at a cost of Rs 19,518 crore and procurement of shipborne BrahMos system at a cost of Rs 988 crore.

Induction of Drishti–10 MALE RPAs marks an important addition to the Indian Navy's RPA inventory. This technologically advanced aircraft would significantly bolster Indian Navy's surveillance capabilities and augment Maritime Domain Awareness efforts.

Rotary Naval Shipborne Unmanned Aerial Systems have been inducted in the IN in early 2024. Four systems comprising two aerial vehicles have been integrated on Fleet ships and are being effectively utilised for surveillance.

First nine of the 24 MH–60Rs helicopters being procured by IN have been operationalised onboard Fleet ships.

5 Hindustan Aeronautics Ltd (HAL) highlights for 2024

A contract was signed for 240 AL–31FP engines for Su–30MKI at a cost of Rs 26,000 crore.

A contract for procurement of 12 Su–30MKI along with associated equipment signed for Rs 13,500 crore.

Two contracts for a combined value of Rs 8,073 crore were signed for 34 Advanced Light Helicopters (ALH) Dhruv Mk III for Indian Army (25 ALHs) and Indian Coast Guard (9 ALHs).

A contract for RD–33 engines for MiG–29s signed for Rs 5,249 crore; to be produced by Koraput Division of HAL.

A contract was signed for Mid Life Upgrade of 25 Dorniers along with associated equipment for Indian Navy at a cost of Rs 2,890 crore.

DRDO highlights in 2024

DRDO conducted a successful test of the New Generation AKASH (AKASH–NG) missile from the Integrated Test Range (ITR), Chandipur off the coast of Odisha in January 2024.

Four flight trials of High–speed Expendable Aerial Target (HEAT)–ABHYAS were successfully carried out by DRDO from the Integrated Test Range, Chandipur in Odisha during 30 January to 2 February 2024.

DRDO conducted two successful tests of Very Short–Range Air Defence System (VSHORADS) missile on 28–29 February 2024 from a ground based portable launcher off the coast of Odisha from Integrated Test Range, Chandipur. VSHORADS is a Man Portable Air Defence System (MANPAD).

DRDO conducted first successful test of indigenously developed Agni–5 missile with Multiple Independently Targetable Re–Entry Vehicle (MIRV) technology. The flight test named Mission Divyastra was carried out from Dr APJ Abdul Kalam Island in Odisha.

Strategic Forces Command, along with DRDO, conducted the successful test of New Generation Ballistic Missile Agni–Prime from Dr APJ Abdul Kalam Island off the coast of Odisha in April 2024.

Man Portable Anti–tank Guided Missile Weapon System, indigenously designed and developed by DRDO, was field evaluated in different flight configurations several times with the objective of proving the technology with high superiority.

DRDO, along with researchers of IIT Delhi developed Light Weight Bullet Proof Jackets named ABHED (Advanced Ballistics for High Energy Defeat) in the country for protection against 7.62 x 54 R API (Level 6 of BIS 17051) ammunition.

Supersonic Missile–Assisted Release of Torpedo (SMART) system was successfully flight–tested in May 2024 from Dr APJ Abdul Kalam Island off the coast of Odisha. SMART is a next generation missile based light weight torpedo delivery system to enhance the anti–submarine warfare capability of the Indian Navy far beyond the conventional range of lightweight torpedo.

DRDO successfully tested RudraM–II air–to–surface missile from a Su–30MKI platform of IAF off the coast of Odisha in May 2024.

DRDO handed over the Medium Range–Microwave Obscurant Chaff Rocket to the Indian Navy at a ceremony held in New Delhi in June 2024. Microwave Obscurant Chaff, a niche technology developed by DRDO's Defence Laboratory, Jodhpur, obscures radar signals and creates a microwave shield around platforms and assets, thus reducing radar detection.

DRDO successfully tested Phase–II Ballistic Missile Defence System in July 2024. The flight test fully met all the trial objectives.

DRDO carried out successful maiden flight test of Long Range Glide Bomb, Gaurav from Su–30MKI platform of IAF. Gaurav is an air launched 1,000 kg class glide bomb capable of hitting targets at long distance.

DRDO and the Indian Navy conducted back–to–back successful flight tests of the Vertical Launch Short Range Surface to Air Missile.

DRDO conducted the maiden flight–test of Long Range Land Attack Cruise Missile from the Integrated Test Range, Chandipur off the coast of Odisha in November 2024 from a mobile articulated launcher.

DRDO successfully completed the Flight Tests of Guided Pinaka Weapon System as part of Provisional Staff Qualitative Requirements Validation Trials. The flight tests were conducted in three phases at different field firing ranges.

DRDO conducted a successful flight–trial of India's first long–range hypersonic missile; it is designed to carry various payloads for ranges greater than 1,500 kms for the Armed Forces.

Israel Aerospace Industries launches HELA Systems

Israel Aerospace Industries opened HELA Systems, its latest cutting edge facility in Hyderabad on 28 November 2024. This strategic hub marks an additional significant milestone in IAI's commitment to reinforcing India's defence infrastructure under its Make in India initiative. The new subsidiary further demonstrates IAI's dedication to fostering local capabilities and advancing self–reliance within the critical domain of radar technologies.

Founded in 2004, HELA Systems has established itself as a premier provider of high end systems. Over the past two decades, the company has delivered comprehensive support for radar systems, including top tier field services and advanced D–level repair capabilities for various radar units.

The Hyderabad facility, staffed by over 45 highly trained professionals and supported by more than 80 field engineers, specialises in maintaining and repairing radar modules and sub–systems, such as power systems, cooling systems, IT integration, radar testing and calibration. The facility's staff are Indian nationals, showcasing HELA's commitment to nurturing local talent and enhancing their expertise. The facility will serve over 100 local talents in the radio frequency and microelectronics areas, supporting India's TRI services most advanced radar system on land, in the air and at sea.

Dror Bar, CEO of ELTA Systems, Vice President of IAI: "As HELA Systems continues to expand its footprint in India, this new Hyderabad facility exemplifies our commitment to providing exceptional in–country support for advanced radar systems across India's defence sectors. By enabling full product support, maintenance, and repair services locally, HELA offers unmatched efficiency in turnaround time, quality, and cost–effectiveness directly in Indian rupees. Our skilled teams and sophisticated control systems ensure rapid response and top–tier service for the Indian defence forces, aligning with India's vision of self–reliance in critical defence technology."

Yaniv Mizrahi, CEO of HELA Systems: "This facility represents a major milestone in India's journey towards self–reliance in defence technology. With this launch, we demonstrate our dedication to supporting India's strategic needs through world class radar solutions, empowering local professionals and fostering innovation."

Text and photos: IAI

Saab looking at quick deliveries

Comprehensive tech & design capability transfer to India

Today, the Indian Air Force does not have the luxury of time as an increasingly hostile and complex air domain is challenging air forces around the world with a range of threats ranging from long range missiles to asymmetric warfare in the shape of drones that are already extracting a heavy toll in on–going conflicts. "We will start delivery from the third year after contract," says Kent–Åke Molin, Head of Gripen for India Programme. That projection is rooted in not just the capability and track record, but also the extensive discussions Saab has been having with Indian partners and suppliers.

"There is a blueprint," says Kent–Åke, "not only to build aircraft, initially out of Sweden and then in India at a rapid pace, but also to build, in parallel, an Indian eco–system of Indian companies, as we have done in Brazil, for India to continuously upgrade Gripen through its lifespan but also commence designing future aircraft indigenously."

This approach also envisages empowering the IAF to start incorporating, from the very start, customised national software and AI in the highly agile platforms at the core of Gripen avionics, which can be rapidly scaled up as greater processing power and AI are put to use.

"Today, any other fighter aircraft, for that matter any other aircraft, that does not have agility in upgrading its systems, ranging from Electronic Warfare to Human Machine Collaboration, on a continuous basis is obsolete even before it is inducted into service. Gripen is the only fighter aircraft with the ability to not only incorporate new technology without significant fleet downtime due to its ability to rapidly qualify and certify new software, but also to give air forces the unique capability to build, qualify, incorporate and certify their own software onto Gripen without the involvement of the manufacturer."

At the core of Saab's India proposition is to deliver aircraft quickly and build Indian capability fast in order to enable the IAF to multiply its fleet options, plan new platforms for the future and even look at spin–offs in the autonomous and unmanned areas. As demand for cutting–edge defence platforms grows, the ability to scale and adapt production lines has become critical in meeting national security objectives. Saab offers the IAF a partnership that is aimed at building current and future capabilities to innovate, manufacture, upgrade and maintain together as well as independently.

Saab's long standing partnership with the Brazilian Armed Forces is testimony to the extensive Transfer of Technology and industrial cooperation that Saab offers to all its Gripen customers.

The collaboration has been instrumental in the development of Brazil's indigenous defence industry, with Brazilian companies like Akaer, Embraer and AEL Sistemas at the heart of the development, production and flight testing of Gripen.

A full Transfer of Technology will ensure a higher degree of indigenous content and generation of high–tech jobs, boosting both the Indian aeronautics ecosystem and its export capacity. Saab's Gripen offer to India provides continuous operational relevance with sustained upgradability of an aircraft that would be produced locally, with all upgrades, maintenance, repair and overhaul done at the proposed Gripen Centre, maximising operational availability of the aircraft. The collaboration also seeks to enhance the long–term capabilities of the domestic defence industry, effectively enabling India to design future–ready technology.

War is inherently unpredictable. To outpace the technological advancements of enemy nations, a strong partnership with reliability, cooperation and innovation as its touchstones becomes vital. Saab's offer to India is not merely a defence sale, but a commitment to the future.

Thales: Catalyzing India's Vision of Aatmanirbhar Bharat in Defence

The Indian defence and aerospace sector in India is witnessing a paradigm shift with an increased focus on indigenisation, marching towards the 'Aatmanirbhar Bharat' vision. Government policies and industrial collaborations are enabling the country to build on manufacturing and export capabilities in the country.

With a 70+ year presence in India, Thales is fully committed to the government's objective of 'Make in India and for the world'. By leveraging our strong technological capabilities across defence, aerospace, cyber and digital markets, Thales has been contributing to the incredible growth story of India.

We are actively supporting the Indian defence industry to play a greater role in world markets and build advanced in–country capabilities across critical systems, manufacturing and services through local teams and collaborations.

Strengthening India's Armed Forces with Versatile Solutions

Thales offers a wide range of capabilities to help India's armed forces achieve and sustain operational superiority. With our global expertise and technological prowess, Thales is supporting the Indian army with air defence radars, optronics and electronic warfare systems, alongside providing the IAF with cutting–edge technologies, including avionics, radars, reconnaissance pods, Identification friend or foe, as well as the Inertial Navigation to Global Positioning System.

In addition to this, Thales provides trusted intelligence for Indian Navy with breakthrough technologies embedded in our combat–proven naval solutions such as electronic warfare, communications and sonar systems for submarines, surface ships and airborne platforms, long range surveillance radar as well as mine hunting solutions, among others.

Thales is also a major player of trusted AI in these complex environments, devoting massive efforts to research and development, both in–house and through academic and industry partnerships. These investments enable the Group to equip armed forces with greater efficiency in data analysis and decision–making, while taking into account the specific constraints, such as cybersecurity, embeddability and frugality, associated with critical environments.

Adding wings to the Indian Aerospace Industry's strength

Thales has been contributing to India's aerospace sector for decades. In 2024, Air India selected Thales' AVANTUp IFE entertainment for 51 of its wide body aircraft to elevate experience for its passengers. In the area of airport security, Thales has deployed its Fly to Gate biometric solution for DigiYatra at seven airports in India.

In addition, we have been selected to deploy the Airport Operation Control Centre (APOC) to optimise overall airport management and enhance passenger experience securely at these airports.

Moreover, Thales has partnered with Garuda Aerospace to promote the development of the drone ecosystem in India. This collaboration seeks to support India in realising its ambition to become a major global hub for drones by 2030.

Additionally, our investments in the upcoming avionics Maintenance, Repair and Overhaul (MRO) facility in India, set to be operational this year, underscores our commitment to delivering world class services to Indian airline customers while supporting the local industry.

Showcasing our commitment to India's growth story at Aero India 2025

The 'Aatmanirbhar Bharat' vision is at the heart of our growth story in India. Thales is proud to have steadily built advanced manufacturing capabilities, critical systems, and services in India through local teams and collaborations.

Our objective is not just 'Make in India' but also 'export from India', enabling the local industry to play a greater role in global markets. Over the years, we have established a team of over 2,200 employees who are working with Thales and its joint ventures in the country.

Moreover, Thales has formed various partnerships with public and private sector industries such as with Bharat Electronics Ltd, dedicated to radars among others. Additionally, we have also joined hands with Bharat Dynamics Limited, Kalyani Group and MKU.

With a growing network of over 75 qualified Indian suppliers, engaged in our global supply chain across defence and civil markets, generating more than 2,000 indirect jobs in India, Thales remains a trusted partner promoting sustainable manufacturing in the country for both India and the world.

As India progresses towards the vision of Viksit Bharat by 2047, Thales will continue to invest in our Indian growth story, bolstering our local teams, collaborations, and innovations for the future.

By Pascale Sourisse, President & CEO, Thales International

Dassault Aviation in 2024

Deliveries, order intakes and backlog in number of new aircraft as of 31 December 2024.

Aircraft delivered in 2024: 21 Rafale (14 France, 7 Export) were delivered, while 20 had been guided, versus 13 Rafale (11 France, 2 Export) delivered in 2023. 31 Falcon were delivered, while 35 had been guided, versus 26 Falcon delivered in 2023.

Aircraft ordered in 2024: 30 Export Rafale were ordered versus 60 Rafale (42 France, 18 Export) in 2023. 26 Falcon were ordered versus 23 Falcon in 2023.

Aircraft in backlog: As of 31 December 2024, the backlog includes 220 Rafale (164 Export, 56 France) versus 211 Rafale as of 31 December 2023. 79 Falcon versus 84 Falcon as of 31 December 2023.

GE Aerospace: Empowering India's defence industry with strategic collaboration

GE's F404 powers the Tejas LCA (Photo: Vayu)

Strategic partnerships are key drivers of success in the aerospace ecosystem. The right partner network is critical not only to provide access to technology, expertise and resources but also brings greater efficiency to the manufacturing process.

GE Aerospace has focused on building effective strategic partnerships to help address some of India's unique challenges. Over the last 10 years, we have worked with several large and small Indian companies to establish an aerospace supplier community in India. 13 Indian companies manufacture and supply commercial engine parts to our global factories. In addition, more than 200 local suppliers and partners provide small parts and materials to our Pune factory.

Strategic partnerships and collaboration

GE Aerospace's association with Hindustan Aeronautics Limited (HAL), the country's pre–eminent aerospace and defence manufacturer, goes back to the year 1986. As a partner to India's military aviation sector, the company has helped to adapt our engines and turbines—F404, F414, T700, LM2500, and LM500—for Indian defence projects.

Starting with working together on the Tejas programme to powering the first operational squadron of light combat aircraft (LCA) Tejas for the Indian Air Force, the partnership was extended in 2021 to power the Tejas LCA Mk1A. And with the MoU to produce F414 in India, we are further expanding the collaboration.

GE Aerospace has the license to implement repairs and overhauls of avionics suite of LRUs for the Hawk Mk.132 (Photo: Vayu)

GE Aerospace has also been instrumental in considerably expanding HAL's capabilities in maintenance, repair and overhaul (MRO) services. As an example, GE Aerospace entered a 30 year contract in 2010 for the license to implement repairs and overhauls of avionics suite of LRUs for the Hawk Mk.132 aircraft, which are the advanced jet trainers operated by the Indian Navy and Air Force.

Naval advancements

INS Vikrant is India's first indigenously built P–71 aircraft carrier, with 76% indigenous content. The Vikrant is equipped with GE Aerospace's propulsion equipment–LM2500 marine gas turbines–a critical component for the Indian Navy, well known for its lightweight design, fuel efficiency, durability, reliability and performance. Through a strategic collaboration, HAL assembles, inspects and tests these turbines. Our gas turbine module kits shipped to HAL also power the Navy's three P17 frigates–Shivalik, Satpura, and Sahyadri.

Indian Navy's IAC R11 Vikrant is equipped with GE Aerospace's LM2500 marine gas turbines (Photo: Indian Navy)

In 2023, we announced an MoU with HAL to mutually explore expansion of manufacturing capabilities for the LM500 marine gas turbine.

Developing skill–led manufacturing

To develop local manufacturing and assembly skills, we partner with local engineering academic institutions and help their students with knowledge and lab equipment. From time to time, we have invested in training technicians who were placed in our partner's factories. At our Pune factory, we have trained over 5,000 people in the last 10 years and equipped them with aero–engine and hi–tech manufacturing skills.

As the aerospace industry in India aspires for growth and excellence, GE Aerospace is committed to bring our best technology and training to our partners here.

By Rita Flaherty, Vice President, Global Defence Sales and Marketing, GE Aerospace

BEML and Balmer Lawrie & Company Ltd sign Strategic MoU

BEML Limited and Balmer Lawrie & Company Limited have entered into a strategic Memorandum of Understanding (MoU) to collaborate and leverage Balmer Lawrie's extensive logistics expertise to support BEML's operations. The MoU was officially exchanged between Mr. Shantanu Roy, Chairman and Managing Director (CMD) of BEML Ltd, and Mr. Adhipnath Pal Chaudhuri, CMD of Balmer Lawrie in the presence of Commodore A Madhav Rao, CMD of Bharat Dynamics Limited and Directors of BEML Limited, in a ceremony held at BEML's headquarters, attended by senior officers from both companies.

The primary objective of this partnership is to enhance BEML's business activities in the areas of sea and air shipments for the import and export of engineering goods, custom clearance, domestic transportation—including metro transportation—and providing operational support for BEML's Special Economic Zone (SEZ) warehouse in Bangalore.

Mr. Shantanu Roy, CMD of BEML Ltd, stated, "This MoU with Balmer Lawrie is a significant step toward streamlining our sea shipments for various business verticals, ensuring timely and efficient transportation of goods and aggregates required for our products. With over 150 years of proven expertise in logistics, Balmer Lawrie will undoubtedly play a crucial role in supporting our expanding business operations."

BEML regularly manages sea shipments for engineering goods, components, and CKDs, alongside other aggregates for its sectors, including mining and construction, railways, metro, and defence equipment. The agreement will also help in easing out air shipments for critical components, transportation of goods and equipment across India, and the export of earth–moving machinery to international markets.

This collaboration represents a significant milestone in BEML's commitment to enhancing its supply chain capabilities, ensuring smooth and efficient logistics solutions for its wide–ranging industrial and defense sectors.

BEML Limited is a leading multi–technology 'Schedule A' company under the Ministry of Defence, plays a pivotal role in serving India's core sectors like defence, rail, power, mining and construction by offering world class products. BEML operates in three verticals viz. Defence & Aerospace, Mining & Construction and Rail & Metro and has state–of–the–art manufacturing facilities located at Bangalore, Kolar Gold Fields (KGF), Mysore, Palakkad, with having very strong R&D infrastructure and nationwide network of sales and services.

Interview with Ludovic Dumont, General Delegate, MBDA India Pvt Ltd

***VAYU**: Can you briefly highlight the salient features of the MBDA Missiles Package for the Rafale Omni–Role Fighter and Rafale–Marine Variant, including the 'game–changing' Meteor BVRAAM, MICA Variants, Scalp Cruise Missile and the air launched Exocet AM39, and elaborate on their specific combat roles?*

India's Dassault Rafale combat aircraft provide the Indian Air Force not just with a fast and agile modern fighter but one that comes armed with a highly potent set of weapons from MBDA that are unrivalled by any of India's neighbours. The most famous of these weapons is the Meteor beyond visual range air–to–air missile, which is widely recognised as a game changer for air combat. The Meteor is powered by a unique rocket ramjet motor that gives Meteor far more engine power, for much longer than any other missile. This means it can fly faster, fly longer, and manoeuvre more than any other missile – giving Meteor the ability to chase down and destroy agile hostile fighters at even the furthers of ranges. As a result, Meteor has a no–escape zone many times greater than any other air–to–air missile. India's Rafale are also be equipped with the Scalp deep strike cruise missile from MBDA to strike hardened and protected targets deep inside hostile territory. The IAF's Rafale are also be equipped with MICA, a missile the Indian Air Force knows very well as it is also part of the upgrade package for the IAF's Mirage 2000 aircraft. MBDA is also proposing these weapons and the famous Exocet AM39 anti–ship missile for the Rafale M for the new Indian aircraft carrier.

***VAYU**: Can you update us on the integration for Wing–Top launch of the ASRAAM for the IAF's Jaguar Upgrade programme and the MICA Missiles for the upgraded Mirage 2000 weapons package?*

Alongside delivery for new IAF platforms, MBDA is also able to delivery major capability enhancements to the existing platforms of the Indian Air Force. The Mirage 2000 upgrade and the Jaguar upgrade programme are two notable examples of this. Here MBDA has delivered MICA air combat missiles for the Mirage 2000 upgrade, and has delivered ASRAAM missiles to upgrade the air combat capabilities of the Jaguar fighter fleet. These also boost the IAF's inventory and stockpile management, for MICA is now used across both the Mirage 2000 and Rafale fleet; while ASRAAM is to be used on Jaguar, Tejas and potentially further platforms in the future.

***VAYU**: Please update us on the collaborations with BDL, briefly tell us about the progress achieved with the BDL and MBDA Agreement signed earlier to establish a facility in India for the Final Assembly, Integration & Test (FAIT) of the Advanced Short*

Range Air–to–Air Missile (ASRAAM), which is slated to be integrated on the Tejas LCA Mk.1A?

MBDA and BDL have worked together for more than fifty years and produced more than 50,000 missiles together in India for the Indian military. Co–operation with BDL forms a key pillar of MBDA's strategy and commitment to Atmanirbhar Bharat in partnership with Indian Defence Public Sector Undertakings (DPSUs) and industry. MBDA and BDL are making very good progress on our joint undertaking to establish facilities for the assembly, integration and test (FAIT) of ASRAAM air–to–air combat missiles in India for the Indian Air Force.

VAYU: Elaborate on MBDA's Next Generation Missiles being developed for Futuristic Programmes?

MBDA is a recognised world–leader in the field of missile technologies and we are constantly conducting research and development to enhance the capabilities of our customers' systems. This we are doing across the full spectrum of products, from lightweight anti–tank systems, to next generation naval and air systems, and we look forward to discussing them with our Indian partners.

VAYU: Tell us about the Mistral ATAM launcher integrated on the Prachanda LCH and ALH Rudra WSI helicopters, covering the firing of the Mistral missile from the Light Combat Helicopter (LCH) and its collaboration with BDL?

The Mistral ATAM air–to–air missile launcher has been delivered to India to equip the ALH and LCH. The system is based on two launchers each deploying two MBDA air–to–air Mistral missiles. Given the wide range of roles that these helicopters will have to undertake, Mistral will provide the helicopter's crew with a weapon that is not only easy to use but one that can be operated in the whole flight envelope from nap of the earth to 15,000ft and at flight speeds from hovering to up to 200 knots. The system has already been successfully integrated on the LCH and ALH platforms manufactured by HAL. Mistral has proven itself a major success story with a 96% success rate in all firings.

VAYU: Briefly tell us about the CAMM/Sea Ceptor Missile offered by L&T–MBDA to the Indian Navy, and also about the SCALP Naval and VL MICA NG Missiles?

The Sea Ceptor naval air defence is being offered to the Indian Navy for its SRSAM requirement by our Indian joint venture, L&T MBDA Missile Systems Ltd in accordance with our support of Atmanirbhar Bharat. Sea Ceptor is a highly advanced naval weapon system that features futuristic technologies such as high levels of autonomy and intelligence through both the missile and the wider system. These features enable the Sea Ceptor system to autonomously prioritise threats and intelligently optimise the allocation of missiles within an engagement to maximise operational effectiveness – and so provide the very highest level of protection from air attack for Indian sailors.

VAYU: Update us on the 5th Gen ATGM5 offered by the MBDA–L&T Joint Venture in India?

L&T MBDA Missile Systems Limited (LTMMSL) has a clear vision regarding the development and manufacture of ATGM5 in India, as this fifth generation weapon or family of weapons matches the requirements and specifications of the Indian Armed Forces. LTMMSL is committed to the Government of India's drive towards the indigenisation of the defence sector under the Make in India initiative, and to create a robust industrial eco system for the integration of ATGMS in India, across a wide spectrum of advanced technologies. The LTMMSL is committed to ensuring that India will have the highest level of operational independence in the use of an ITAR–free missile.

VAYU: What are MBDA's future expansion plans in India and its engagement with Indian vendors to expand the supplier base?

MBDA have a wide base of suppliers and partners in the Indian defence ecosystem and is proud of our long history of Make in India in support of the Indian Armed Forces. Aligned with our support of Atmanirbhar Bharat, MBDA is always looking to strengthen and deepen our footprint in India.

VAYU: Which MBDA Missile Systems exhibits are going to be displayed at Aero India 2025 at Bengaluru?

MBDA will be displaying its full range of the newest complex weapon systems to meet the requirements of the Indian Armed Forces. Befitting Aero India, a particular focus will be on MBDA designed weaponry for the needs of the Indian Air Force – including famous systems such as the Meteor beyond visual range air–to–air missile or the Scalp air launched deep strike missile.

Interview with Nikhil Joshi
Managing Director, Boeing Defence India

***VAYU**: Boeing has a long standing presence in India's defence sector. How has this history influenced the company's strategic approach to supporting India's defence modernisation and operational readiness today?*

NJ: Boeing's legacy in India, spanning over 80 years, has solidified our role as a trusted partner with unparalleled experience in supporting the Indian Armed Forces. This extensive history has been instrumental in shaping our strategic approach, ensuring that we not only provide platforms but also offer tailored, mission–ready solutions that align with India's defence modernisation objectives. The establishment of Boeing Defence India (BDI) in 2017 further reinforces our commitment to India by focusing on strengthening in–country capabilities and advancing operational readiness through localised support and collaboration. This effort aligns with India's broader goals, such as the Make in India initiative, and leverages Boeing's global technical expertise to address evolving defence and national security priorities. Our continued investment in local infrastructure and partnerships ensures that we remain a pivotal player in India's defence modernisation journey while contributing to self–reliance in aerospace and defence.

***VAYU**: With India's rapid defence modernisation, how is Boeing ensuring that its platforms are not only available but optimised for long term performance in the field?*

NJ: To ensure long–term performance, Boeing integrates comprehensive, cost–effective support solutions through frameworks like Performance–Based Logistics (PBL), which enhance fleet availability and reduce lifecycle costs. Boeing Defence India (BDI) plays a crucial role by providing timely maintenance, repairs, and access to advanced technological solutions that support mission readiness. Our PBL approach, including Next Generation Product Support, ensures optimal

performance by minimising downtime, maximising asset lifespan, and improving operational effectiveness. This holistic lifecycle management, which has already proven successful for platforms like the C–17 under our Globemaster Integrated Support Programme (GISP), ensure that the platforms continue to deliver high performance for years to come, contributing to the Indian Armed Forces' ability to safeguard national security. The overwhelmingly positive feedback we receive from our defence customers in India further reinforces the value our platforms and support solutions bring to their missions.

***VAYU**: How does Boeing view the convergence of civil and defence MRO efforts in India, and what are the strategic advantages of this approach?*

NJ: The convergence of civil and defence MRO efforts is a strategic move that allows for shared resources, expertise, and infrastructure, driving cost efficiency and reducing turnaround times. Boeing sees this integration as an opportunity to introduce defence–grade technologies into the civil aviation sector, fostering innovation and strengthening India's overall aviation ecosystem. By expanding the MRO footprint, we are not only supporting defence needs but also positioning India as a global hub for aerospace services, furthering the country's aspirations for self–reliance in both sectors.

***VAYU**: How is Boeing ensuring the P–8I fleet in India stays technologically advanced? How is Boeing preparing its support systems to address future challenges and complexities?*

NJ: In January 2024, Prime Minister Modi inaugurated the new state–of–the–art Boeing India Engineering & Technology Centre (BIETC) campus in Bengaluru. Built with an investment of $200 million, the 43–acre campus is Boeing's largest such investment outside the US and will become a cornerstone for partnering with India on next–generation products and services for the global aerospace and defence industry. The centre houses a talented pool of 6,500+ engineers and innovators across Bengaluru and Chennai who are helping drive innovation in aerospace. These technologists undertake high quality, advanced aerospace work and offer engineering expertise to Boeing's defence, space, and commercial businesses, spanning engineering design of structures and systems, manufacturing support, developing systems to test our aircraft, and providing digital solutions to our airline customers.

Cutting–edge R&D in traditional and emerging areas is performed at the centre, including next generation airplane health management, environment friendly coatings, advanced networks, and secure communications where teams leverage new age technologies such as Artificial Intelligence, Machine Learning, Internet–of–Things, Cloud, Model–Based Engineering, and Additive Manufacturing through our offerings like Next Generation Product Support (NGPS), to enhance quality, safety, and productivity, and above all, mission capability and readiness.

In India, Boeing is driving innovation that is transforming the aerospace and defence sector, and we are proud that our team here is now an integral part of the Boeing global engineering ecosystem and India's global technology capabilities. Boeing continues to invest in in next generation technologies and support solutions that enhance operational efficiency and adaptability. We are focused on building scalable, flexible support models that can quickly respond to changing defence needs, especially with the integration of advanced technologies like artificial intelligence, machine learning, and autonomous systems. Additionally, our continuous collaboration with Indian partners ensures that we remain agile in the face of evolving geopolitical and technological challenges, keeping Boeing's service support at the cutting edge of operational effectiveness.

(All photos: Boeing)

Lockheed Martin brings 'Vast Experience System' to Aero India 2025

Lockheed Martin is unveiling its immersive 'Vast' experience system in India for the first time at the 15th biennial edition of Aero India taking place at Yelahanka. The company is highlighting its vision for 21st Century Security solutions with a focus on integrated capabilities on offer to the Indian Armed Forces.

The immersive Vast experience is the prime attraction at the Lockheed Martin booth, providing visitors with access to a system that brings multi–domain missions to life through interactive 3D visualisations.

The company's exhibit also showcases its most innovative capabilities, including the C–130J Super Hercules tactical airlifter, F–21 fighter aircraft, MH–60R "Romeo" multi–mission helicopter, Javelin weapon system and S–92 multi–role helicopter among others.

"Aero India has been a leading platform for Lockheed Martin and the aerospace and defence sector for many years, and we look forward to our participation this year with the Vast Experience System," stated William L. Blair, vice president and regional chief executive, Asia and India, Lockheed Martin. "Building on our deep partnerships with the Indian industry, we look forward to showcasing some of our advanced capabilities that address our customers' biggest challenges for the 21st Century and grow our presence and partnerships that support greater self–reliance in the defence sector."

Boosting Lockheed Martin's presence at the show is the C–130J Super Hercules aircraft model which represents a strong legacy of partnership with the Indian defence industry. The Indian Air Force operates 12 C–130Js to support a variety of tactical airlift missions. India also is connected to the C–130J through Tata Lockheed Martin Aerostructures Limited, a joint venture that has the distinction of being the single global source of C–130J empennage assemblies included on all new Super Hercules aircraft.

In 2024, the company expanded its commitment to India through a teaming agreement with Tata Advanced Systems Limited to expand upon the companies' business relationship through the C–130J Super Hercules tactical airlifter on future potential business opportunities to include: Establishing a Maintenance, Repair and Overhaul (MRO) facility in India to support the IAF's existing fleet of 12 C–130Js as well as other global Super Hercules fleets; Expanding C–130J manufacturing and assembly in India to produce aircraft for the IAF's MTA programme, subject to US and Indian government approvals.

An F–21 fighter aircraft model, which is on offer to the Indian Air Force (IAF) for the Multi–Role Fighter Aircraft competition, is configured with the latest sensors and mission avionic systems that couple on–board and off–

Javelin, the world's most versatile, one–man–portable and multi–purpose weapon system, is also part of Lockheed Martin's exhibit at Aero India. The anti–tank weapon system can be deployed by its traditional man portable manner as well as from multiple platforms and used during the day, at night and in any kind of weather. Using fire–and–forget technology, Javelin provides operational flexibility so that operators can rapidly engage and then move on to a new firing position, affording the highest level of survivability to the user.

The S–92 multi–role helicopter is connected to India through the Tata Sikorsky Aerospace Limited, a joint venture that has the distinction of being fully integrated into Lockheed Martin's global supply chain for manufacturing aerostructure components for the S–92 helicopter.

Lockheed Martin continues to build upon more than three decades of partnerships and seven decades of association with India by nurturing and expanding collaborations with local industry to support the foundation of indigenous defence manufacturing ecosystem.

Today, the company's presence has moved beyond defence systems to provide technical support, apprenticeships, fostering positive change and inspiring the next generation from under–represented communities to build sovereign capabilities through industrial partnerships and human capital development.

Text courtesy: LM

board data information into an effective, easy to manage combat situation display. F–21 is the ideal solution to meet India's fighter force structure, affordability, and 'Make in India' and "Skill India" requirements.

The MH–60R "Romeo" SEAHAWK helicopter occupies a prominent place at Lockheed Martin's Aero India display. The MH–60R is the most capable and mature Anti–Submarine (ASW)/ Anti–Surface Warfare (ASuW) multi–mission helicopter available in the world today.

Ten MH–60R helicopters are presently available to the Indian Navy for operations. A total of 24 MH–60Rs will be delivered to India over the next year.

IAI launches innovation acceleration programme: NeuSPHERE

Israel Aerospace Industries (IAI) launched its NeuSPHERE Innovation Acceleration Programme in India on 25 November 2024. Rooted in IAI's

commitment to promoting technological leadership, the NeuSPHERE Programme provides a platform for Indian deep–tech startups to co–create cutting–edge innovation, accelerate their growth and expand globally.

IAI's NeuSPHERE Innovation Acceleration Programme focuses on the Indian technology startup community, in particular inventive deep–tech startups

focusing on big data, signal and image processing, advanced navigation systems, AI and autonomy, XR–maintenance and training, green energy, advanced production, quantum, edge computing, Human Machine Interfaces and wearable technology. It will provide the participating Indian startups access to advanced resources and technologies, including global mentorship and guidance, networking and funding, to accelerate their market–ready solutions.

Through IAI's NeuSPHERE Programme, IAI reaffirms its commitment to India's innovation ecosystem, propelling Indian startups towards global competitiveness and technological excellence.

Brig. Gen. (Res) Eytan Eshel, Executive Vice President of Technology, Chief Technology Officer (CTO), R&D and Innovation of IAI stated, "The NeuSPHERE Innovation Acceleration Programme in India is a significant step towards fulfilling IAI's strategic vision of collaborating with India's startup ecosystem. We recognise the tremendous technology talent in India and are very excited about this programme and to work together to help these companies scale their offerings. This programme is part of our efforts to create a worldwide network of technological excellence and drive forward the future of aerospace and defence."

Rafael's focus at Aero India 2025

As Rafael commemorates nearly 30 years of collaboration in India, we reflect on a journey marked by shared success and deep rooted partnerships. Over the decades, we have delivered advanced, combat proven systems that continue to serve India's defence forces, a testament to the resilience and reliability of our solutions.

Our enduring commitment to India is more than just operational—it's strategic. Since 2014, Rafael has fully embraced the Make in India initiative. Through our subsidiaries, Kalyani Rafael Advanced Systems (KRAS) and Astra Rafael Comsys (ARC), we have heavily invested in local manufacturing, technology transfer and knowledge sharing. This collaboration not only is designed to enhance India's defence capabilities but also contributes significantly to its economic growth and self–reliance.

At Aero India 2025, Rafael is showcasing its latest advancements in air defence, precision guided solutions and electronic warfare. Our focus remains on innovation, driven by substantial R&D investments to provide cutting edge technologies that secure critical assets while fostering local Indian partnerships.

Looking ahead, we envision India becoming a global hub for defence exports, a transformation supported by robust ecosystems we help create. The modernisation and growth of India's defence industry inspire confidence, and we at Rafael are proud to stand alongside our partners on this remarkable journey.

We are deeply grateful for the trust and collaboration we have shared over the years. As we continue to innovate and grow together, Rafael remains committed to strengthening its partnerships with the Government of India, the Ministry of Defence, and our esteemed local partners.

Here's to many more years of shared success and innovation!

Text courtesy: Rafael
Images: Vayu

Interview with Abhishek Singh

SVP – India and SE Asia, BD & Future Programmes (Defence), Rolls–Royce

***VAYU**: How is Rolls–Royce contributing to India's aspirations of expanding manufacturing and defence exports?*

Rolls–Royce sees India as a significant opportunity for growth and expansion of its global supply chain, specifically in the A&D sector. We work with a large set of supply chain partners, with a sharp focus on enhancing manufacturing capabilities and integrating them into the global supply chain ecosystem. We continue to strengthen and grow these partnerships, in line with the 'Make in India' initiative.

Ours is the original 'Make in India' story which started 68 years ago when we partnered with Hindustan Aeronautics Limited (HAL) for licensed production of our engines within the country. We have a strong joint venture with HAL called International Aerospace Manufacturing Pvt. Ltd. (IAMPL), which manufactures aero–engine components for defence, civil and business jets. Our other joint venture with Force Motors, called Force mtu Power Systems, produces mtu Series 1600 engines and complete generator sets at the Export Oriented Unit in Chakan near Pune, for both Indian and global markets.

We are also proud of our engineering capabilities in India, with 2000 high skilled engineers working in–house and through outsourcing agreements on various global development programmes. Overall, more than 3000 people work across the Rolls–Royce ecosystem in India, including our own businesses, supply chain partners and JVs.

***VAYU**: Tell us about Rolls–Royce's proposal for India's AMCA programme?*

Our presence in India spans over 90 years, and we have continued to support the Indian Armed Forces with complex power and propulsion solutions. Rolls–Royce has also successfully transferred combat jet engine technology in India, enabling manufacturing, assembly and testing capabilities in–country. Today, we are well positioned in the region with a strong ecosystem of strategic partnerships, skilled talent, digital solutions, service delivery, robust supply chain and manufacturing.

We are keen to participate in co–development opportunities that will create both technology and capability in India, and help accelerate India's vision of self–reliance in defence. Our proposed combat aircraft engine co–development model will offer India an opportunity to create and own intellectual property (IP) for critical combat engine technology, allowing future upgrades and exports. Such a partnership will ensure the transfer of both know–how and know–why that will support and facilitate future development programmes. This will also enable the supply chain ecosystem and defence production capabilities for combat engines in India including aftermarket support, with significant potential to generate job opportunities.

This is in contrast with the license–to–build approach where IP is owned by the OEM (Original Equipment Manufacturer) resulting in limited or no in–country

capability development for India. We are offering a collaborative model for bespoke combat engine, development and lifetime support to suit India's requirements.

Such a programme, with the full support of the UK Government, would deepen defence cooperation between India and the UK. The UK is a strong and natural ally for India in pursuing the co–development of combat engines. The recent 2+2 dialogue and other engagement between the two nations further underscore the commitment to a comprehensive and strategic India–UK partnership.

The time is opportune to take this partnership to the next level through co–creation of critical technologies that the UK is well placed to offer. Rolls–Royce, with its long standing relationship with the Indian Armed Forces, stands ready to be the industry partner of choice to collaborate with Indian partners to deliver this vision.

***VAYU**: How is Rolls–Royce supporting the Adour engines in service with the Indian Air Force?*

As the Indian Air Force undertakes its modernisation programme, Rolls–Royce is committed to providing it with the best value, and highest quality products possible. The Adour Mk 804/ Mk 811 was made, and continues to be supported in India by Hindustan Aeronautics Limited (HAL), with Rolls–Royce support. We are committed to this partnership and will continue to support today's fleet, including the Adour Mk 804/ Mk 811 through diligent planning and mutual cooperation of IAF, HAL and Rolls–Royce.

Rolls–Royce and HAL have partnered to 'Make in India' engine parts for Adour engines, supporting their long–term sustainment for both Indian and global customers. Additionally, we also manufacture Adour engine components with various partners in India. This further underscores our efforts to expand indigenous production capabilities while ensuring the operational readiness and performance of the Adour engine fleet, ensuring the highest level of support for these engines until the end of their service.

***VAYU**: Tell us about the partnership that Rolls–Royce announced with TCS for hydrogen fuel systems for sustainable aviation.*

Rolls–Royce is committed to becoming a net zero company by 2050 and supporting our customers to do the same. We are improving the efficiency of our products, proving compatibility of our engines to alternate fuels and collaborating with partners to enable the energy transition journey.

Our partnership with Tata Consultancy Services (TCS) involves research into hydrogen fuel system technology, continuing to prove hydrogen could be a zero carbon aviation fuel of the future. With the support of TCS, we want to address three key challenges in the journey to enabling hydrogen for use in aviation: fuel combustion, fuel delivery and fuel systems integration with an engine. Additionally, Rolls–Royce and TCS have been working together since 2010 in the areas of design, manufacturing engineering, control systems and software, after–market services as well as IT services.

This partnership with TCS highlights Rolls–Royce's commitment to driving sustainable transformation across industries and supports the broader mission of using advanced technologies to make a positive societal impact. It is a crucial step in advancing these sustainability goals, positioning the company at the forefront of the industry's efforts to reduce environmental impact and contribute to a sustainable future in aviation.

Lockheed Martin's C–130 Hercules 70 Years Strong and Growing!

Left: KC–130J Super Hercules of the USMC and Right: The "Fat Albert" C–130J of the US Navy.

The ever enduring C–130 Hercules celebrated 70 years of unwavering service last year. Since its inception in 1954, the Hercules continues to be used in over 70 countries with more than a million flight hours and growing.

Seven decades ago, the C–130 had an original usage as a medium cargo plane able to land in short, confined runways. As the mission and needs of the fleet changed, the aircraft moved into providing tactical airlift, humanitarian aid, air support and various mission support across the globe.

The C–130 has had over 70 variants, 15 of which are actively being produced by Lockheed Martin today, and is distinguished by having the longest continuous military aircraft production run in history. From aerial command centres to weather observation and, occasionally, an aerial drone carrier, the Hercules meets the needs of the fleet. The C–130 has lent its services to nearly every mission capability needed for military or civilian application.

The US Navy and Marine Corps employ multiple variants to provide assault and logistics support, including the KC–130J "Super" Hercules. This "super" plane includes the troops and cargo transport capabilities of other C–130 variants and adds air–to–air refueling capability for helicopter, fixed wing and tiltrotor receiver aircraft to its mission.

One standout variant is the C–130J assigned to the US Navy Flight Demonstration Squadron. Affectionally named Fat Albert, the C–130 made its Blue Angels debut in 1970 and continues to fly alongside F/A–18E Super Hornets in airshows around the world.

The C–130 is responsible for supplying mission critical troops and materials in every American military conflict since the mid–20th century. This stellar aircraft can deliver a variety of airlift support, including parachute or ground delivered combat troops or cargo, such as vehicles, supplies and evacuation support.

Indian Air Force C–130J–30

"There is no more versatile aircraft than the C–130," stated Col. Steven Puckett, programme manager Tactical Airlift Programme Office (PMA–207). "As a C–130 pilot and now the programme manager for Navy and Marine Corps variants of the platform, maintaining the combat relevance and reliability of this critical logistics support aircraft is my organisation's highest priority."

Tactical Airlift Programme Office manages the cradle to grave procurement, development, support, fielding and disposal of the Navy's tactical airlift platforms, including the C–130.

Text courtesy: Lockheed Martin

Thales Compact 2D AESA Airborne Surveillance Radar AirMaster C

Increasing complex environments in which armed forces carry out their operations, combined with the growing challenge to train qualified personnel, have put significant strains on airborne surveillance crew. Demand across the world, for multi–role helicopters, light ISR aircraft and unmanned platforms, has increased and broadened the workload among crews.

AirMaster C is designed to minimise its footprint onboard platforms. A true single unit design, AirMaster C is 30% lower in size, weight and power requirements compared to other market offers today. The fixed panel design includes both the antenna and data processing to deliver a simple to integrate, simple to install radar. When connecting multiple panels to achieve surveillance capability beyond 120°, standard optical cabling is used to simplify routing. Optical cabling contributes to minimising weight and simplify maintenance.

AirMaster C is developed as a smart radar to take the burden away from the crew. "4P Polarisation" automatically delivers improved clarity of image and "Dual–Range" allows the operator to see targets at long range and very close, simultaneously. Sensor autonomy, self–learning and the capability to analyse and classify large volumes of data, all work to increase the radar ability to perform a high number of detection, identification and surveillance tasks. Operators can focus on the outcomes for faster, more accurate decision making.

Predictive maintenance, combined with AESA technology, ensures high mean time between failure and critical failure. The health and usage monitoring system supports maintainers in determining where the next issues are likely to occur and fix them before they do. Should the radar experience a failure during a mission it is designed to continue functioning with a minor performance reduction thanks to a graceful degradation mechanism.

Thales has built on the successfully proven experience of the AirMaster Series radar I–Master and Searchmaster to deliver a more compact 2D AESA fixed–panel radar with state–of–the–art enhancements.

Thales in India

Thales has been present in India since 1953. Headquartered in Noida, the company has other operational offices and sites in Bengaluru, Hyderabad, Mumbai and Pune among others. 2200 employees are working with Thales and its joint ventures in India.

India's "Make in India" policy is fully supported by Thales. The company's strategy of developing industrial footprint in India is in line with the government's aim to develop the defence base of the country. With this as the backdrop, Thales has formed various co–operative partnerships with public and private sector industries, bringing in its expertise in delivering high end technology solutions.

Hindustan Aeronautics Limited (HAL): Thales has been working closely with HAL for over 50 years and provide high end avionics to equip the platforms that HAL designs.

Bharat Electronics Limited (BEL): Incorporated in August 2014 as BEL–Thales Systems Limited (BTSL), this JV is dedicated to civilian and select ground based military radars.

Reliance Aerostructure Limited: Created in 2017, this JV with Reliance Aerostructure leverages Thales' offset commitment as part of the Rafale contract, developing Indian capabilities to integrate and maintain radar and electronic warfare sensors. Other co–operations include Bharat Dynamics Limited, Kalyani Group and MKU among others.

News from Saab

Gripen E debut at CRUZEX

Saab's fighter jet was a highlight at CRUZEX 2024, the largest multinational operational training exercise in Latin America, organised by the Brazilian Air Force (FAB). Over two thousand military personnel from Brazil and 15 other nations from across Latin America, Africa, Europe and the United States gathered for one of the largest operational air exercises in the Southern Hemisphere, CRUZEX 2024.

Held late last year at the Natal Air Base in Rio Grande do Norte, Brazil, the exercise featured over 100 combat aircraft. The main highlight of this edition was the debut of the F–39E Gripen in high complexity scenarios. As the most advanced fighter in service in Latin America, F–39E Gripen executed a broad range of tasks in Composite Air Operations (COMAO), where a large number of aircraft with different objectives operated simultaneously against an enemy to saturate its defences, enhancing mission efficiency.

In operation since December 2022, F–39E Gripen incorporates cutting edge technologies, some of which are unprecedented in the Brazilian Air Force, such as the Active Electronically Scanned Array (AESA) radar and the Infra–Red Search and Track (IRST) passive targeting sensor. These sensors, along with its manoeuvrability, performance, communication, navigation, and electronic warfare systems, position F–39E Gripen as a strategic capability for maintaining the sovereignty of Brazilian airspace.

Saab's autonomous swarm technology

Saab's Autonomous Swarm technology recently featured in the ground breaking Project Convergence 2024 trials, consisting of one month in the United States. A large UK team, comprising 40 employees from Saab owned BlueBear and UK MoD Defence Science and Technology Laboratory (Dstl) personnel, demonstrated the ability to deploy interoperable AI within Autonomous Swarms of Uncrewed Aircraft Systems (UAS).

At the core of BlueBear's AI–enabled autonomy solution is the ability to 'hot–swap' AI from any supplier in an autonomous systems–of–systems. This technology is key to unlocking the game changing potential of deployed networked sensors and effectors in an integrated multi–domain battlefield.

Autonomous capability for naval vessels

Saab has presented Autonomous Ocean Core, a ready–to–use autonomous control system to provide autonomy capabilities to surface and subsurface naval platforms in military and civilian missions. Autonomous Ocean Core is a vessel agnostic control system with an open architecture, designed to make vessels autonomous to enhance their mission success at sea. It provides baseline autonomy, including vessel control, to platforms on or below the ocean surface and allows operators to add additional capabilities continuously without losing built–in safety functions.

Modernising Sweden's coastal anti–ship missile capability

Saab has signed a contract with the Swedish Defence Materiel Administration regarding the modernisation of Sweden's coastal anti–ship missile capability. The total order value is SEK 800 million and deliveries will begin in 2026. The majority of the order intake was booked in the third quarter of 2024. The contract includes Saab's RBS15 Mk3 anti–ship missile integrated on a launcher module installed on a truck.

Exercise Pitch Black 24 in Australia

Italian Navy F–35B and IAF Su–30MKI during Pitch Black 24.

Marina Militare/Indo–Pacific campaign

An epochal date, this 1 June 2024 could not be defined otherwise, when the 31st Naval Group set sail from the Taranto base with the wishes of good winds from the Chief of Staff of the Navy Admiral Enrico Credendino and the Commander in Chief of the naval team Admiral Aurelio De Carolis,

The Cavour aircraft carrier accompanied by the Alpino frigate, have an important job to do, a world first for the Marina Militare (MM), an imposing but very demanding project that will require the maximum commitment of men and vehicles for 5 long months, but as history teaches us the challenges and objectives are prestigious, the greater the commitment will be to achieve success.

The target is really important, the 31st Naval Group in its long mission will be engaged in various exercises and will touch several countries, among the most important exercises we undoubtedly mention Pitch Black 2024 in Australia, a biennial exercise organised by the Royal Australian Air Force (RAAF), then sending the PPA Montecuccoli, the MM participated in the RIMPAC exercise (Rim of the Pacific), the largest biennial international maritime exercise in the world, organised

by the US Navy, and in the Pacific Dragon (again with the Montecuccoli ship), another maritime exercise international, every two years organised by the US Navy with the collaboration of the Japan Maritime Self Defense Force and the ROK Navy (Republic of Korea Navy), and interactions with the US Navy.

But it is on Pitch Black 2024 that we want to focus in this article, an exercise which saw the participation of 20 countries, Italy, Australia, France, Germany, India (with 6 Sukhoi Su–30MKI), Indonesia, Japan, Malaysia, Philippines (with the brand new FA–50), Papua New Guinea, Republic of Korea, Singapore, Spain, Thailand, UK, USA, Brunei, Canada, Fiji and New Zealand.

Our task is to document some activities regarding the exercise and document the activities of the MM (and of the AM in an article dedicated to it) with its own aerotactic component on board, i.e. the Grupaer, in this case truly a world first with the last jewels delivered, i.e. the F–35Bs, the objective to be achieved is "simple", that is to develop cooperation and interoperability and interchangeability in a multinational and inter–force context, remembering that Italy with the embarked components of MM and AM is among the few countries in the world capable of redeploying 5th generation aircraft with their own component on board.

As you well know, it is not possible for us to publish the precise units of the aircraft embarked, but the Cavour

ship has reached the considerable number of 13 aircraft embarked between F–35B, AV–8B and a two–seater TAV–8B aircraft, while the AM naturally reached the base autonomously doing more stages accompanied by KC–767A refuelers.

Arriving at the Darwin base, one realises an aspect that is always rarely highlighted, namely logistics.

Preparing such a large number of men, vehicles and equipment in areas located well beyond our borders in a short time has now become an essential skill to acquire, and here in Darwin all the men of the MM and AM are working to prepare communications, equipment, containers, armaments, spare parts etc., it is like a world within a world, but it is essential that everything proceeds smoothly to allow our pilots to operate as planned from 12 July to 2 August 2024 and so it was.

Living everyday life with specialists, pilots, crew members and being "accepted" gives you a different perception of their work, one of the things that impressed us most is that even when everything seems perfect in reality it isn't, a myriad arrives of problems, of variables, of misunderstandings, and this happens everywhere, but what is striking about all this?

That all this is addressed and resolved every time, the problems are addressed, the misunderstandings pass, the variables evaluated and resolved, a total reliability of the entire ship system and its air component which has practically reached 100% reliability.

Daily missions flown by blocks of 2–4–6 aircraft for the F–35Bs and AV–8Bs, (all AV–8B pilots will then transition to the F–35Bs), night missions, COMAO of over 30 airplanes, impressive to see sometimes even 20–25 airplanes waiting on secondary runways or connections to obtain take–off authorisation, a curious note is that Darwin airport, being also a civil airport, also accepts the landing of small aircraft, and it was not uncommon to see 15–20 aircraft remaining waiting even for 15/20 minutes stopped because a small tourist plane had to land, something like that was unthinkable for our mentality.

As regards the MM aircraft, we must say that the F–35B component operated only from Darwin except for a couple of occasions while the AV–8B component operated both

from the Australian base of Darwin and from the Cavour ship depending on the exercise phases. GrupAer's F35B aircraft, (data exclusively from the first week of activity) flew DACT (Dissimilar Air Combat Training) missions with Australian F35, USAF F22, Korean F15, Australian F18, IAF Su–30, Indonesian F16 and Japanese F2 aircraft.

BFM (Basic Fighter Maneuvers) with Japanese F2s, IAF Su–30MKIs, French Rafales, the AV8Bs also flew BFM missions, in practice these are close air combat, with Malaysian F18D aircraft, Italian F2000s, DACT missions with Philippine FA50s, F35s and Australian FA/18Fs, with missions lasting from one to two hours but which could be extended with the aid of in–flight refueling (almost all the tanker aircraft were based at Amberley).

The latest data available is the RANGE FAM missions (5 missions during the first week of exercise) flown for the MM by both the F35B and AV8B, these are familiarisation flights at a range, justified by the fact that both types of aircraft they carried out drops of inert armament (MK82) 500 lb BDU45B, (in practice the inert bombs are equipped with a precision GPS/laser guidance kit).

Two days before the end of the exercise, the AM personnel arrive on the Cavour aircraft carrier and will have to support the flight activities for the two AM F35Bs, which will continue the campaign together with the MM personnel.

The Pitch Black 2024 exercise ends on 2 August 2024 with a beautiful ceremony and exchanges of gifts by the pilots of the various air forces who participated and for the MM/GrupAer component it is the time to draw up an undoubtedly very positive summary of the Carrier Strike Group and the exercise.

Tracing the official data in 22 days of training activity for the Air Wing, he reached 180 hours of flight, conducted 110 missions including (as mentioned above) BFM, DACT missions, in–flight refueling, take–offs, landings, air, air, air ground, and command and control, SEAD.

Commander of GrupAer CV Gianbattista Molteni released the following statement: "Finding ourselves planning and flying missions, some of which were very demanding, represented an opportunity for growth for each of the pilots assigned to the Group and for the specialist staff operating from the ground. We were able to fly in packs of 40 or more aircraft, including American F–22 fighters, Singaporean F–15s and Indian Su–30MKIs, dealing with different tactics and procedures, refueling from tanker aircraft of various nationalities within an airspace as large as half the size of France, in the presence of air–to–ground polygons and emitters of all kinds. The collaboration with our Air Force colleagues with whom we operated in an effective, synergistic and interchangeable manner was also fundamental and constructive, to consolidate the national 5th generation expeditionary sea–based capability" stated Captain Gian Battista Molteni, Commander of the Embarked Air Group, on the sidelines of the closing ceremony of the exercise, which took place at the Australian Air Base in Darwin.

The exercise was certainly preparatory for obtaining the IOC, as confirmed by the CV Dario Castelli, Commander of the embarked Airwing, in this regard he specified that:

"The IOC of the F–35B component will allow us to operate with the Allies, ensuring complete interoperability and interchangeability. From this perspective, our participation in the Pitch Black 2024 exercise allowed us to increase and strengthen the ability to project air–naval power from the sea, even in theatres located at greater distances than the Wider Mediterranean and for prolonged periods of time. I underline that currently our country is the only one in Europe capable of expressing a credible projection capability from the sea based on a 5th generation aircraft such as the F–35B".

The Navy pilots also played the role of Mission Commander in some COMAOs made up of over 30/35

aircraft of different generations and different nations. Air Commodore Pete Robinson, Commanding Officer of the PB24 exercise, also valued the participation of the Italian component during his speech at the end of the exercise, highlighting that the Cavour aircraft carrier played an extremely important role, forging a realistic scenario in line with the current operational theaters.

The Cavour aircraft carrier was used as a command and control platform planning and coordinating some air operations, sharing the tactical situation in Italy every day with CINCNAV (Command in Chief of the Naval Squadron) and COMCOA (Command of Air Operations).

Naturally, in addition to civilians, numerous authorities had the opportunity to "see" our flagship up close, including the Governor General of Australia, Hon. Samantha Joy Mostyn, the Australian Deputy Prime Minister and Minister of Defense, Hon. Richard Marles, the Governor of the Northern Territory, Professor Hugh Heggie, the Minister for Education, the Hon. Mark Monaghan, the Chief of Defense Staff, Admiral Cavo Dragoon, accompanied by senior authorities from Australian Defence, the Navy and the Air Force and the Italian Ambassador to Australia Paolo Crudele. Our personal experience ends here, and we return to Italy, but for the CSG the commitments

will continue and will touch other nations such as Japan, the Philippines, Singapore, India, Pakistan, Oman and Saudi Arabia allowing it to continue carrying out all the training activities that will involve the naval part and the embarked CSG, remembering that the two F35B AMs will also remain operational on board until the end for perfect integration between the FAs.

It did not surprise us, in fact, a few weeks after our return to learn from the MM press release that:

"Following the results obtained by the Carrier Strike Group and the achievement of the objectives of the embarked aerotactic component, today we can declare the achievement of the Initial Operational Capability (IOC) of the 5th generation national expeditionary sea–based capability".

This is what was announced by the Chief of Staff of the Navy, team Admiral Enrico Credendino on board the Cavour aircraft carrier, moored at the Yokosuka Naval Base, in Japan, as part of the Carrier Strike operational projection campaign in the Indo–Pacific National group.

The Initial Operational Capability of the F–35B component – obtained after over 2600 hours of flight and 2700 maintenance interventions – attests to the ability to express, through the 5th generation aircraft embarked on the Cavour aircraft carrier, offensive and defensive missions to counter the air threat, of engaging land and naval targets and suppressing enemy air defences, projecting itself with the Carrier Strike Group into remote areas and in complete logistical autonomy.

The F–35B flight group established on the Cavour aircraft carrier, which achieved this significant milestone, is made up of aircraft from the Navy's Embarked Aircraft Group and the 32nd Wing of the Air Force. The Navy and Air Force have achieved a growing synergy in recent years, culminating in the course of this projection campaign in the Indo–Pacific, which has made it possible to accelerate the process of developing a national capability of absolute value for defence, which further increases readiness and Italy's ability to contribute effectively, together with allies, to global security and stability, wherever necessary.

Our country is the only one in the European Union to be able to form a Carrier Strike Group with 5th generation assets and – together with the USA and the UK – constitutes the very small core of NATO allies with this capability. In this key, the Carrier Strike Group with the F–35Bs is a concrete expression of Italy's rank as a medium regional power with a strong maritime connotation, and represents a tool of reassurance for allies or of deterrence towards potential adversaries: a versatile and flexible device to project oneself and be influential wherever necessary.

With the achievement of Initial Operational Capability it will be possible to promote new ones opportunities for interoperability and interchangeability between the Allies, thus conferring further depth also to international cooperation.

"With the IOC", added Admiral Credendino, "the Maritime Defence Component takes a notable step forward in expressing the ability to project forces from the sea even in operational theatres far from the usual gravitation basins, for prolonged periods of time, pursuing complete interoperability and interchangeability in joint operations with allies and partners: one of the main objectives of the Carrier Strike Group Campaign in the Indo–Pacific".

Text and all photos Gian Carlo Vecchi

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GBADEX–LADEX 2024 exercise at BA Nancy

The "GBADEX–LADEX 2024" exercise, conducted by the Armee de l'Air et de l'Espace (French Air and Space Force), was held from 18–21 November 2024 at Base Aerienne 133 "Henry Jeandet" Nancy–Ochey (ICAO: LFSO). The exercise combined Ground Based Air Defence (GBAD) and Counter–Unmanned Aircraft Systems (C–UAS) operations to prepare for diverse aerial threats.

This exercise combined the previously separate held "GBADEX" and "LADEX" exercises, and it involved four GBAD squadrons from BA Avord, BA Saint–Dizier, BA Istres and BA Mont–de–Marsan, under supervision of a Command and Control Center for Air Defence (CMD3D).

The exercise deployed a multi–layered ground–to–air defence system, including SAMP/T Mamba: A medium–range surface–to–air missile system capable of countering a wide range of aerial threats, including aircraft, drones and ballistic missiles; Crotale NG: A short–range air defence system complementing the Mamba's capabilities; BASALT (BAsses ALtitudes et Tactique): A heavy C–UAS system protecting CMD3D and the Surface–to–Air Missile Operational Centre (SAMOC) and finally MC2 Technologies NEROD RF/5F: Lightweight jamming rifles used by C–UAS teams to disrupt hostile drones.

General Pierre Gaudilliere, commander of the Brigade Aerienne de l'Aviation de Chasse (BAAC) is responsible for all air defence, air–to–ground and reconnaissance aircraft.

General Gaudilliere explained about the history and the future of this Ground Bound Air Defence exercise: "This marked the first exercise of its kind in over two and a half years. Previous sessions had been delayed due to real world missions, including deployments in Romania. The timing of this exercise followed the Paris Olympic Games, a period of intense operational engagement for

many personnel. The aim was to resume basic training and enhance readiness for future scenarios. The organisers plan to conduct similar exercises on a more regular basis, potentially one or two times per year. Future iterations may be larger in scale, with more systems deployed and different locations selected to vary the environment and conditions. Some systems used in the exercise were brought from other bases, reflecting the collaborative nature of the operation. This training is viewed as the foundation for more extensive exercises in the future, emphasizing growth and adaptability in defence strategies."

Lieutenant Colonel Lionel, the exercise director said that his exercise marked the first integration of C–UAS assets to protect GBAD systems against drone threats. And this exercise was an important step forward for the French Air Force.

During the exercise BA Nancy was 'attacked' by French Army helicopters, Rafale jets from nearby BA St–Dizier and local Mirage 2000D jets. Some Mirage 2000D aircraft attacked the airbase at a very low level to surprise the defenders and after the 'attack' the Mirage 2000D pilots (Capitaine Jerome, Capitaine Martial, Lieutenant Clement) joined the compound for a debriefing.

During a few hours the Nancy airspace was closed for aircraft and helicopters while the base was under attack by various drones at low and medium level. The BASALT system detected the incoming drones while the NEROD teams would jam or neutralise the drones. In order to detect the drones, various electronic and optical systems were set up next to the larger radar systems of the Crotale and SAMBA air defence systems.

Weapons demonstrated during the media day on 20 November 2024: MC2 Technologies NEROD–F5 (handheld drone jammer, black), MC2 Technologies NEROD–RF (handheld drone jammer, brown), Thales Crotale, short range missile system, Thales/MBDA SAMP/T (systeme Sol–Air Moyenne Portee/Terrestre, nickname MAMBA) medium range missile system, Gazelle helicopter of the French Army (Aviation legere de l'armee de Terre) and various Mirage 2000D jets from BA Nancy during low level attacks.

Background information

GBADEX (Ground–Based Air Defence Exercise): Purpose: To train and enhance the capabilities of ground–based air defence units in countering aerial threats such as aircraft, drones, and missiles.

Focus: Operation of surface–to–air missile systems like the SAMP/T Mamba and Crotale NG, Integration of detection and interception systems to defend critical assets and airspace and Coordination among ground based units and command centers for tactical air defence.

LADEX (Low Altitude Defence Exercise): Purpose: To specialise in the detection, tracking, and neutralisation of low altitude aerial threats, with a particular emphasis on Counter–Unmanned Aircraft Systems (C–UAS).

Focus: Developing tactics to address emerging threats from drones and other low flying platforms, testing and deploying anti–drone technologies such as BASALT systems and NEROD RF/5F jamming rifles and protecting sensitive installations and assets from increasingly sophisticated drone threats.

Ground–based air defence (GBAD)

Mission and Role of GBAD: Threat Neutralisation: GBAD systems protect key infrastructure, military assets, and population centers from aerial threats, including drones, missiles, and aircraft. First Response: They often serve as the initial line of defence, intercepting threats before they penetrate deeper into French airspace. Adaptability: Modern systems like Mamba and Crotale are designed to counter a wide range of threats, from low altitude drones to high speed cruise missiles.

Integration with National Air Defence: Coordination with the Air Force: GBAD units work under the command of the French Air and Space Force (Armee de l'Air et de l'Espace), which oversees airspace security and situational awareness. Interoperability: These systems are integrated with airborne platforms, such as fighter jets and AWACS (Airborne Warning and Control System), to ensure seamless threat detection and neutralisation. Data Sharing: GBAD units use advanced radars and sensors to share real time data with other air defence components, ensuring coordinated responses.

Key GBAD Systems in France: SAMP/T Mamba: A medium range system capable of engaging aircraft and missiles, forming the backbone of France's GBAD. Crotale NG: A short range system used to defend critical sites and tactical units. Anti–Drone Technologies: Systems designed to counter the growing threat of UAVs (Unmanned Aerial Vehicles).

Layered Defence Strategy: High–Altitude Defence; Fighter jets and long–range missiles address threats at higher altitudes and farther distances. Mid–Range Defence: Systems like Mamba engage threats within a mid–range envelope. Short Range Protection: Systems like Crotale and close–in defences handle low altitude and close proximity threats.

Exercises and Readiness: Exercises like GBADEX (Ground–Based Air Defence Exercise) simulate real world scenarios to test the coordination and effectiveness of GBAD units. These drills also enhance interoperability between different branches of the military and allied forces, ensuring readiness for high intensity conflicts.

Contribution to NATO and EU Defence: France's GBAD capabilities are integrated into NATO's Integrated Air and Missile Defence (IAMD) system, contributing to collective

security in Europe. These systems also align with the EU's strategic defence initiatives, enhancing regional stability.

Differences between NEROD–F5 and NEROD–RF: The NEROD–F5 and NEROD–RF are both anti–drone jamming systems developed by MC2 Technologies, a French company specialising in radio frequency (RF) and electronic warfare technologies. While both systems serve as counter–unmanned aircraft systems (C–UAS), they differ in their design, capabilities and operational applications.

Future French air defence, the VL MICA

The VL MICA (Vertical Launch MICA) is a ground and naval–based variant of the MICA missile, providing short range air defence. The MICA anti–aircraft missile was introduced in 2010 for the Rafale and Mirage aircraft. In the VL MICA system it retains the dual seeker technology with IR (infrared) and RF (active radar) guidance to defend against aircraft, helicopters, drones and missiles. The VL MICA system is modular, deployable on trucks and naval vessels, and offers 360–degree coverage. It has a high rate of fire, with a two second launch interval, and a range exceeding 10 kilometers, reaching altitudes over 9 kilometers. Recent developments include the VL MICA NG (New Generation), which features improved propulsion and advanced seekers, extending the range to 40 kilometers.

The first two Mica VL systems will replace the Crotale NG units that will be transferred to Ukraine. During the 2024 summer Paris Olympic and Paralympic Games, a VL MICA system was deployed in southern France to protect the Olympic sailing events.

Report by Joris van Boven and Alex van Noije
Photos: Joris van Boven and Armee de l'air (photo of the command post)

EH3/67 60th anniversary

BA Villacoublay: In the southwestern area of the French capital Paris, is the Base aérienne 107 Vélizy–Villacoublay (ICAO: LFPV) located. This airbase is mainly used for transportation of the French VIPs (presidents, ministers, generals etc). Besides this main task there are other users on this airbase. The French Gendarmerie has a detachment with helicopters; the Groupe interarmées d'hélicoptères (Joint Service Helicopter Group) of the French anti terror unit is flying a mixed group of Army and Air Force helicopters.

Another inhabitant is Escadron d'Hélicoptères EH 3/67 'Parisis' flying the AS550 Fennec helicopter.

EH3/67 and the roles: EH3/67 belongs to Brigade Aérienne d'Appui et de Projection (BAAP, Air Support and Transportation Brigade) of the l'Armée de l'Air et de l'Espace. In this Brigade, all transport and helicopter units are organised. There are 4 helicopter units in this Brigade: Escadron d'hélicoptères 1/44 Solenzara (BA Solenzara), Escadron d'hélicoptères 1/65 Alpilles (BA Orange), Escadron d'hélicoptères 1/67 Pyrénées (BA Cazaux) and Escadron d'hélicoptères 3/67 Parisis (BA Villacoublay). Whereby EH 1/65 'Alpilles' and EH 3/67 'Parisis' fly the same Fennec helicopters and have the same roles.

The squadron plays a crucial role in Quick Reaction Alert (QRA) missions, particularly concerning "slow movers"—aircraft that operate at lower speeds, such as light aircraft or helicopters. These missions are part of the Mesures Actives de Sûreté Aérienne (MASA), or Active Air Safety Measures, which involve intercepting and identifying unauthorised or suspicious aircraft within French airspace. The Fennec helicopters are well suited for this task due to their speed, maneuverability, and ability to operate in various environments. In addition to QRA duties, Escadron d'Hélicoptères 3/67 Parisis provides logistical support to various military and governmental entities in the Île–de–France region. The unit has a history of adapting to evolving mission requirements, including participating in international operations such as Operation Sangaris in the Central African Republic.

The squadron's versatility and rapid response capabilities make it a vital component of France's national defence, particularly in ensuring the security of its airspace against low–speed aerial threats.

EH3/67 60th anniversary

On 17 October 2024, EH3/67 celebrated its 60th anniversary at its homebase BA Villacoublay. Air Brigadier General Cédric Colardelle, commander of the Brigade Aérienne d'Appui et de Projection (BAAP, Air Support and Transportation Brigade) of which the squadron is a part, lead the commemorative ceremony of the 60th anniversary of the helicopter squadron. Colonel Pierre Cornetto, commander of Villacoublay air base, praised in his speech "the confidence of the winged horse and its young spirit" and "the entry into the golden age of the celestial steed of "Parisis"".

Officially created on 1 October 1964 on Air Base 107, the squadron carries out a wide variety of missions, from Ar Security (MASA), to search and rescue (SAR – Search and Rescue), through air support. The EH "Parisis" has recently distinguished itself by its exceptional and remarkable commitment in 2024 to the protection of the Rugby World Cup, the 80th anniversary of the Normandy Landings and the Olympic and Paralympic Games in Paris.

Over the past 60 years, the 'wings of the Pegasus' (the emblem of EH3/67) have also been deployed in West Africa, the Republic of Cote d'Ivoire, Gabon, Terre Adelie, Cambodia, and the Central African Republic as part of Operation Sangaris and New Caledonia.

MASA

The Escadron d'Hélicoptères 3/67 "Parisis" executes the MASA (Mesures Actives de Sûreté Aérienne) tasks primarily by utilising Eurocopter AS555 Fennec helicopters for their agility, speed, and ability to operate effectively at low altitudes. These tasks focus on ensuring airspace security, particularly against slow–moving aerial threats like light aircraft, ultralights, and drones that may evade traditional jet fighter intercepts.

EH3/67 Commander

Lieutenant Colonel Francois, commanding officer of the EH 3/67 Parisis helicopter unit emphasised the importance of inter–army coordination in aligning the fleet's capabilities. One of the significant advancements is the introduction of the Airbus Helicopter H160M Guepard helicopter programme. This initiative, spearheaded by the Ministry of the Armed Forces, aims to unify fleet operations across various military branches. Although the H160 is still in its early stages, with deliveries expected around 2027, its potential has already sparked preparation and adaptation efforts. The squadron's infrastructure is set to evolve alongside these advancements. While the squadron's location may remain unchanged, its facilities and organisation will undergo substantial upgrades to meet the demands of the new programmes.

EH3/67 Vice Commander

Commander Gregoire, the second–in–command at his unit, shared insights into the training, operations, and future advancements of the squadron. As a leader, he highlighted the unit's dedication to operational readiness and their plans for modernisation. The squadron conducts approximately 2,800 flight hours annually. Out of this, around 500 hours are devoted to operational air defence missions, with the remainder focused on preparation and training. Training is rigorous and includes weekly and even daily exercises such as hoist operations, stretcher drills, and deployments in complex zones with medical teams. This constant training ensures seamless synergy among team members.

Discussing mission scenarios, Commander Grégoire outlined three primary types of air defence operations: aerial assistance, air policing, and counterterrorism. Fortunately, the squadron has not had to engage in real world counterterrorism missions but remains prepared through extensive training. In air policing and assistance missions, they have successfully intercepted and addressed infractions, such as unauthorised entries into restricted airspace, especially during high profile events like the Olympic Games. Their proactive measures have consistently resolved situations without the need for force.

Looking to the future, Commander Gregoire introduced the upcoming Airbus Helicopters H160M "Guepard" helicopter, expected to revolutionise their operations. This advanced aircraft, set for delivery in a few years, promises greater speed, altitude and range. Equipped with cutting edge technology such as tactical data links, state–of–the–art radars, and next generation thermal cameras, the Guépard will enhance the squadron's ability to detect and intercept targets quickly and support aerial operations more effectively. The unit is already preparing for this transition, including infrastructure upgrades to accommodate the new fleet.

The squadron's base will undergo significant renovations to support the Guepard's integration. These improvements are part of broader efforts to ensure the unit is fully equipped to meet the demands of modern air defence and operational support missions. Commander Gregoire expressed confidence in the team's readiness and the strategic planning underway to embrace these advancements.

Text and photos: Joris van Boven and Alex van Noije

Weapon Instructor Course 2024

From 28 October till 5 November 2024, the Weapon Instructor Course 2024 end stage took place. The 29 international students of the WIC were involved in large scale air battles in a period of two weeks. This was the final phase of their training as a weapons instructor. They flew from Leeuwarden Air Base, both during the day and in the evening in darkness. The final exercise is all about 'Large Force Employment'. This involves the planning and deployment of approximately thirty aircraft. When aircraft take off for a new mission they will both act as the allied forces and the enemy forces with the intention to shoot the other party out of the sky in a simulated manner. The students from Belgium, the Netherlands and Norway will all apply the skills they have learned in an earlier stage. They started the highly regarded training programme for weapons instructors in May 2024. The students are both fighter pilots and (non–)commissioned officers from other disciplines like for example Air Battle Managers.

The Weapons Instructor Course (WIC) 2024 at Leeuwarden Air Base had several core objectives aimed at developing the tactical and instructional expertise of its participants. These objectives ensure that aircrew members emerge as highly skilled instructors and leaders within their respective air forces.

The WIC had a few primary objectives which are the core of the whole course. The course focused on advanced tactics, techniques, and procedures for employing modern combat aircraft, such as the F–35A, in complex operational environments.

Participants learned to plan and execute multi–domain operations with a focus on precision and efficiency. A significant goal was to prepare participants to become instructors within their own units. This included teaching them how to effectively convey complex tactical knowledge and mentor less experienced aircrew members. The WIC emphasised interoperability among allied air forces, such as those of Belgium, Germany, the Netherlands and Norway. By working closely in joint exercises, participants gained experience in multinational operations and coordination.

Participants were trained to manage mission planning for a variety of scenarios, from air–to–air combat to ground–attack missions. They also practiced coordinating with other units and assets to achieve mission objectives. The course also provided a platform to test and refine

modern combat tactics. Participants were encouraged to analyse operational scenarios critically and develop innovative solutions to challenges. The WIC aimed to cultivate strong leadership skills, enabling graduates to lead teams in high–pressure combat scenarios and act as key advisors to their commanders. The course simulated high threat environments, including scenarios involving modern air defense systems and adversarial tactics. This preparation ensured that participants could adapt to and overcome emerging threats in real world operations. By the end of the WIC, graduates were expected to possess a deep understanding of air warfare, exhibit superior decision–making skills, and be capable of enhancing the combat effectiveness of their respective air forces through advanced training and leadership.

Modern warfare scenarios at the WIC

The scenarios flown during the WIC missions are designed to be progressively complex, reflecting the challenges of modern air combat and multi–domain operations. These scenarios focus on both individual and team based tactical skills, with a strong emphasis on realistic and high intensity combat situations. During the basic course phase of the WIC many skills are practiced.

It starts with all the basic skills which are used as separate building blocks to build complex mission profiles in the end stage of the WIC. These skills can be determined as; Basic Fighter Maneuvers (BFM) as the basics for everyone involved. Air Combat Maneuvering (ACM) where two or more aircraft work together to counter simulated adversaries, focusing on mutual support, communication, and tactical execution. Beyond Visual Range (BVR) engagement scenarios involve identifying, tracking, and engaging threats at long ranges using advanced sensors, networking, and weapon systems like the AIM–120 AMRAAM. Defensive Counter–Air (DCA) where participants simulate defending a designated area against waves of aggressor aircraft. The focus is on maintaining situational awareness and efficient use of resources. Offensive Counter–Air (OCA) missions involve striking enemy airfields, radars, or other critical infrastructure while avoiding or defeating enemy defenses. Suppression of Enemy Air Defences (SEAD) where participants practice identifying and neutralising threats using electronic warfare and precision guided munitions. These missions often include elements of evasion and coordination with other assets. Close Air Support (CAS) aircraft are tasked

with identifying and engaging targets in close proximity to friendly ground forces, requiring precise targeting and coordination.

All basic skills which are learned in the months before the end stage come together in a full two week end examination for the participants. Here all lessons learned are combined in one large air combat scenario where objectives need to be assured by the future weapon instructors. Multi–Domain Operations scenarios involve coordinating with other forces (e.g., naval or ground units) to achieve strategic objectives.

Training by night

Training by night was a critical component of the WIC 2024 at Leeuwarden Air Base. Reflecting the evolving nature of modern combat and the need for air forces to operate effectively in all conditions, including nighttime. The emphasis on night training served several key objectives which were all trained during the final stage of the WIC.

Modern air combat increasingly requires the integration of air, land, sea, and cyber domains. Night training ensures that pilots can operate in all aspects of these multi–domain operations, where visibility and situational awareness are more limited than during day time operations. Operating at night requires advanced tactics, equipment, and coordination. Pilots need to effectively use night vision systems, radar, and other onboard sensors to perform their missions under a strong reduced visibility. Modern aircraft like the F–35A are equipped with advanced sensors, radar and targeting systems that allow pilots to engage targets at night more effectively. Training in nighttime conditions allows pilots to master these technologies in the most challenging conditions. The integration of low–light technologies, such as Night Vision Goggles (NVGs) and infrared targeting pods, becomes essential for maximising operational effectiveness after dark.

The WIC 2024 emphasised the ability to use these tools to detect and engage targets at night, and pilots were mastering these skills. Night time operations provide a natural cover for stealth operations, allowing aircraft to exploit their reduced radar visibility. The WIC was a very suitable environment for the testing of stealth capabilities in realistic conditions. In high–threat environments, pilots need to evade enemy radar and detection systems. Night training provides an ideal setting to practice evasive maneuvers, electronic warfare techniques and sensor

countermeasures. Real world conflicts often occur around the clock, therefore conducting night training is crucial to simulate the intensity and unpredictability of operations. The training allowed participants to rehearse scenarios such as strike missions, air defence, and close air support in darkness, with all the added complexities of operating in low–light or no–light environments.

Objectives of the RNLAF with the F–35A

The Dutch objectives in the Weapons Instructor Course (WIC) 2024 at Leeuwarden Air Base were centered on enhancing the Royal Netherlands Air Force's (RNLAF) operational capabilities. The intention was refining tactics for the F–35A, and preparing their instructors to lead and develop the next generation of fighter pilots. The WIC serves as a cornerstone of the Dutch commitment to maintaining a modern, versatile and well–trained air force.

The Netherlands aimed to advance the tactical use of their F–35A Lightning II, focusing on its stealth, sensor fusion, and multi–role capabilities. Dutch pilots practiced integrating the F–35A into a wide range of missions, including air superiority, close air support, and precision strike. The primary goal for Dutch participants was to train pilots who could serve as weapons instructors for the brand new F–35A fleet. These individuals will be responsible for training other pilots and advancing the RNLAF's overall combat effectiveness. Dutch weapons instructors are expected to lead tactical innovation and contribute to NATO–wide interoperability.

The RNLAF prioritised improving coordination with NATO allies, such as Belgium, Norway and others, to operate effectively in multinational coalition settings. Participation in joint training scenarios strengthened their ability to work seamlessly in NATO missions and operations. The Dutch used the WIC to test and refine tactics specific to their strategic needs, such as defending European airspace and participating in international peacekeeping missions.

Norway, the other F–35A user

The Royal Norwegian Air Force's participation in the Weapons Instructor Course (WIC) 2024 at Leeuwarden Air Base was driven by several strategic objectives. These goals align with Norway's focus on enhancing its operational capabilities, fostering interoperability with NATO allies and preparing for modern threats in the north. The Royal Norwegian Air Force (RNoAF) deployed F–35A aircraft to the WIC to refine their tactics, techniques, and procedures for employing their fifth–generation fighter. Norwegian pilots focused on mastering the aircraft's advanced systems, such as sensor fusion and electronic warfare capabilities, in demanding scenarios.

Norway sought to enhance its ability to operate seamlessly with other NATO air forces, such as those of the Netherlands and Belgium. Participation in multinational scenarios allowed Norwegian pilots to practice coordinating in complex joint operations. A primary objective was to develop Norwegian weapons instructors who could train other pilots within the RNoAF. These instructors are pivotal in ensuring that Norway maintains a high level of proficiency across its air force. The WIC provided

an opportunity to simulate scenarios that mirror the challenging operational conditions in the Arctic region, where Norway often operates. Norwegian pilots used the course to practice adapting to high–threat environments, including advanced air defenses and extensive night operations. For the Norwegians, the WIC 2024 was not just a training exercise but a strategic investment in their air force's future capabilities. It allowed them to refine their use of the F–35A, strengthen alliances, and ensure readiness for the dynamic challenges of modern air combat in the Arctic region.

Text and photos: Joris van Boven and Alex van Noije

BACCARAT 2024

The exercise BACCARAT 2024 of the French Army (Armee de Terre) and the Aviation Legere de l'Armée de Terre (ALAT) took place from the beginning of October 2024. The exercise is organised by the French 4th Air Combat Brigade (4e Brigade d'Aerocombat, 4e BAC). The exercise consisted of fighting an enemy who had seized territory from an allied country. This scenario is nowadays a very realistic scenario for which troops need to be prepared by training. During this edition of BACCARAT, the focus was on long distance missions of over 150 km, facing an enemy on equal terms which is very well equipped and well trained. This year's exercise took place in a civilian area in the Grand Est region in Northeastern France.

BACCARAT 2024 was a major size exercise for the French Forces as it contained unit from all over the country. More than 1,000 soldiers of almost twenty different army units, more than thirty helicopters and 260 vehicles including twenty one armoured vehicles took part in the scenarios. BACCARAT 2024 is the first major exercise conducted within the framework of the Deep Action and Intelligence Command (Commandement de l'Action dans la Profondeur et du Renseignement, CAPR) which was founded on 1 August 2024. The extremely rainy weather at the beginning of October pushed men and machines to the test, requiring constant adaptation, making the exercise even more realistic. The start of the development of the current BACCARAT exercise started in 2016. The French Army and the ALAT helicopters were already for many years deployed all over the world.

BACCARAT 2024 aims to plan, coordinate and conduct actions in the depth of the battlefield, in joint forces, in a high–intensity framework against a hardened enemy. Specific tactical sequences were therefore set up in corporation with the Air and Space Force as part of the missions to destroy enemy ground–to–air capabilities. The exercise also aims to strengthen 3D coordination, marking a particular effort on drone–helicopter cooperation, in particular through the work conducted with a Puma drone detachment from Great Britain of the 61st Artillery Regiment, which is implementing the SMDR2 (Mobile Detection and Intelligence System Generation 2). To prepare for an exercise of this scale, preparations were already started for at least a year in advance.

BACCARAT 2024 is an important milestone in the preparation of the DIODORE exercise which will take place in March 2025. This is first exercise of the newly created Command of Actions in Depth and Intelligence

(Commandement de l'Action dans la Profondeur et du Renseignement, CAPR). The objective of this exercise, within the framework of operations in the depth of the battlefield, is to shorten the intelligence–decision–fire loop, by seeking to integrate all contributing functions within a common staff.

NH–90 Caiman HMA (3e RHC)

A Maneuver and Assault Helicopter like the NH90 Caiman has a wide variety of missions for which it can be conducted. The NH90 Caiman helicopters involved in the exercise were from the 3rd Combat Helicopter Regiment which is based at Etain–Rouvres. The helicopters that were deployed during the BACCARAT exercise were used for many different tasks. The helicopters were mainly used for 'heliport missions'. The objective here is to drop troops that can be engaged as soon as they land as close as possible to an enemy objective in order to seize it whether it is a building, an individual or a group of vehicles. Landing on enemy terrain can be done in several ways, like; either by dropping the troops directly on the ground, or, when the landing area is too small, by using the fast rope technique with the helicopter hovering above its target. The second type of mission is an 'extraction mission'.

In operations in exercises like BACCARAT it is very rare for a maneuver and assault helicopter to move without cover. Generally, the formation moves at least in patrol with three helicopters. Mostly 2 HMA like an NH90 or a Puma and one 1 HRA like the Tigre or a Gazelle. The HRA ensures the protection during the set–up but also secures the landing zone and its environment before the troops are disembarked after landing. From a tactical point of view, landing and take–off are the critical phases for a helicopter when landing in an enemy zone. The helicopter moves at low speed and at low height, therefore its more easily to be hit by enemy fire. If it is also required to disembark or embark personnel, the helicopter will have to remain motionless on the ground for the duration of the maneuver.

SA342 Gazelle helicopters with Mini–guns (3e RHC)

One of the most extraordinary configurations seen at BACCARAT were the Gazelle helicopters which were equipped with a huge door mounted mini–gun. The gazelles which participated in the exercise were from Etain–Rouvres and belong to the 3rd Combat Helicopter Regiment. The Gazelle Gatling configuration is an evolution of the Gazelle SA342 (Ma or M1 version). The original helicopter is slightly modified to accommodate the M134D machine gun on board and allow the gunner to use it easily. The M134 mini–gun is an American 7.62×51mm NATO standard six–barrel rotary machine gun with a high rate of fire of 2,000 to 6,000 rounds per minute. The gun

features a Gatling–style rotating barrel assembly with an external power source, normally an electric motor. The "mini" in the name is in comparison to larger calibre designs that use a rotary barrel design, such as General Electric's earlier 20 mm M61 Vulcan, and "gun" stands for the use of rifle ammunition as opposed to auto cannon shells. Even old equipment, such as the SA342 Gazelle, continues to evolve in order to adapt to new types of missions which are demanded on the modern battlefield. In the case of the "Gazelle Gatling", as the crews describe it, the need had already been identified for several years for such a weapon onboard of an ALAT helicopter. The idea for this concept was in France reinforced by the observation of the use of comparable capabilities in other armies in NATO. This new asset gives this lady of a respectable age a whole new function within the ALAT.

Eurocopter EC665 Tigre HAD (5e RHC)

The Eurocopter EC665 Tiger HAD version (Support & Destruction Helicopter) is an attack helicopter of the French ALAT. The helicopters involved in BACCARAT 2024 are assigned to the 5th Combat Helicopter Regiment. The 5e RHC has been based in Pau since September 1984, in the "Chef d'Escadrons de Rose" district which is its current location. The Tiger HAP is a medium–weight air–to–air combat and fire support helicopter built for the French Army. The main role of the helicopter within the ALAT is to support allied troops. This can be done by fire (Destruction), but also by delivering intelligence, or even by its simple presence in the area, which is dissuasive depending on the enemy threat. The Tigre is able to deploy a wide range of weapons, which makes it indispensable in all theaters of operation today, and becomes a real force for headquarters and decision–making centers. The helicopter is fitted with a chin–mounted GIAT 30 mm gun turret and can carry 68mm SNEB unguided rockets or 20 mm machine cannons for the fire support role as well as Mistral air–to–air missiles if needed. The Tiger is a system that was specifically built for the French armed forces, which means that it was designed to integrate optimally with other army equipment. To communicate with ground troops, but also other units at land in the air or at sea, it is equipped with different radio stations that operate on a wide range of frequencies. Clear and descent communication is key to use the Tigre in strength as an extension of the other army units.

Text and photos: Joris van Boven and Alex van Noije

Apex Buccaneer, collaboration over the High North

As the sun sets, two USAF F–35's meet up for some air to air refuelling. Apex Buccaneer provided Norway, the UK and US with a unique opportunity to combine their strengths.

A trilateral exercise, called Apex Buccaneer, took place over Norway on the 3 December 2024. During this exercise, American, Norwegian and British troops practiced sharing information between multiple platforms to build a shared vision of the simulated battlefield and then deploy weapons on it. Specifically, Norwegian joint terminal attack controllers on the ground directed payloads onto the targets. United States Air Force B–52H bombers dropped live ordnance on these simulated enemy positions in Norway.

Exercise Apex Buccaneer saw United States B–52H Stratofortress's from the 20th Expeditionary Bomb Squadron, F–35A Lightning IIs, KC–135R Stratotankers and a U–2S Dragon Lady work alongside Norwegian F–35As and P–8 Poseidon maritime surveillance aircraft, as well as Royal Air Force F–35Bs, an A330 MRTT Voyager tanker and a RC–135W Rivet Joint Signals Intelligence aircraft. Norwegian army, navy, and special forces troops also took part on the ground. All assets combined acted as enablers, sharing mission critical data to create a unified air picture. This enabled exercise participants to overcome a variety of simulated threats, ultimately facilitating the successful completion of the B–52's mission, striking the simulated targets at the Setermoen military range in Norway.

The key tactic being trained on was multidomain Find, Fix, Track and Target (F2T2). "Find" means scanning the battlefield for potential targets. This represents the first step in the dynamic kill chain, built around identifying potential threats. It involves the initial detection of an emerging target or threat, heavily leaning on dynamic ISR capabilities to monitor areas of interest and determine the nature and extent of a threat, and its timeline. The "find" phase will dictate priorities and opens the next phase of the kill chain. "Fix" means locating the potential target's exact position and identifying it as a worthy target. In

this part of the chain, Intelligence, Surveillance and Reconnaissance (ISR) capabilities are selected, allocated and directed to "fix" upon the emerging threat previously identified. This phase confirms, identifies and locates the target and disseminates this information to combatant commanders for further analysis.

"Track" means keeping track of the target's exact location and identity. A potential target is extensively monitored to enhance situational awareness and establish nuances in the target's nature, behaviour, establish its validity and ultimately determine why, how and when it should be interdicted. Finally, "target" means choosing and using the right tool to destroy or otherwise affect the target. It ensures that the necessary operational and legal assessments are conducted to safely and securely act. This is conducted within the parameters of the law of war, vigorously assessing it against the full spectrum of legal requirements that dictate the process of a military actions to ensure legal and safe conduct. This phase also determines the specific capabilities and considers other critical elements required to conduct an operation successfully and safely. These include determining the supporting assets, such as air–to–air refuelling, strike and ISR capabilities.

The 'High North' is a term that has become widely recognised throughout the security world, which defines all territory within the Arctic Circle and parts of the North

A KC–135 Boom operator has the best view of the house. They lay backwards looking at the receivers while the operate the boom during the refuelling process.

Atlantic, otherwise considered the 'Greater Arctic' region. Arctic deterrence and the defence of NATO's northern flank is becoming more critical.

General James Hecker, commander of United States Air Forces in Europe – Air Forces Africa has reinforced this, stating that "the Arctic is a critical region for our collective security and global stability. Training with our Norwegian and UK allies in this environment demonstrates our shared commitment to defending NATO's northern flank and adapting to emerging threats."

A B–52H assigned to the 20th Expeditionary Bomb Squadron takes off from RAF Fairford, England for the Apex Buccaneer mission. (Photo: Airman 1st Class Laiken King)

Reaper Flight, a trio of USAF F–35A's flying out of RAF Lakenheath, UK, made the journey up to Norway support by several tanker aircraft.

"Multi–domain integration is essential for leveraging the full spectrum of capabilities," stated General Hecker. "It creates a more adaptable, resilient and precise military force capable of addressing diverse and evolving threats across the battlespace". The ability to understand how each nation operates, to share critical information quickly, and to work seamlessly with each other ensures all involved parties are prepared for future events. Leading the exercise were F–35s participating from the three participating nations. These aircraft were pivotal in the successful completion of the mission, through their data–sharing capabilities.

As the sun sets and light fades, several F–35's meet up with the tankers to take on much needed fuel to continue their mission.

The United States Air Force stated that "The trilateral exercise allowed for the seamless integration of the F–35 data sharing capabilities, as pilots from all three nations exchanged real time tactical information, creating a unified air picture and demonstrated the aircraft's ability to operate as a force multiplier."

This demonstrates the capability advantage presented by Fifth Generation aircraft and highlights their relevance as the global security environment evolves. Group Captain Bishop, head of operational plans for the Royal Air Force, summarised this in saying that "Fifth–generation platforms are pivotal to maintaining air superiority in contested spaces, and exercises like this showcase their unmatched capability."

Thanks to a variety of tanker aircraft, Apex Buccaneer's combat and ISR assets were able to stay on station longer, meaning that the mission flowed seamlessly without pause, ensuring the continuity of operations through uninterrupted situational awareness and data flow.

Operating in this way is imperative in a modern, data driven battlespace. More broadly, having tanker aircraft on hand nearby helps reassure combatant commanders that, should mission requirements evolve, and aircraft need to reach new areas or remain in place longer, there is an effective means to facilitate this around the clock.

Text and photos: Erik Bruijns

History of Tactical Leadership Programme (TLP)

In January 1978, Belgium, Canada, Germany, Netherlands, United Kingdom and the United States founded the Tactical Leadership Programme (TLP) which was located at Furstenfeldbruck airbase which is in the south of Germany. The courses began as a two week academic and doctrine course only in which experienced crews presented, debated, evaluated and formulated tactics, techniques and procedures with each other. In September 1979, the TLP moved to Jever airbase which is in the north of Germany. Next to the academic and doctrine courses also a flying course was added, extending the total course from two till four weeks. The TLP was held for 10 years at Jever and during these years a total of 71 flight courses were conducted, graduating about 2,000 pilots and crew members!

In March 1989, the TLP moved to Florennes airbase, Belgium and the course was restructured into three groups; Flying branch, Academic branch and Support branch. A liaison officer from the French Air Force joined the TLP staff and also France began to participate in the courses, followed by Denmark and Italy in 1996. Due to the fall of the Berlin wall Canada withdrew its forces in Germany and they left the programme but retained a liaison officer and continued to participate in the courses. The TLP

needed a training area that would be representative of possible future conflict scenarios and due to limited weather conditions as well as the very busy airspace with commercial flights and also the prohibition of night flight courses the TLP was searching for a better place to develop their tactical skills. The solution for all this problems was found at Albacete airbase in Spain. In the 20 years that the TLP was at Florennes a total of 107 flight courses were conducted, graduating 2,978 pilots and crewmembers.

In 2009, a new Memorandum of Understanding (MoU) was signed, this MoU positioned the TLP outside of the NATO structure. Till 2009 France and Greece only had liaison officers within the TLP but they also signed the MoU, so a total of ten nations signed the MoU; Belgium, Denmark, France, Germany, Greece, Netherlands, Italy, Spain, United Kingdom and the United States. On 1 October 2009, the inauguration of the programme took place at Albacete airbase, followed by the start of the first academic year only a few days later.

The first flying course began in November 2009. In the 15 years that the TLP is at Albacete a total of 34 flight courses and 130 academic courses were conducted, graduating around 5,000 pilots and crewmembers.

With its history of more than 45 years the Tactical Leadership Programme is one of the most prestigious and long standing training programmes of the European military aviation. Literally thousands of European and American pilots from most of the European and North American countries have participated with almost four technological generation aircraft, third, fourth, the so–called fourth plus and now with the fifth generation aircraft.

Explanation of Tactical Leadership Programme (TLP)

The mission of the Tactical Leadership Programme is to increase the effectiveness of allied tactical air forces through the development of leadership skills, mission planning, briefing, tactical flying and debriefing skills and conceptual and doctrinal initiatives. The TLP trains young students which can go to larger exercises after their graduation with the TLP. At the moment the TLP Commander is Colonel Cesar Acebes from the Spanish Air Force, also the TLP warrant officer, Finance officer and the Secretary are all from the Spanish Air Force. The French Air Force is responsible for the flying branch which contains operations, maintenance, air to surface, air to air and opfor. The German Air Force is responsible for the Academic branch which contains academics and doctrine, intelligence and synthetics. The Spanish Air Force is also responsible for the Support branch which contains administration, sofa, supply, IT and graphics.

In the Flying branch are two TLP courses: Composite Air Operations (COMAO) and Rescue Mission Commander (RMC). The COMAO course runs three till four times a year and has a duration of three weeks. During this course a total of twelve missions will be flown, nine live and three missions in the simulator. The RMC course is at the moment temporarily on evaluation. This course has a duration of two weeks in which seven live missions will be flown.

In the Academic branch are three TLP courses: COMAO Synthetic, Intel and Support. The COMAO Synthetic course runs three times a year and has a duration of two weeks. During this course there are five missions in the MACE Simulator. The Intel course runs two or three times a year and has a duration of two weeks. During this course they train to support COMAO missions and have practical exercises in the simulator. The Support course runs two or three times a year and has a duration of two weeks. The main goal is the introduction to COMAO operations.

The Tactical Leadership Programme has five pillars. Modern fighter integration: At the moment there is a transition to the new generation platform, which was certified by the United States Air Force in 2019, and modern weapons system instructors are requested. Agile Combat Employment: Capability to generate combat power and cross maintenance activities. Advanced synthetic training: This is the most transformational pillar due to development of MACE simulator capabilities in which at the moment three missions are executed during the flying course and five missions during the COMAO Synthetic course. Contested and Degraded Operations: Complex orders of battle supported by a synthetic environment (MACE) and proper opposing forces needed. Multi–domain Operations: Ground, naval and special operations forces exploring integrating cyber and space domains in all the TLP courses.

The Tactical Leadership Programme has three main areas at Albacete airbase; Headquarters with hangar, ramp and hotel. The headquarter and hangar are near the ramp where the aircraft and helicopters for the flying course are. The TLP hangar is a modern hangar with six maintenance posts and the ramp has 32 parking slots. The hotel has a total of 450 rooms which can only accommodate half of all the TLP staff. The other half is staying in hotels in Albacete city which is also very good for the local community. The TLP also needs services and support from the airbase itself like Operations, Air Traffic Control (ATC), fire–fighting, fuel, medical services and security.

The main reason, despite the weather, to move the TLP from Florennes, Belgium to Albacete, Spain was the airspace availability. The airspace available for the TLP is at the moment 95 by 150 nautical miles large and contains for half above land and half above sea. In this airspace low level as well as supersonic flights are allowed. This airspace is larger than the airspace of the large exercise Red Flag in the United States of America. All points mentioned make this airspace for the TLP unique in Europe!

Future strategic guidelines of Tactical Leadership Programme (TLP)

At the moment ten countries signed the Memorandum of Understanding (MoU) but Portugal will be the eleventh country as of 1 January 2025. Other countries, like Czechia,

Finland, Poland, Slovakia and Sweden, also showed their interest in the TLP courses so it is possible that in the future more countries will sign the MoU. In the MoU is also stated that if there is enough interest the flying courses can be increased from four to six courses a year. At the moment there is two to three times more demand for all courses than what we can offer. More participants in the flying courses means more aircraft, more parking slots and more airspace availability but all those things are possible but it is up to the countries itself.

Other strategic guidelines are: Develop the five pillars: Integrate modern air combat aircrafts, promote ACE concept, enhance LVC capabilities, integrate contested and degraded operations and address multi–domain operations. Integrate new technologies: Faster innovation in the programme, evaluate new alternatives for OPFOR elements and improve existing TLP tools. Build–up a solid engagement plan: NATO as a priority, enhance other interactions (JAPCC, EAG and EPRC) and explore new opportunities with the Spanish Air Force. Adapt infrastructures to new operational requirements: Allow operations of new generation aircraft, MACE and future technological developments and improve lodging and other TLP facilities. Promote TLP image: Presence in relevant events and initiatives in the local community.

The TLP vision for the future is that the TLP will be the NATO standard for modern fighter integration by providing the highest end training programme, live and virtual, the optimal fighting airspace for its courses and the most challenging contested and degraded scenarios in Europe!

TLP Flying Course (FC) 2024–04

The fourth flying course of 2024 (FC 24–04) started on 11 November 2024 and lasted till 29 November 2024. During this course Blue (Participants) took part with 22 and Red (Opponents) took part with 10 aircraft. There were 7 air support assets and various Surface Based Air Defenses (SBAD) like Spanish Mistral, Malline, SA–8, SA–11 and SA–17, German Roland, French Arpege, SA–15 and SA–17 and the United States TRTG, MALTS, LCTE, SA–8, ZSU–23, SA–17 and SA–14. During this course the briefing meteo, scenario and mission started at 10.00 with an estimated take off time at 15.00 and the latest landing at 18.00, all local time. After the mission the debriefing needs to be planned and executed. The last part of the day is which lessons were identified or learned? After this the day ends around 22.00 local time. It was the first time that Italian Air Force participated with the F–35 and the Hellenic Air Force participated with the Rafale during a TLP. The participants during Flying Course 2024–04 were:

Blue (Participants) 22:

France: 2x Mirage 2000D from EC.01.003

Germany: 8x EF–2000 from TLG31 and 2x Tornado IDS from TLG33

Greece: 2x Rafale from 332 MPK

Italy: 2x F–35 from 32 Stormo and 2x EF–2000 from 36 Stormo

United Kingdom: 4x EF–2000 from 29 Squadron

Red (Opponents) 10:

Germany: 2x EF–2000 from TLG73

Greece: 2x Rafale from 332 MPK

Italy: 2x EF–2000 from 51 Stormo

France: 2x Mirage 2000D from EC.01.003

United Kingdom: 2x EF–2000 from 29 Squadron

Air support assets (7):

France: 1x EC–725 from EH.01.067

Germany: 1x Learjet 35A Jam kite

Italy: 2x HH–101 from 15 Stormo

Spain: 1x Casa 295 from Ala 35 and 1x MQ–9A

NATO: 1x E–3 AWACS

Article and photos: Lowpass Aviation–Bram Marijnissen and Rene Sleegers
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Weapon Instructor Course delivers

The last edition of the Weapons Instructor Course (WIC) recently closed with some good results. No less than 25 WIC participants received their certificate after finalising the 6 month thorough course while obtaining a positive outcome. The certificates were handed out at Leeuwarden AFB, The Netherlands, during a WIC closing ceremony in November 2024.

The aim of the WIC course is to achieve a higher level of integration between the various optional weapon systems and their supporting units, as well as to increase the tactical leadership of the participants. Potential participants for WIC can not apply themselves for this course, but are nominated due to their talents and outstanding skills showed in each of their disciplines. This year saw a variety of students representing Belgium F–16 pilots, Norwegian and Dutch F–35 pilots, MQ–9 pilots and sensor operators, intelligence officers and Patriot missile operators. The training is provided by the Weapons School, part of the 323nd Air Combat Development Centre (ACDC) at Leeuwarden Air Force Base.

WIC 2024 started in The Netherlands with 4 weeks of lectures in the theoretical part of the training and then moved to Royal Norwegian AFB Orland for the Air to Air phase by early June. In this so called out–of–area exercise, several F/A–18 Hornets from the Finnish Air Force were

also detached to Orland to join as external assets for the air–to–air campaign as opponents. The Air to Air phase at Orland lasted until August and, after a short holiday break, the training continued again in the Netherlands for the following Air to Surface part at Leeuwarden AFB later in that month.

The first part of the second WIC phase had only aircraft of the participants gathered at Leeuwarden conducting their individual or combined scenarios. This meant that the several ramps at Leeuwarden were the housing areas for Dutch F–35's from 322 and 313 squadrons, Dutch MQ–9A Reaper from 336 squadron, Norwegian F–35's from 331 and 332 Skvadrons and Belgian F–16's representing front line units from Floreness with 1 and 350 squadron and Kleine Brogel with 31 and 349 squadron.

The second WIC phase was split up into 2 flight parts. The initial part was running for the first 2 weeks of October and had the participants excuting their training missions during day time. After a short break the final part took place in the last week of October and the first week of November. This so called Weapon System Integration Course (WSINT) was the closing exercise of WIC 2024. For this final episode several nations were invited to participate in order to execute more robust and complex mission scenarios. Leeuwarden had therefore additional German Tornado ECR's from TLG51 from Schleswig AB and German Eurofighters from TLG71 from Laage AB. Next to some additional Dutch F–35's, the Belgian AF forwarded also several extra F–16's to WSINT. For jamming duties two civilian Learjet 35's were temporarily based at

Leeuwarden. In these final 2 weeks, the mission schedule saw 2 daily moments with 1 afternoon wave in daylight and another later on during night conditions in restricted areas over the North Sea and a northern part over The Netherlands.

As the earlier WIC edition took place 3 years ago and meanwhile the war started in Ukraine in 2022, the air force explained that the focus of WIC had adjusted accordingly and moved more to protecting the national and NATO territories. The highly sophisticated F–35 platform is with its powerful sensors very capable to operate in such scenarios, however the mission objectives can only be reached when all domains (air, land, sea, cyber and space) are working integrated together.

The WIC training is not held in a regular schedule, which can be shown with the previous edition which took place in 2021. Due to the size of a WIC training, while normal operations and international obligations must go on as planned, it was no option to have and WIC and the annual international Frisian Flag exercise at Leeuwarden held together in 2024.

So with one year interruption, Frisian Flag is expected to take place again in March–April 2025. No forecasts have been given when a new WIC may take place again.

Text and photos by Peter ten Berg

The Rebirth of a Legend in Turkey: F–4 Phantom

Following Turkey's entry into NATO, the Turkish Air Force accelerated its modernisation efforts. By the early 1970s, its fleet included F–104, F–5 and F–100 fighter jets. However, there was a pressing need for a new combat aircraft that could carry more weapons and excel in both air–to–air and air–to–ground missions. The decision was made to procure F–4 Phantom aircraft, which had gained worldwide recognition during the Vietnam War.

Under the Peace of Diamond I programme, 40 F–4E/RF–4E Phantom aircraft were ordered. Over time, through both new purchases and transfers from other NATO countries, the Turkish Air Force acquired a total of 236 Phantom aircraft.

Training and initial delivery

In preparation for the arrival of the F–4s, a team of 101 personnel, including eight pilots, four navigation officers, two maintenance officers, one electronics officer and 86 non–commissioned officers from various technical branches, were sent to the US in two groups for training in 1973 and 1974. The F–4s were intended to replace the aging F–100s, with Eskisehir and Malatya Erhac Air Bases designated as the first recipients.

However, due to the outbreak of the 1974 Cyprus Peace Operation, the delivery of the aircraft was delayed. The first two F–4s arrived in August 1974 after the operation, leading to the establishment of the 113th "Tayfun" Squadron. By the end of 1975, 22 aircraft had been delivered. Subsequent deliveries were delayed due to the US arms embargo imposed after the Cyprus operation, and the remaining aircraft were only delivered in 1978. These were assigned to Malatya's 171st (Korsan) and 172nd (Şahin) Squadrons, as well as Eskisehir's 111th (Panter) Squadron.

Additional acquisitions

In 1978, under the Peace of Diamond II programme, Turkey ordered 40 additional aircraft, including eight

RF–4E reconnaissance variants. Delivery of these planes began in 1980 after the embargo was lifted. These new aircraft were allocated to Eskisehir's 111th, 112th, and 113th Squadrons, enabling the retirement of older F–100s. The eight RF–4Es replaced the RF–84s in the 113th Squadron. In addition, 14 F–4E aircraft provided as US military aid facilitated the creation of Malatya's 173rd "Safak" Squadron.

Enhancements and new capabilities

With the introduction of the F–4 Phantom, the Turkish Air Force acquired new air–to–ground attack capabilities. The fleet was equipped with AGM–65A/B Maverick missiles, Pave Spike laser targeting pods and 2000–liter GBU–8 HOBOS guided bombs.

After the Gulf War in 1991, the US transferred 40 additional F–4 Phantom aircraft to Turkey. Furthermore, between 1992 and 1994, Germany provided 46 RF–4E reconnaissance aircraft as they retired the model from their inventory. These planes increased the 113th Squadron's aircraft count to the standard 20, and others were delivered to Malatya's 173rd Squadron, creating a second reconnaissance squadron.

Modern roles and achievements

Today, F–4E Phantom aircraft remain in active service with the 111th "Panter" Squadron for air–to–ground strike missions. Additionally, the 401st Test Squadron was established in 2014 to test and develop various locally produced munitions. F–4E Phantom aircrafts, alongside F–16s, play a critical role in these test missions.

Over their 50 years of service, F–4E Phantoms have participated in numerous cross–border operations in northern Iraq and Syria, as well as international exercises. Thanks to several modernisation programmes, they have been upgraded to meet modern operational requirements and maintain their relevance on the battlefield.

Celebrations for the 50th Service Anniversary

As part of the celebrations for the 50th anniversary of F–4 Phantom aircraft in the Turkish Air Force, the Ministry of National Defence and the Turkish Air Force organised several special events.

In this context, the Turkish Air Force formed a special group of aviation photographers, consisting of six Turkish and two foreign civilians. For the first time in Turkish Air Force history, this civilian group conducted air–to–air photography of Phantom aircraft from an A400M plane.

Three F–4E Phantom jets were prepared for these photoshoots. One of these aircraft was painted black

to commemorate the 50th anniversary of the Phantom. The Turkish flag was painted on the fuselage, and the international emblem of the Phantom aircraft, the "Spook" (ghost) symbol, was added to the underside. This specially painted aircraft was unveiled to the public for the first time during the photoshoot.

Another unique activity related to the Phantom jets was the valley pass photography event, which, for the first time, allowed public viewing. The photoshoots were conducted in a valley north of Eskisehir.

Additionally, a "phantom elephant walk" was organised for the first time. Ten F–4E Phantom jets taxied at low speed on the runway, posing for elite approximately 700 aviation photographers from Turkey and various countries worldwide. The event also included the participation of the first Phantom squadron commander, General Ergin Celasin, who later served as the Air Force Commander, and the current Air Force Commander, General Ziya Cemal Kadıoglu. Both honoured the event with their presence.

Article and photos: Tayfun Yasar & Onur Kurc

Cruzex 2024: Training the Latin way

It took some extra years before a new edition of the largest multinational exercise of Latin America could take place, but finally in November 2024 various air forces had gathered at Natal air force base, Brazil, for a 2 weeks joint training in "Cruzex".

"Cruzeiro do Sul Exercise" (CRUZEX) or "Southern Cross Exercise" is a multinational operational exercise organised by the Brazilian Air Force (FAB) since 2002 and aims at joint training in conflict scenarios and promoting the exchange of experiences among the participating nations. After the first edition in 2002, Cruzex had a bi–annual sequence up to 2010. In 2012 the exercise only had a Command and Control (C2) focus, while the original set up was again held in 2013 and 2018.

The Covid pandemic was slowing down new planning, however in 2022 the air base of Natal was designated by the FAB command to start planning a new exercise for 2024. Exercise Director and Natal base commander General Ricardo Guerra Rezende explained that after thorough scheduling and preparational activities, Cruzex 2024 finally started on November 4th for 2 weeks of intense exercise missions. This edition brought together 16 different nations, involving more than 3000 servicemen and approximately 100 aircraft.

International

During the weekend before the starting date of 4 November, most international participants arrived at Atlantic coast located Natal Air Base in the north eastern edge of Brazil. The USAF arrived with F–15C's from the Louisiana Air National Guard 159th Fighter Wing, together with a KC–46A Pegasus tanker from the 77th Air Refuelling Squadron. All the other participants were Latin American nations, like Argentina with IA–63 "Pampa" and a KC–130H "Hercules". The Chilean Air Force came with a KC–135 "Stratotanker" which dragged several F–16C and D's towards Natal. Paraguay showed up with AT–27 Tucano's and a supporting Casa C–212 "Aviocar", while Peru brought its KT–1P "Torito" light attack and trainer aircraft along with a C–130 "Hercules". The last Cruzex contributors came from Colombia, with a KC–767 tanker,

and Portugal with a KC–390 "Millenium" tanker–support aircraft.

The final list of aircraft which joined Cruzex had seen several changes against the original list made during one of the pre–planning conferences, months prior to the exercise. Remarkable differences included Argentine's A–4AR "Skyhawks", Peruvian AF Mirage 2000's and Colombian "Kfir" fighter aircraft, which disappeared from the list. No reasons were given for all these changes, however a fatal Skyhawk crash at Villa Reynolds airport Argentina, on 15 July might have been a reason for the Argentine AF to represent the country with the Pampa instead of the A–4. The future of the A–4 in Argentine service is anyhow becoming more uncertain now that the country is expecting future delivery of the 24 F–16's it purchased from Denmark earlier in 2024. Denmark was able to offer their aircraft as it is replacing its fleet of F–16's by the Lockheed Martin F–35 "Lightning II".

Cruzex 2024 furthermore welcomed military observers from South Africa, Germany, Canada, Ecuador, France, Italy, Sweden and Uruguay to enrich the exchange of experiences and strengthening international cooperation.

Forca Aerea Brasileira

The host of the Cruzex exercise, the "Forca Aerea Brasileira" (FAB), brought a wide variety of its aerial assets to Natal Air Base, as General Ricardo Guerra Rezende explained. It included the initial appearance of the new F–39E "Gripen" fighter aircraft, which replaced the earlier operational Mirage 2000. Earlier, in 2014, Brazil ordered at Swedish manufacturer Saab, 36 fighters of the NG model, of which the deliveries are currently still ongoing. A media conference during Cruzex 2024 was the stage for the Brazilian and Swedish ministers of defence to announce the signing of a Letter Of Intent (LOI), which marked the start of negotiations to acquire additional Gripens for Brazil and purchasing Embrear KC–390's for Sweden to replace their C–130 fleet. The current FAB

Gripen inventory is estimated at about 8 aircraft out of the 36 ordered and with the intention to increase the fleet with 25%, another 9 aircraft may be involved. During the first week of Cruzex 2024, a total of 7 different Brazilian Gripens had been counted at Natal. Next to the new Gripen in Cruzex, the FAB had furthermore a firm presence of F–5EM and double seater EF "Freedom Fighters" as well as the A–1AM and BM fighters. The later aircraft, which is in fact a Brazilian built AMX aircraft, may have had its farewell as contributor to Cruzex, as the aircraft is expected to be taken out of service somewhere during 2025.

Another aircraft at age which participated in Cruzex was the "Armada" AF–1 Skyhawk from the Brazilian VF–1 navy unit based at Sao Pedro da Aldeia and without any end of life expectations statements given, this iconic type keeps on going. The Brazilian AF participants continued with a number of A–29A and B "Super Tucano" aircraft for light attack duties, while the more general transporting and supporting operations were conducted with C–105 and SC–105 Amazonas (a C–295), KC–390's and some H–36 Caracal helicopters. The E–99M aircraft, an Embrear 145 for AEW&C, together with its close related R–99 platform, were taking care of surveillance, interception Electronic Warfare (EW) and Electronic Intelligence (EI) missions during Cruzex.

Brazilian roles

Lieutenant Colonel Ramon Lincoln Santos Forneas, Commander of the First Air Defence Group (1º GDA) explained some of the roles of the main Brazilian front line aircraft during Cruzex. The debut of the F–39E in the Cruzex mission's activities included Air Opposition Operations which were coordinated by the Air Defence Package Leader. The embedded self–defence systems, including the Radar Warning Receiver (RWR), Infrared Search and Track (IRST), and Missile Approach Warning System (MAWS) made

the Gripen essential for detecting and countering threats. The Cruzex scenarios required quick reaction capabilities or so called "Threat Reaction," where the F–39 tested its response capacities. The fighter was furthermore used to evaluate advanced tactical missions, performing both offensive (Offensive Counter Air, OCA) and defensive (Defensive Counter Air, DCA) functions. For these OCA and DCA operations, the Gripen protected friendly forces as they executed actions within enemy territory, as well as operations aimed at defending against enemy attacks. Another critical aspect measured during CRUZEX 2024 was the F–39 Gripen's combat survival rate, utilising Mission Planning Assistance II (PMA II) which is a system that simulates the impact of threats in the scenario and provides a detailed analysis of each vector's performance.

LtCol Forneas continued on the F–5EM's which were tasked with air defence missions. As the type stands out for its ability to manage tactical formations, it also was serving as Air Defence Package Leader. The F–5EM role is to protect airspace, coordinating defence and escort actions against threats as well as ensuring the safety of aircraft and strategic assets. The F–5 also received in–flight refuelling, making it able to extend its mission range. Next to be mentioned by LtCol Forneas was the A–1AM and BM fighter which is designed for attack and reconnaissance missions, playing a significant role in tactical leadership

as Mission Commander in composite air mission scenarios. The A–1AM coordinates formations and conducts strikes in integrated operations while also performing aerospace reconnaissance and playing a strategic role in this context.

"The A–29 Super Tucano conducts integrated attacks, offering versatile performance by engaging ground targets with conventional weaponry. Equipped to respond to both air and ground threats, the A–29 has self defence systems that enhance its effectiveness in mixed threat operation", as LtCol Forneas concluded.

FAM, FIT & COMAO

Exercise Director General Rezende mentioned that the exercise had three phases: the first, called FAM (Familiarisation), includes familiarisation flights to help crews adapt to the Area of Operations; the second, FIT (Forces Integration Training), promotes integration among the various participating Air Forces; and the final phase will feature flights in pre–planned scenarios with multiple aircraft, known as Composite Air Operations (COMAO). The exercise aims to update tactics, techniques, and procedures in composite air operations, preparing the armed forces for conventional warfare scenarios and other complex challenges. "I also stress the exercise's importance in contributing to global order and peace, as well as maintaining Brazil's sovereignty and territorial integrity," as general Rezende emphasised.

The exercise had a strong focus on cyber defence, air defence, and satellite control in order to prepare and integrate the Brazilian armed forces and its allies, while enhancing operational capabilities and fostering essential international cooperation during times of crisis and complex military operations. For the cyber defence element, Brazil, Chile, Colombia, United States, Paraguay and Peru contributed together in space and cyber operations during Cruzex.

Text by Peter ten Berg
Photos by Força Aerea Brasileira (FAB)

History, current and future of Ala23, Spain

It was in the 1930s when the city Badajoz had its first aerodrome which was located on the "Las Bardocas" estate between the Gevora and Guadiana rivers, which periodically subjected it to flooding. During the Spanish war and the following years this airfield served as an elementary school for pilots but shortly after the end of the war the search began for a new location for the airfield. The new location which was chosen as the most suitable is the current Talavera la Real airbase in the region Extremadura near the city of Badajoz. In the early 1950s work began on the so called Reactor School which entered into service in 1953. The works continued for several years, during which the facilities and buildings necessary for the performance of the teaching tasks entrusted to the unit were completed and which have remained unchanged throughout its history.

On 12 September 1958 Talavera la Real airport was opened to national air traffic, with the Madrid–Badajoz airline being operated by the company AVIACO. In June 1959 the Aeronautical easements of Talavera were established which were modified in 1968. On 14 July 1976 the first regular airliner from Iberia was inaugurated and the facilities of the airbase were used to handle the passengers. The problems arising from the joint use of the

airbase made it advisable to build a terminal building and an aircraft parking platform on the opposite side of the runway. The construction works began in 1981 and were completed in 1983 although the terminal was not opened until 1990 when two daily flights were established with Madrid and two flights per week with Barcelona. At the moment the airport has regular flights with Madrid and Barcelona throughout the year and are expanded in the summer and includes other tourist destinations.

History, current and future of Ala23

On 10 December 1953, Jet School was founded with its first commander Lieutenant Colonel Jose Ramon Gavilan y Ponce de Leon. Its purpose was to provide Air Force pilots with the necessary training so that their adaptation from conventional piston aircraft to the new jets, that would soon arrive from the United States as a result of the Cooperation Agreements, would be completely satisfactory. The first training aircraft for the school that arrived in March 1954 were Lockheed T–33As and the first flight for the school was performed on 24 March 1954. In October 1958 the Reactor School received the North American F–86F Sabre and the Application and Shooting Squadron was founded. In this way the unit provided training to the pilots in the same aircraft that they would fly in their later destinations in different Fighter Wings within the Air Force. In April 1965 the squadrons Jet School and Application and Shooting Squadron were renamed 731 and 732 squadron. The last flight with the F–86F Sabre was on 26 June 1969, in total the F–86F has flown 27.029 hours with 356 students and 29 instructors. A few months later, on 3 November 1969 the Reactor School reached the historic figure of 100.000 flight hours.

The Northrop Casa F–5B joined the unit on 12 December 1970 and it represented a significant leap in the training provided by the school. The last flight with the T–33 was on 28 May 1973 after twenty years of operational service. In total the T–33s have flown 79.297 hours with 535 students and 105 instructors. On 23 March 1987 the Reactor School was renamed to 23rd Fighter and Attack Training Wing and its squadrons became 231st and 232nd squadron known as “Patas Negras”. Patas Negras is a symbol of excellence because Extremadura is home to a pure–bred Iberian pig, which has black nails, from which is produced a world renowned cured ham.

The instructors are assigned to 231 squadron and the students are assigned to 232 squadron. At the moment 231 squadron consists of 11 instructor pilots from the Spanish Air Force and 1 instructor pilot from the Argentine Air Force, which is here for two years. In 2023 the squadron existed for 70 years and a SF–5 received a special tail to mark this anniversary. The Northrop Casa F–5B has proven to be an excellent training aircraft and during the years it received two midlife update programmes, the first one started in 1991 and extended the lifetime of the airframe with 3.000 flight hours. The second midlife update in 2000 was assigned to Israël Aircraft Industries (IAI) and subcontracted to EADS/CASA which brought the aircraft to the SF–5M standard. The main focus on the second update was on the avionics, installation of a glass cockpit, Head–up display (HUD), Hands on Throttle and Stick System (HOTAS), virtual radar and new navigation and communication systems. Also the wingtips have been modified in order to accept the AIM–9 Sidewinder and the new Martin Baker Mk–16L, a zero–zero ejection seat, has been installed so the pilots don’t need to strap themselves on their parachute before entering the cockpit.

This transformed the SF–5M in a lead–in fighter trainer perfectly tailored to prepare the pilots to their final assignment. Due to this update the lifetime of the airframes has been extended to 2027. Nowadays the squadron is operating 19 SF–5M training aircraft. In total on all aircraft types the squadrons have more than 250.000 flight hours flown by around 1700 students and 300 instructors.

Squadron and second Base Commander Lieutenant Colonel Alfredo Lago Llinas

I joined the Air Force in 1995 in the 51st Air force Academy Class (the best) and graduated in 2000 with the

rank of first lieutenant. During my years in the academy I flew approximately 50 hours on the T–35 Tamiz and approximately 150 hours on the C–101 Aviojet. After my graduation I was assigned to the 14th Wing in Los Llanos Air Force Base, which is located near the city of Albacete, and flew during my 6 years stay a total of 920 flight hours on the Mirage F–1. In 2006 I was assigned to the 23rd Wing located in Talavera la Real Air force Base, which is located near the city of Badajoz. I was there until 2015 with the ranks of Captain and Major. After that an 8 year non flying period followed with different assignments within the Ministry of Defence (MoD) and Air Force Headquarters in Madrid.

In 2023 I came back to the 23rd Wing as the Chief of Training and Squadron Commander. During all those years in the 23rd Wing I flew 2,000 hours on the Northrop F–5. During my career I've been deployed twice to Afghanistan, 3 months each deployment, as a JTAC and once to Djibouti for 4.5 months as the Chief of Air Operations of the Spanish Detachment in Atlanta Operation.

Fighter Pilot Training Course

When a person applies for the Air Force he or she must be between 18 and 21 years old, not older! The younger the pilot, the more years to fly. At this moment the oldest pilot within the Air Force is 45 years old. After that they become instructors, squadron commander or will have an office job. The future pilots undergo an education programme which lasts five years. The first two years are basic military training and then three years of flying in four phases. During the third year of the education they start with phase 1 at San Javier and contains learning the basic flight maneuvering and visual navigation on the PC–21. A total of 35 flight hours are being made during this phase.

If a student fails for this phase the only option within the Air Force is to become a drone operator. The fourth year of education contains phase 2 which is also at San Javier and contains instrumental, navigation, formation and night flights, all in the PC–21. Also navigation trips

are made during this phase. A total of around 80 flight hours are being made during this phase. During the fifth and final year of education, phase 3 and phase 4 will take place at Talavera la Real. This last part of the training starts in September and lasts until June the next year and after having completed the flying course the students go back to the academy to complete their studies and graduate in July. The first flight in phase 3 at Talavera la Real is called the Dollar Flight which is a tradition within Ala23. The instructor pilot is seated in the front while the student pilot takes the back seat and the instructor treats the student to a flight in which the boundaries of the capabilities of the F–5 are explored including the students first introduction to a supersonic flight!

The student gives his instructor a special silver dollar which they will receive back once the training has been successfully completed and the student is transferred to an operational squadron, that's why this flight is called the Dollar Flight. Phase 3 is the same as phase 2 but the flights are more advanced and they're flying in the F–5. Also Air to Ground flights are part of phase 3.

During phase 3 it becomes clear for which type of fighter aircraft the future pilot is capable, the EF–18 Hornet or the EF–2000 Typhoon. During phase 4 the flights are becoming more advanced and also Air to Ground and Air to Air flights are being made. The difference between phase 3 and phase 4 is that in phase 3 you learn how to fly the aircraft and in phase 4 you learn how to use the aircraft. During phase 3 and phase 4 a total of 40 hours are being made on the simulator and around 115 flying hours are being made in the F–5, so in total around 230 flight hours are being made during the flying course of their education.

At Talavera la Real is also a virtual reality cab which is not obliged but is a good extra practice for the future pilots. Phase 4 is also including a two week exercise to Zaragoza for Air to Ground training missions with practice bombs. During this exercise each future pilot flies 8 sorties. In the past the future pilots flew in the T–35 and Casa 101 at San Javier but nowadays this part of the education is flown in the PC–21 as the T–35s are withdrawn from use and the Casa 101s are only used for acrobatic demonstration flights.

At the moment the first class is graduating by flying only on the PC–21 in phase 1 and 2. The PC–21 has made basic flight training more modern and efficient given the advanced capabilities of the aircraft and also of the new simulator. The PC–21 is a newly build aircraft which flies very smooth and is easy to fly in but the F–5 is an older aircraft and is difficult to fly, but this helps them in the future. The first F–5 arrived in Spain in 1970 and received two midlife update programmes so at the moment there are talks about making money free for another midlife update to keep the F–5 flying for another 5 till 10 years or replacing them by another type, but which type? At the moment a total of 60 students are trying to complete their education and becoming pilots within the Spanish Air Force and they are divided into 30 for transport at Salamanca, 10 for helicopters at Granada, 10 for fighter aircraft at Talavera la Real and 10 for paratroopers at Zaragoza/Alcantrilla. After completing the 4 flying phases the students go back to Murcia to complete their education and then they decide where they want to continue their career. The pilot with the highest rates will be the first to choose which vacancy he or she will fill, so not everyone gets where he or she wants!

Maintenance

Regular and daily maintenance checks are performed at Talavera la Real itself, like the tires, engines and small failures. After 25 flight hours the F–5 needs small maintenance and after 150 hours the F–5 gets a revision in the hangar which takes a week time. After 500 flight hours the F–5 needs large maintenance which is being done by Maestranza Central de Aviacion at Albacete Air Base. After 1,000 flight hours a major overhaul is performed and involves a complete review of the aircraft and its integrated systems. During this overhaul the entire aircraft is stripped down and the airframe's integrity is investigated, checked for metal cracks and all systems are tested. After the re–assembly of the aircraft it must pass the acceptance test which is performed by an experienced instructor pilot from Ala23.

The authors of Lowpass Aviation.com would like to thank all the involved personnel of Spanish Air Force for their hospitality, time and help during our visit at Ala23, Talavera la Real.

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Falcon Leap: exercise combined with remembrance

During the remembrance activities Dutch and US soldiers are flown into the 'battlefield' with armed UH–60M Black Hawks. Note the futuristic looking helmets of the flying crew (photo by Robert Dekkers).

In September 2024, the annual airborne exercise Falcon Leap was again organised in The Netherlands. What once started as a remembrance activity has grown into a full three weeks international exercise. However the remembrance part is not forgotten, on the contrary. And this year, with Market Garden being 80 years ago, that part was maybe even more important than in other years.

The exercise is organised by the 11 Luchtmobiele Brigade (LMB, air mobile brigade) of the Royal Netherlands Army. However the Royal Netherlands Air Force (RNLAF) plays an important role as well, especially the Eindhoven based 336 squadron of the Air Mobility Command (AMC). Together they managed to fill the three weeks with a lot of different challenging scenarios.

Main task of the Dutch defence forces is defending their own territory and that of their allies. Exercise Falcon Leap contributes to this task and Major Bjorn Coppers, airborne planner of 11 LMB, explains: "We train together with

Logo of the 2024 edition of Falcon Leap

foreign troops and we aim to reach the highest level of readiness. This is crucial within the NATO treaty." He continues: "Evacuations are part of Falcon Leap. When hurricane Irma hit the Dutch Antilles isle of Sint Maarten, aircraft of the AMC flew our troops there. At the spot our pathfinders took charge of the local airfield. All training we do during Falcon Leap contributes to these kind of operations."

No less than 12 countries participated in this edition: The Netherlands, Belgium, Germany, Greece, Poland, Portugal, Romania, Spain, the United Kingdom and the United States plus France and Italy that both only sent troops this year, no aircraft. Very full platforms at Eindhoven airbase were the result, with multiple C–130 Hercules, C–27 Spartan, C–295 and A.400 Grizzly aircraft in changing numbers present over the weeks. Major Coppers: "Falcon Leap is the biggest international airborne exercise in The Netherlands. Units form the 11 LMB train dropping cargo and paras over The Netherlands and also Belgium, which is done together with foreign army and air force units. This cooperation enables us to guarantee the readiness state of our airborne troops, both on national and international level." He adds: "An important part of Falcon Leap is the cooperation with the Air Mobility Command here in Eindhoven. They are responsible for all tactical air transport of the RNLAF. Thanks to the use of C–130 aircraft, our paratroopers can be deployed fast and efficient over large distances."

Three aircraft on the platform at Eindhoven with their cargo doors open, waiting for the paras that will board soon.

A line of paratroopers getting ready to board this Portuguese C–295M, one of the rarer participants of the exercise (Photo by Joop Zandbergen).

Third country that sent the C–295M was Poland, the second largest user of the type in Europe after Spain.

"All aspects connected to airborne deployment are trained during Falcon Leap, making it a crucial exercise to accomplish the readiness of our troops. Topics were the quick deployment of units, moving fast over large distances and the integrated planning together with 336 squadron of the AMC. Falcon Leap also offers participants the opportunity to operate with foreign parachutes and radio communications, which is crucial to improve the cooperation between NATO forces." To jump with other forces parachutes requires some thorough cross training. Also the use of a wide range of different transport aircraft, from the small C–27 to the large A.400, is good exercise for the jumpers. And as most missions are flown at low level, this is very important training for the flying crews as well.

This HC–130J 'Combat King II' is rarely seen in Europe. It is the only dedicated fixed–wing personnel recovery platform in the US Air Force inventory of which there are some three dozen operational. The moist air makes for the 'corkscrew' vapour trails.

The exercise was built up over three weeks. The first week saw only Dutch participation, with some 250 to 300 paratroopers of the 11 LMB doing jumps. The next two weeks other forces joined, slowly building up the scale of the droppings up to some 1,000 soldiers jumping together. Next to these paratroopers, large amounts of cargo were dropped as well, to supply troops on the ground with much needed materials (so–called Container Delivery System [CDS] drops). Exercise areas were in the north and the centre of The Netherlands plus a dedicated training area in the north of Belgium.

Although the dropping of the paratroopers and cargo were maybe the most spectacular part to watch, there is obviously more to the exercise than that. Brigadier General Frank Grandia, commander of 11 LMB, explains after one of the missions: "A large group of Dutch and foreign Red Berets were dropped (at Marnewaard), after which they immediately had to fight an equal opponent

who was entrenched in the training village of Marnehuizen. When you turn on the television, you see this on almost every day, but in real life. War, both in Ukraine and Gaza."

The last day of the exercise jumps were made at the Ginkelse Heide, a historic location because of the droppings that happened here during Operation Market Garden in 1944. Next day here the public remembrance activities were held as well. Major Coppers: "Commemorating Operation Market Garden, the day after the exercise ends, will stay an integral part of Falcon Leap. Historical awareness will always be connected to Falcon Leap. We have to honour our history and at the same time prepare for future challenges."

This venerable C–47 Dakota was present at Eindhoven during the last week, preparing the paras for their jump during the Market Garden commemorations.

Market Garden was the largest airborne operation during the Second World War. It was part of the allied offensive operations fighting nazi Germany in September 1944, three months after the D–day landings in Normandy. Aim was to conquer the strategically important bridges over the large rivers in occupied The Netherlands, especially the Waal and the Rijn. These were crucial to be able to advance into Germany, evading the Sigfried Linie, the heavily defended German defence line running from Northern France till halfway The Netherlands. Next to the deployment of paratroopers, allied forces were also flown in using gliders that were towed behind transport aircraft. Unfortunately the operation turned out to be a disaster, costing the lives of many soldiers and also civilians. Due to multiple factors the Allied forces didn't succeed in holding the bridge at Arnhem, resulting in failure of the mission and the infamous term 'a bridge too far'. Only half a year later the Allied troops managed to march into Germany and finally defeat the nazi regime.

During the remembrance activities, the paratroopers jumped from both a historic C–47 Dakota, using the original round parachutes, and from the modern cargo planes. Some 80,000 spectators also watched a demonstration of soldiers of the 101 Airborne Division, one of the units that participated in Market Garden in 1944, together with Dutch troops of the 11 LMB conquer a village after being flown in by UH–60 Blackhawk and CH–47 Chinook helicopters. General Grandia: "Every year this is very special. Not only do we take the time to reflect on those brave soldiers who fought for our freedom in the Second World War. But at the same time, we want to increase awareness of the fact that in 2024 freedom and security unfortunately cannot be taken for granted." As General Grandia mentioned before, that's a fact we can all see on television daily. So exercises like Falcon Leap will keep being important for the foreseeable future!

Other vehicles are brought by CH–47F Chinook, including this jeep (photo by Robert Dekkers).

Text & photos: Patrick Dirksen of Tristar Aviation, additional photographs where stated from Joop Zandbergen and Robert Dekkers

Golden anniversary party for the F–4E

The F–4E Phantom II is a twin engine, two seat fighter–bomber produced by McDonnell Aircraft Corporation, with over 5,000 built by 1979, making it one of the most successful post WWII fighter aircraft. Today the aircraft continues to serve in limited numbers in Iran, Greece and Turkiye. The Turkish Air Force received its first F–4E in 1974, and on 17 November 2024, it celebrated the aircraft's 50th year of service at the 1st Main Jet Base in Eskisehir.

The celebration began on 16 November, when over 200 Phantom enthusiasts gathered in Gurleyik Selalesi national park, 75 km northeast of Eskisehir. Pilots from the 111th Squadron Command "Panther" unveiled the specially painted F–4E adorned with the Turkish flag. The event featured low level flight demonstrations showcasing the Phantom's tactical capabilities, while also providing a thrilling airshow with aircraft buzzing the crowd at under 50 meters with full afterburners.

On 17 November, VIPs, press members and over 500 fans gathered at the 1st Main Jet Base. Throughout the day, several F–4Es performed flyovers. The highlight was at the end of the day when 20 General Electric J79 engines roared when 10 F–4Es conducted a massive, slow and seemingly unstoppable elephant walk on runway 28, emphasising the aircraft's power.

F–4E history in Turkish Air Forces

Tensions with Greece over Cyprus and Greece's 1972 F–4E purchase prompted Turkiye to modernise its air force, leading to an agreement on 14 August 1972, to buy 40 F–4E Phantoms.

From 1973–1974, 101 Turkish personnel trained in the US for F–4E operations, after which Turkiye established the Mobile Training Device Command at Eskisehir in 1974. Training transitioned fully to Turkish instructors by 1975. The first two F–4Es arrived on 30 August 1974, followed by six more, though an arms embargo delayed the remaining 32 until late 1975.

Turkiye later acquired 32 F–4E and 8 RF–4E aircraft by 1979, 70 more F–4Es between 1981–1987, and 40 F–4Es and 46 RF–4Es from 1991–1992. In total, 236 F–4 Phantoms (182 F–4E and 54 RF–4E) were received, with the last aircraft today still in service at Eskisehir's 111th Squadron "Panther" and 401st Test Squadron.

With the F–4E came advanced munitions, including TV guided AGM–65 Maverick missiles, laser–guided bombs (GBU–10/12), and optical guided GBU–8 bombs, giving Turkiye precision air–ground attack capability for the first time. AIM–7E Sparrow and AIM–9 Sidewinder missiles enhanced air–to–air combat, while ALQ–119 ECM pods improved electronic warfare defences. The F–4E's APQ–120 radar enabled all–weather, day–and–night interceptor missions.

F–4E Squadron overview

1st Main Jet Base Command (Eskisehir)

111st Squadron Command "Panther", (F–4E, F–4E/2020 Interceptor/Bombardment)

In scope of modernising the striking force components of the Turkish Air Force, the 111st Squadron Command was modernised with F–4E aircraft as of 23 October 1998 and continued to execute their missions on the interceptor–bombardment squadron. On 22 February 1999, the first aircraft with the tail number 77–0289 was sent to Israel for modernisation. The modernisation of the aircraft of this squadron was completed on 29 January 2001 and the squadron achieved the capability of carrying out interceptor/bombardment missions in every weather condition both day and night with the F–4E/2020 aircraft. 111st Squadron Command is currently the only squadron command in Turkish Air Force which serves as the interceptor/bombardment role with F–4E/2020 aircraft.

112nd Squadron Command "Devil", (F–4E Intercept/ Fighter)

In 1975 it was decided that the 172nd Squadron Command be equipped with F–4E aircraft. Within this scope, 20 aircraft were allocated to the 172nd Squadron Command. 112nd Squadron Command which was modernised with F–4E aircraft in 1974, continued the interceptor/bombardment missions until 1979. In 1979, modern weapons of air defence were added to the inventory of the Air Force Command, thus changed the roles with the F–4E aircraft and became a "All Weather Intercept" Squadron. In September 2004 the 112nd Squadron Command transitioned to the interceptor–bombardment role. The activities of the 112nd Squadron Command was put out on 12 June 2015 after a last flight.

113rd Squadron Command "Light", (USAF/GAF RF–4E, reconnaissance)

The F–4E Phantom II was first introduced to the Turkish Air Force through the 113rd Squadron "Tayfun," established on 29 August 1974, at the 1st Main Jet Base. Under Squadron Commander Air Pilot Staff Major Ergin Celasin, the unit received its first two aircraft on 30 August 1974, as part of the Peace Diamond I project. By 1975, 20 aircraft had been delivered, and the squadron achieved combat readiness. In 1979, the 113rd Squadron transitioned into a reconnaissance unit, adopting the call code "Light" after modernising with RF–4E aircraft under the Light Project. It conducted tactical reconnaissance missions until its final flight on 21 April 2014.

401st Test Squadron Command (F–4E/2020 Test)

The testing and modernisation activities of the Turkish Air Force Command started in 1996 under the roof of the 1st Air Supply Maintenance Centre Command within the Modernisation Management Department (later Technology Weapon Systems Development Department).

The 401st Test Squadron Command made it possible for us to conduct flight test activities which only a couple of countries possess in the world with our own national capabilities. 401st Test Squadron Command continues to execute the testing activities of ammunitions and their systems to be added to the inventory of Turkish Air Force which are developed by the Turkish Defence Industry.

3rd Main Jet Base (Konya)

131st Squadron Command "Dragon", (F–4E, Training)

The history of the 131st Squadron Command dates back to 1951 to the establishment of the 112nd Squadron Command under the structure of the 1st Main Jet Base. The 131st Squadron Command which added the F–4E aircraft to its inventory in 1987, started to give "Combat Readiness Training". On 30 July 2004 the activities of the 131st Squadron Command which was under the structure of 3rd Main Jet Base were put out and it deployed to the 7th Main Jet Base with its aircraft and joined the 173rd Squadron Command.

132nd Squadron Command "Dagger", (F–4E, F–4E/2020 Weapon & Tactical)

In July 1970, the 131st and 132nd Squadrons moved from Konya to Cigli/Izmir under the Education Directorate. On 15 September 1970, the 133rd Operation Training Unit (OTU) was established, later renamed the 132nd Squadron on March 28, 1972, equipped with F–84F aircraft. In February 1994, the squadron added F–4E Phantom aircraft to its F–5A/B Freedom Fighters and began offering advanced training programmes, including weapons tactics, formation leadership, and commander courses. On 1 September 2006, the squadron was reorganised, acquiring F–4E/2020 Terminator and F–16C/D aircraft. F–4E aircraft were removed, and the unit was renamed the 132nd Weapons and Tactics Squadron Command. On 4 May 2014, it transferred its F–4E/2020 aircraft to the 111th and 171st Squadrons and now operates exclusively with F–16C/D aircraft.

Special paint blasting to the skies.

7th Main Jet Base (Erhac–Malatya)

171st Squadron Command "Pirate" (F–4E, F–4E/2020 Terminator/Interceptor Bombardment)

The history of the 131st Squadron Command dates back to 1951 to the establishment of the 112nd Squadron Command under the structure of 1st Main Jet Base. The 113rd Squadron Command which was located in Eskisehir from its establishment until 1963 deployed to the 7th Main Jet Base Command on 10 August 1963. 171st Squadron Command was modernised with F–4E aircraft on 5 July 1979. The 171st Squadron Command which started its missions with the F–4E/2020 aircraft on 21 December 2001, participated in Air Force Command third generation fighter aircraft shooting competitions in 2004 and 2008 and took the first place. The 171st Squadron Command successfully executed its missions both nationally and internationally and in 2016 it was put out and the squadron personnel and its aircraft joined the 111st Squadron Command.

172nd Squadron Command "Falcon", (F–4E Intercept/ Fighter)

172nd Squadron Command was first established in 1951 with the affiliation to the 8th Air Base Command (8th Air Regiment) with the name of 182nd Squadron Command in Erzincan. It deployed to 7th Main Jet Base on 12 September 1963. The 172nd Squadron Command which was modernised with F–4E aircraft in 1978, assumed the Lightning Detachment Command mission in May 1982 and gave "F–4E Combat Readiness Training". After the decision of the Air Force Command to take the F–4E aircraft out of the inventory which were outside scope of modernisation, an "F–4E Implementing Order" was published on 26 February 2009 and the 172nd Squadron Command was temporarily put out.

173rd Squadron Command "Dawn" (GAF, RF–4E, reconnaissance)

The 173rd Squadron was established at the 7th Main Jet Base on 2 November 1981, as an "All Weather Intercept" unit. With 20 GAF RF–4E aircraft acquired from Germany under the Kaan Project, it transitioned to a tactical reconnaissance role on 1 July 1994. On 30 June 2004, its RF–4E aircraft and personnel moved to the 113rd Squadron, ending its reconnaissance mission. The 173rd Squadron relocated to Erhac and began training new pilots for fighter bombardment missions. By 16 August 2004, it became the Air Force's sole F–4E pilot training squadron. Later, it resumed a reconnaissance role with RF–4E aircraft from the 113rd Squadron, while F–4E training shifted to the 172nd Squadron. The 173rd Squadron was deactivated after the Air Force's final RF–4E mission on 12 March 2015.

Modernisation programmes

The F–4 Phantom, first flown in 1958, reflected 1960s technology and was effective in air–to–air missions with its APQ–120 radar until the mid–1980s. By the 1990s, Turkiye's fleet of F–4E Phantom II aircraft had aged and became unsuitable for modern needs. Turkiye chose modernisation over replacement due to cost considerations and experience with maintaining the Phantoms.

Terminator Project

In 1997, Turkiye signed a $632.5 million contract with Israel Aerospace Industries (IAI) to upgrade 54 F–4Es.

F–4E with typical dragchute.

Special paint leading the elephant walk.

26 were modernised in Israel, and 28 at Turkiye's 1st Air Supply and Maintenance Center. The upgrades extended service life by 20 years. The IAI upgrade was based on the Kurnass 2000 developed for the Israeli Air Force and included the replacement of the existing radar with ELTA product EL/M–2032 and the integration of AN/ALQ–178[V]3 electronic countermeasure system, MXF–484 VHF/UHF radio, HOTAS flight control system, heads–up display (HUD), integrated INS/GPS navigation system, airborne videotape recorder (AVTR), full colour multi–function displays (MFD), a new mission computer and MIL–STD–1553B data bus.

The most significant improvement that increases the strike capability of the Terminators is that the F–4E/2020 aircraft can fire Popeye missiles. The Popeye is a solid rocket powered stand–off missile weighing 1,360 kg (3,000 lb) with a 340 kg (750 lb) blast fragmentation or 360 kg (800 lb) I–800 penetrating warhead and imaging infrared or TV guidance. It has a reported range of 100 km, depending on its launch altitude. The missile can also be controlled directly through the data link.

Isik Project

The Isik (Light) Project was Turkiye's first fully national modernisation initiative, upgrading 18 RF–4E aircraft with enhanced navigation, communication, and electronic warfare capabilities. It standardised RF–4Es from both the US and Germany into a unified configuration. Upgrades included digital cockpits, INS/GPS navigation for precise positioning, advanced communication systems, and the AN/ALQ–178[V]3R electronic warfare system. The aircraft were also equipped with advanced reconnaissance pods, extending their service life into the 2020s. The Isik Project symbolised Turkiye's growing self–reliance in aerospace modernisation, combining reliability with advanced technology to meet evolving defence needs.

Simsek Project

Finaly in 2006 the Simsek Project started to enhance the airframe and avionics of 16 F–4E Phantom II aircraft in the Turkish Air Force. The goal was to strengthen the aircraft's structure and integrate advanced systems to improve its combat capabilities. By 2010, the last upgraded F–4E, designated F–4E/TM, was delivered to the 1st Main Jet Base Command marking the completion of the project.

Conclusion

The Turkish Phantoms began service on 30 August 1974, supporting the Turkish Air Force in nine squadrons. They introduced modern radar, ECM, and advanced weaponry. Through the Terminator, Isik, and Simsek programmes, Turkiye gained vital experience in system integration and testing. Although the Phantoms were slated for retirement in 2020 with the arrival of the F–35s. However delays of the F–35's due to political issues with the US have extended their service and the F–4Es will continue to fly Turkiye's skies for the foreseeable future.

Article by Johan Franken & Frank Van Der Avoort

Cruzex 2024: Bigger and better!

The goal of Cruzex was to create a highly complex simulation environment while fostering integration beyond aircraft in the skies.

During a six years absence, the Forca Aerea Brasileira (FAB – Brazilian Air Force) organised once again their large–scale war simulation exercise called Cruzeiro do Sul Exercício (CRUZEX – Southern Cross Exercise). The largest multinational air training in Latin America, organised by the Brazilian Air Force since 2002, took place at Natal Air Base, in Rio Grande do Norte from 3–15 November 2024. One of the main objectives of Cruzex is to provide the training opportunities in Joint Air Operations, including Ground Attack, Air Defense, Escort, In–Flight Refueling, Air Alert and Control, Reconnaissance, Combat Rescue, Cargo Drop, and Paratroopers. Different nations working closely together, flying aircraft with different functions and capabilities, acting in an integrated and cooperative manner, allowing for a high operational gain, while also promoting the exchange of experiences among all those involved.

The training also enabled the validation and introduction of new doctrines and tactics for operational use, in addition to testing the mobilisation and logistics capacity of the FAB's aeronautical squadrons. Commander of the Natal Air Base, Brigadier General Rezende explained: "The realisation of another edition of the largest multinational warfare training in Latin America aims to strengthen interoperability between the Air Forces of different countries, promoting joint training in complex and challenging scenarios. It is an opportunity, both for

Composite Air Operations (COMAO) are integrated in Cruzex with large force launches during the day.

Cruzex is a large exercise with flight activities continues throughout the day and making use of both runways available at Natal Air Base.

FAB service members and for the other 15 participating countries, to add knowledge, enabling experiences in joint action scenarios. The exercise is not intended to highlight the advantages of one force over another, or between aircraft, nor to designate winners or losers. Instead, it provides joint training where each country contributes its knowledge and capabilities to the collective evolution of the forces involved."

Until the mid–90s, the operational exercises of the Brazilian Air Force took place only within the national territory, being restricted to training among its own squadrons. This began to change with exercise Operations Tiger (1994, 1995 and 1997) and exercise Mistral (1997 and 1998), carried out in cooperation with the United States Air Force (USAF) and the French Air Forces (Armee de l'Air), respectively. These exercises allowed for the first time to verify the level of training of pilots and the performance of the A–1 (local designation of the AMX), F–5 and Mirage III fighters of the FAB, against more modern combat aircraft. In 1998, it was the turn of the A–1 jets to participate in Red Flag, one of the most realistic air drills in the world, at Nellis Air Force Base, in Nevada, in the United States. The subsequent analyses of these meetings showed the excellence of the training and the innate skills of the Brazilian military pilots. Although it was successful in some clashes, especially the A–1 (with its performance being highly praised), the technological gap and the need for modernisation or the acquisition of more capable vectors for the FAB were also evident, culminating later with the implementation of the F–5BR Programme and the launch of the F–X Project. Finally, another conclusion drawn from these exercises with friendly nations was the idea for the planning and organisation of a large multinational training within Brazil.

Late in the afternoon return of an A–1AM based at Santa Maria.

The setup of Cruzex is based on experienced gained by the FAB in their participation in Red Flag in the US and

NAS JRB New Orleans based F–15's made the type debuted at Cruzex.

Tactical Leadership Programme (TLP), in Europe. Focused on the realism of the actions, these trainings had as a backdrop, the assembly of fictitious scenarios, in which a contested territory was invaded by a certain nation (red country), resulting in the formation of an international coalition, led by the blue country, with the objective of expelling the invader. Using this plot and always attentive to the latest air warfare tactics, the FAB, with the experience acquired in participating in multinational exercises, decided to create its own training along the same lines. Thus, the Cruzeiro do Sul Exercise emerged.

The first edition took place in 2002, in the south of Brazil, with the Canoas Air Base, in Rio Grande do Sul, being chosen as the central point of air operations, housing the main air resources of the training. Brazil, Argentina, Chile and France participated with aircraft. Squadrons from Florianópolis and Santa Maria Air Bases were incorporated into the exercise, operating in a split manner. The model of geographical distribution of activities, with an Air Base centralising operations and other nearby locations integrating the scenario or functioning as support points, would become a trademark of Cruzex. Two years later, it was the turn to Natal, in Rio Grande do Norte, to host the training, with the participation of Brazil, Argentina, France and Venezuela. The exercise was established on a biennial basis, and so, in 2006, the Anapolis Air Base, in Goias, received aircraft from six countries, Brazil, Argentina, France, and Venezuela, in addition to the return from Chile and the debut of Uruguay. From 2008, the exercise gained a permanent headquarters, the Natal Air Base (BANT), and took place in November, due to the favorable weather at this time of year.

One of the main reasons for the choice was the fact that Natal is one of the largest Air Bases of the FAB, with an appropriate infrastructure to host large air trainings. As seen, the place had already hosted Operations Tigre II and Mistral I, in addition to Cruzex itself, in 2004. Geography also weighed in favour of placing the exercise in the South of Brazil. The State of Rio Grande do Norte, which is located in the Northeast region of Brazil, was closer to North America and Europe, facilitating logistics and the displacement of foreign air assets. The vast airspace with minimum civilian airplane activities adds to the favourable position for the exercise to the held in Natal.

With each edition, Cruzex has been gaining importance and incorporating new elements, challenges and scenarios, in the always complex and dynamic fields of air warfare and military technology. The numbers are impressive and give the exact dimension of the greatness of the exercise. For the 2024 edition, there were 16 participating countries (half of them actively participating with air assets, equaling the number of the 2013 and 2018 editions), more than three thousand military personnel involved and close to 100 aircraft, from Brazil and foreign nations. Air assets participated from Brazil (Air Force and Navy), Argentina, Chile, Colombia, the United States, Paraguay, Peru and Portugal; with personnel for actions in the Space and Cyber domains coming from Brazil, Chile, Colombia, the United States, Paraguay, and Peru. In addition, observers joined from South Africa, Germany, Canada, Ecuador, France, Italy, Sweden and Uruguay. The 2024 edition marked several important milestones, with participation for the

Paraguay participated for the first time with aircraft. Three AT–27 Tucanos made the long journey North to Natal.

The Argentina Air Force is a regular participant during Cruzex, providing a KC–130H for this years's edition.

last time of certain types and participation for the very first time of certain types as well as air forces in Cruzex.

By far the biggest contributor to the exercise was the FAB. Having started the organisation of Cruzex already back in 2023, many of their participating aircraft came to Natal 3 weeks earlier to prepare for the exercise. Coming from Santa Maria, in the South of Brazil, were five AMX International A–1AM/BM aircraft. This will very likely mark the last participation of the type in the exercise as the type is soon to be withdrawn from service. No less than 14 Northrop F–5EM/FM's participated during the exercise. With a loss of one of their aircraft during the week before the exercise, the type remained heavily involved in flying activities. The aircraft came from both Canoas and Santa Cruz. One of the stars of Cruzex was the first time participation of the Saab F–39E Gripen, based at Anapolis. With seven aircraft present during the exercise, the FAB brought almost their entire arsenal of the new fighter, of which the latest are currently being built in Brazil after the first batches coming directly from Sweden. Based at Natal, so outnumbering all other participating aircraft, the Embraer A–29A/B Super Tucano participated from all four main squadrons/bases, Natal, Porto Velho, Boa Vista and Campo Grande. Based at Anapolis, the Embraer R–99 and E–99M provided Remote Sensing and Airborne Early

The E–99M performs airborne early warning and control (AEW&C) missions and the FAB has five in active service.

The plot of the exercise in the 2024 edition was centered on hypothetical scenarios of Regular, Regional and Limited War, focused on Air Force actions.

The workhorse of the FAB is the (K)C–390, here in tanker configuration.

Warning and Control (AEW&C) missions. Transport duties were provided by Manaus and Campo Grande based Casa C–105A Amazonas. A Search and Rescue (SAR) version, SC–105, was also present at Natal, but did not fly during the exercise. Another newcomer and heavily used during its short career was the Embraer (K)C–390 Millennium. The new workhorse of the FAB provided both transport as well as air to air refuelling duties. Another end of an era appearance came from two McDonnell Douglas AF–1B/C Skyhawks of the Brazilian Navy. With only a handful of these aging aircraft flying, this is very likely their last participation.

Cruzex always brings a wide variety of types and countries together. The 2024 edition was not different. The Fuerza Aerea Argentina (FAA – Argentine Air Force) travelled North with four Fabrica Argentina de Aviones (FAdeA) IA–63 Pampa III advanced training and light attack jets, making their debut. They were supported by a single Lockheed Martin KC–130H Hercules which also provided air to air refuelling during the exercise. Another debutant came from the Fuerza Aerea del Peru (FAP – Peruvian Air Force), which provided five Korea Aerospace Industries (KAI) KA–1P Torito training and attack turboprop aircraft. Participating for the second time, Peru also provided a KC–130H. More tanker support came from the Fuerza Aerea Colombiana (FAC – Colombian Air Force), providing a single Boeing KC–767 Jupiter. Unfortunately, the Kfirs which were on the initial planning did not attend. Returning for the sixth time was the Fuerza Aerea de Chile (FACh – Chilean Air Force) with five General Dynamics F–16C/D Vipers and a single Boeing KC–135E Stratotanker. The United States Air Force (USAF) has been a supporter of Cruzex for a long time and also supported this year's edition. Participating for the first time, six McDonnell Douglas F–15C's arrived from Louisiana supported by a Boeing KC–46A Pegasus. After participating as observers in previous editions, the Fuerza Aerea Paraguaya (FAP – Paraguayan Air Force) was a welcome new participant. Sending one Casa C–212–400 Aviocar and three Embraer AT–27 Tucanos, it was a big learning curve for the pilots, being able to work closely together with other nations as well as other types of aircraft. Having bought the KC–390 from Brazil, and currently operating two, Forca Aerea Portuguesa (FAP – Portuguese Air Force) sent a single KC–390, also marking their first participation. Being able to closely work together with FAB pilots, flying the same type of aircraft is crucial for the FAP, so they can maximise their capabilities of the new aircraft.

The exercise in Natal was divided into three phases. The first, called FAM (Familiarisation Mission), included adaptation flights to assist, mainly foreign crews, in acclimatising to the geographical characteristics of the area of operations, local air traffic and radio frequencies; the second, called FIT (Force Integration Training), promoted joint work among the various participating Air Forces, but in a limited way, employing formations with a smaller number of aircraft. This phase also provided interaction and cooperation among all participants, essential elements for the third and final stage, centered on Composite Air Operations (COMAO) itself, marking the high point of the training.

The second and final week of the exercise was marked by the intensification of activities and included flights in highly complex scenarios, with multiple aircraft involved in air operations, requiring accurate and careful planning and with a level of pressure similar to that of a real conflict. In this phase, the packages involved the participation of more than 60 aircraft, acting simultaneously and in an integrated manner, representing the forces of both sides. The fighters acted in the role of air defence.

Their role was to escort and protect the transport, attack, air to air refuelling aircraft and the valuable Air Command, Control and Warning aircraft. At the same time, they had the function of locating, engaging and neutralising their similar opponents, who constituted the great threat to other aircraft. In total, about 1,500 hours were flown and more than 800 missions were accomplished, in favour of constant training, interoperability, and cooperation.

Text and photos: Erik Bruijns

Royal Canadian Air Force (RCAF) 100th Anniversary

The RCAF was formed on 1 April 1924, just 15 years after the first powered, controlled, heavier–than–air flight in Canada in 1909, a reminder of how quickly aviation evolved.

One of the RCAF's predecessors, the Canadian Air Force, was granted permission to use the (British) Royal Air Force's Blue Ensign in 1921, which was extended to the RCAF upon its formation on 1 April 1924. Since 1946, RCAF aircraft have been marked with a distinctly Canadian design: the RCAF Roundel featuring a red maple leaf. After being dissolved among five different commands in 1968, forming the unified Canadian Armed Forces, the RCAF's air units and assets were consolidated once more in 1975 under the newly formed Air Command, which reverted to its historical name The Royal Canadian Air Force in 2011.

The insignia featured on this coin's reverse was unveiled in 2013. It features the motto Sic Itur ad Astra ("Such is the pathway to the stars"), which was first granted to the RCAF's precursor, the Canadian Air Force, in 1920, changing to the Royal Air Force's Per Ardua ad Astra ("Through adversity to the stars") in 1923 after the Canadian Air Force was allowed to use the title "Royal"; Sic Itur ad Astra was reinstated in 1975.

2024 Royal Canadian Air Force $2 Coin

As Canada's Air Force marks its centennial, the two $2 commemorative circulation coins feature a design that spans 100 years of RCAF missions, machinery and milestones.

The colourised wrap role contains 25 engraved $2 coins featuring historic RCAF aircraft, past and present, that have been used to perform different roles throughout the RCAF's first century of service from air defence to search–and–rescue efforts.

The RCAF Roundel has been colourfully re–created on the reverse. Only 20,000 rolls of these coins are available worldwide. Metal: Outer ring: Three–ply nickel–plated steel, Inner core: Three–ply brass–plated aluminum bronze, with selective colour. The Non–colourized Special Wrap Roll contains 25 engraved $2 coins. Only 10,000 rolls of these coins are available worldwide. Metal: Outer ring: Three–ply nickel–plated steel; Inner core: Three–ply brass–plated aluminum bronze. Sold at C$79.95 each roll.

Designed by Toronto–based illustrator Pui Yan Fong, the coin's reverse spans 100 years of Royal Canadian Air Force (RCAF) history, represented by stylized depictions of aircraft flown by RCAF personnel past and present. The inner core features the RCAF roundel above a Model H of the CC–130 Hercules that has been the mainstay of the RCAF transport fleet for over 60 years; the upward angle of the Hercules is a nod to the RCAF motto, Sic itur ad astra ("Such is the pathway to the stars"), while the double dates "1924 2024" commemorate the RCAF Centennial.

Left: Colourised wrap role contains 25 engraved $2 coins roll. Middle: 100 years of RCAF aircraft, past and present. Right: Non-colourized Special Wrap Roll contains 25 engraved $2 coins.

Eight current and historical RCAF aircraft appear on the outer ring, from top to bottom: the Finch Mk. II, CSR–123 Otter, F–86 Sabre Mk. 6 and CF–100 Canuck Mk. 5 on the left side; and on the right, the CT–114 Tutor, CC–115 Buffalo, CF–188 Hornet and CH–146 Griffon helicopter. The obverse features the effigy of His Majesty King Charles III by Canadian artist Steven Rosati.

Commemorative Collector Keepsake Card – 100th Anniversary RCAF

Both versions of the $2 coin (colourised and engraved only) are featured in this Commemorative Collector Keepsake Card to focus exclusively on the commemorative theme. The RCAF Centennial is an opportunity to honour the history and heritage of Canada's Air Force and to recognise its personnel's national service and contributions to aviation, national security, emergency support and international peace.

The aircraft depicted on the coin represent some of the ones flown by RCAF personnel, past and present. An inspiring salute, for aviation and history enthusiasts; and for all who are inspired by the RCAF's important legacy of service. Limited quantity of 50,000 keepsake cards have been issued by the mint. Sold at C$14.95.

Special Edition Silver Dollar Proof Set

The identifying mark of Canada's Air Force, the Royal Canadian Air Force (RCAF) badge stands for valour and duty, uniting present–day RCAF personnel and their trailblazing predecessors and symbolizing the contributions and sacrifices that have made and continue to make the RCAF what it is today. Exclusively available as part of this set, the 2024 Special Edition Silver Proof Dollar is a salute to RCAF personnel past and present.

RCAF Badge: The RCAF badge provides a strong, visually compelling design that is rooted in history, and this coin gave our engravers the opportunity to bring the insignia to life in a new way. Crafted in 99.99% pure silver, the Special Edition Proof Dollar is only available as part of this set, thus making it a coveted RCAF Centennial collectible. Limited mintage. Only 20,000 sets are available to collectors worldwide. Sold at C$119.95. Engraved on the coin's reverse, the double dates "1924 – 2024" commemorate the RCAF Centennial and its 100 years of service.

The Special Edition Proof Dollar is presented in book style packaging alongside six other Canadian circulation coins, one of every circulation denomination issued in 2024, and all of them minted in a proof finish.

Silver Proof Dollar 100th Anniversary of the Royal Canadian Air Force

Since its creation in 1924, the Royal Canadian Air Force (RCAF) has evolved into a storied national institution, one that has played a pivotal role in our nation's history and in the skies above. Building on the foundations laid by Canadian pilots in the First World War, the fledgling RCAF first distinguished itself through its civil air operations, pioneering the use of aircraft for fighting forest fires and contributing to the mapping of Canada.

Whether participating in air defence, Arctic patrols, NATO training, humanitarian flights, natural disaster relief, peacekeeping operations or search–and–rescue efforts or even providing space power support to the Canadian Armed Forces.

Designed by artist Jason Bouwman, the Force's history and aviation fleet are represented by four significant aircraft (from left to right): the De Havilland DH–82C Tiger Moth symbolises the RCAF's early years; the McDonnell Douglas CF–188 Hornet represents its fighter fleet; the Lockheed CC–130 Hercules represents its fixed wing aircraft fleet; and the Boeing Vertol CH–147 Chinook, its helicopter fleet. Three of the aircraft leave a contrail behind that begins to form the RCAF tartan; however, all four aircraft are connected to the Royal Canadian Air Force roundel, with the skyborne maple leaf (centre) representing Canada's Air Force. The RCAF's future and its space division are represented by the planets and orbital rings, with the two outermost rings running across the maple leaf to represent the centennial years "1924" and "2024" (and all that has been achieved between these centennial dates); the stars honour the RCAF's current inspirational motto, Sic Itur ad Astra ("Such is the pathway to the stars"). At the bottom, the flaming parrot tulip (representing "Rescue") is one of four tulip bulb types specially selected to commemorate the RCAF's Centennial in gardens across Canada. The obverse features the effigy of His Majesty King Charles III.

The annual Fine Silver Proof Dollar 2024, collage on the coin's reverse design is the product of a close collaboration between the Royal Canadian Mint, the Royal Canadian Air Force and the artist, Jason Bouwman. Only 35,000 coins are available to collectors worldwide. With a sale price of C$69.95. The Fine Silver Proof Dollar is encapsulated and presented in a black Royal Canadian Mint–branded clamshell with a black beauty box.

serve Canadians and the world, taking part in search–and–rescue missions and NATO training programmes, disaster relief and peacekeeping operations, and even providing space power support to the Canadian Forces, proving the sky is no longer the limit for Canada's Air Force.

One design, three eras of aircraft history. Representing 100 years of RCAF history, the coin's reverse features three different fighter aircraft: the Sopwith Camel of the First World War and the RCAF until 1929; the Supermarine designed Spitfire fighter flown in the Second World War; and the Lockheed Martin F–35 Lightning II that represents the future of RCAF aircraft. This 99.99% pure silver collectible honours the RCAF's distinguished history and heritage on its retro–style reverse, where the illustrative art style spans three different eras of RCAF aircraft history and captures the pulse–pounding thrill of flying. Modern meets traditional engraving. Traditional engraving brings the different aircraft to life on your coin's reverse, which also features laser engraving and special frostings to help distinguish select design elements. Of the 17 RCAF fighter squadrons serving overseas during the Second World War, 14 flew the Spitfire in combat. Credited with being flown to shoot down more enemy aircraft than any other allied type, the Camel was named for the bump caused by the fairing covering the two machine guns on the nose of the aircraft.

The reverse design spans three different eras of RCAF aircraft history. Two of the aircraft speak to the RCAF's past: on the left, the Camel was flown as a fighter aircraft in the First World War and as an advanced combat trainer with the RCAF until 1929; and on the right, the Spitfire fighter was flown in combat by RCAF squadrons overseas in the Second World War. The F–35 Lightning II, the inspiration for the lightning bolt in the background, is prominently featured in the foreground, where the stealth

Left: Special Edition Silver Dollar Proof Set depicting the RCAF Badge. Middle: Silver proof dollar depicting four different aircraft. Right: Effigy of His Majesty King Charles III.

The Royal Canadian Air Force Centennial $20 Pure Silver Coin

Look to the skies, commemorating the RCAF's legacy of service. Higher, faster, farther—such is the pathway to the stars. The Royal Canadian Air Force continues to proudly

fighter represents the RCAF's future fleet. The obverse features the effigy of His Majesty King Charles III.

This fine silver coin continues the theme featured on the 2024 Proof Dollar, only 12,000 coins are available to collectors worldwide. With a sale price of C$109.95.

Left: $20 pure silver coin with effigy of HM King Charles III. Middle: Rose Gold plated fine silver proof dollar. Right: Rose plated fine silver proof dollar with effigy of HM King Charles III.

Fine Silver Proof Set: 100th Anniversary of the Royal Canadian Air Force

Rose gold lifts the RCAF proof dollar to new heights. The 2024 Fine Silver Proof Dollar honours the RCAF's history and legacy during its centennial year (1924–2024). Instead of traditional yellow gold, rose gold plating elevates the 2024 proof dollar by introducing a luxurious and deeply symbolic colour contrast. The rose gold plating appears on the maple leaf, the rim on the proof dollar's reverse, and the rim on its obverse. This set gives you every denomination of Canadian circulation coins. In addition to the enhanced proof dollar, you get one of each: 2 dollars, 1 dollar, 50 cents, 25 cents, 10 cents and 5 cents, for a total of seven coins. Only 25,000 sets are available to collectors worldwide. Sale price of C$234.95.

Designed by Canadian artist Jason Bouwman, the Royal Canadian Air Force's history and aviation fleet are represented by four significant aircraft (from left to right): the De Havilland DH–82C Tiger Moth symbolises the RCAF's early years; the McDonnell Douglas CF–188 Hornet represents its fighter fleet; the Lockheed CC–130 Hercules represents its fixed–wing aircraft fleet; and the Boeing Vertol CH–147 Chinook, its helicopter fleet. Three of the aircraft leave a contrail behind that begin to form the RCAF tartan, however, all four aircraft are connected to the Royal Canadian Air Force roundel, with the skyborne maple leaf (centre) representing Canada's Air Force.

The RCAF's future and its space division are represented by the planets and orbit rings, with the two outermost rings running across the maple leaf to represent the centennial years "1924" and "2024" (and all that has been achieved between these centennial dates); the stars honour the RCAF's current inspirational motto, Sic Itur ad Astra ("Such is the pathway to the stars").

100th Anniversary of the Royal Canadian Air Force – Pure Gold Coin

With the creation of the Royal Canadian Air Force (RCAF) on 1 April 1924, Canada gained its first permanent full time air force, and its early fleet helped develop aviation in Canada. Its formative years and the vital role it played in the British Commonwealth Air Training Plan during the Second World War are represented by the De Havilland DH–82C Tiger Moth depicted on this 99.99% pure gold coin.

The reverse design by artist Neil Hamelin features the Royal Canadian Air Force (RCAF) roundel in the background, with a proud maple leaf at its centre. The RCAF's early years are represented by the De Havilland

Left: $20 Pure Silver Coin depicting the Sopwith Camel, Spitfire and F-35. Middle: $100 - Pure Gold Coin with effigy of His Majesty King Charles III. Right: Shows the RCAF De Havilland DH-82C Tiger Moth

DH–82C Tiger Moth, which was adopted by the RCAF in 1938 and was the last of the Moth trainers the RCAF and civil aviation used in Canada.

The Tiger Moth served as one of the basic trainers in Canadian Elementary Flying Training Schools under the British Commonwealth Air Training Plan during the Second World War, when the RCAF developed into the fourth largest Allied air force. The obverse features the effigy of His Majesty King Charles III. Only 1,500 coins are available to collectors worldwide, sale price of C$1099.95

By Vijay Seth
Aerospace Heritage Trust
Images courtesy: Royal Canadian Mint

Air Marshal (R) Harish Masand says…

I learnt more than flying from them: Hasimara Happiness December 2024 (Part–1)

166 Bde

Hasimara has been on my mind for a long long time and I personally carry some unforgettable memories from that place where I spent perhaps the best four years of my youth and literally turned from a boy to a man. Unfortunately, for one reason or another, I just could not make a visit after 1981 when our daughter, Ruheene, was born in 10 Air Force Hospital in Hasimara. Ever since we celebrated the Golden Jubilee of the 1971 Indo–Pak War in 2021 in Gauhati courtesy the then C–in–C Air Marshal DK Patnaik, many of my friends had also been egging me on to organise a visit to Hasimara. Most persistent amongst these was my course mate, Wing Commander VK "Actor" Vasudeva, who kept at asking me to organise this visit/reunion in Hasimara particularly after seeing the way I had organised the course reunion in Secunderabad in early January 2018 on the occasion of the Golden jubilee of our commissioning and getting our wings on 31 December 1967.

166 Bde and the ladies.

Druk and old memories.

The Guys with Pam Ma'am–All Smiles.

Initially, I was waiting for 101 Squadron to celebrate its anniversary so as to combine the two events with the visit of the Hasimarans immediately after the 101 anniversary since I had done two tenures in 101, first on the Su–7s in 1973 and then on the MiG–21 in 1976–77, but that kept getting delayed since the Squadron had just converted on the latest fighter in the Indian Air Force, the French Rafale, and was busy with operational activities. Finally, around August 2024, I started planning for the visit and reunion of those who fought the War from Hasimara to coincide with the 53rd anniversary of the commencement of the War in the East on 4 December 2024.

Ms Pam Chatrath.

Our effort was to locate and contact all the surviving members of 16 Wing, 17 and 37 squadrons as well as 111 HU of those days and try and get them to join in on the lines of more the merrier since everyone would have had their own stories and anecdotes to narrate which would enrich the interaction with the current generation in Hasimara as also within ourselves when we found the time to sit around a fire and reminisce. Unfortunately, many of those days had passed on and many others were unable to join due to their other commitments and particularly reasons of poor health. In this effort, I was assisted by "Actor" Vasudeva in finding out contact numbers of people and forming the Hasimara Group on WhatsApp to ease communications and information flow. By September, I had 18 who said Yes to the idea which brought the total number of persons to about 30.

However, by the time it came to firm up and commit, we had only nine members with a total of 16 persons. Despite this small number, we were encouraged by the fact that Mrs Pam Chatrath was eager for this trip down memory lane even at the age of 87. Later, when we meet her after all these years, the old lesson dawned on us again that age is just a number and she led our Hasimarans team from the front, and all the while looking gorgeous, as the attached picture would show. Then Wing Commander N Chatrath was commanding 17 Squadron during the War and, I guess, leading from the front comes naturally to the Chatrath family since he led the first few raids from 17 Squadron against Kurmitola airfield in Dacca on 4 December 1971 and also downed an F–86 Sabre flown by Wg Cdr SM Ahmed in his very first mission at about 0720h IST/0750 East PST and was awarded the Vir Chakra for this and more that he did during the War. Mrs Chatrath was accompanied by their son, Arvind, who was a small boy in those days and now a distinguished gentleman of 60.

Next came Mrs Asha Cariappa, all of 85 years, but again her participation in every planned activity during the visit and the additional dance moves on the very first

evening hosted by the Wing on the 4th put all younger members of the visit to shame. As a matter of fact, one of the young guys in Hasimara even asked me where we all got the energy from and where was the elixir hidden by us. Asha's husband, then Squadron Leader KC "Nanda" Cariappa, was commanding 111 HU those days who later retired as an Air Marshal but could not join the visit. Despite this shortcoming in our VIP power, the very mention of daughter–in–law of the Field Marshal opened the door and the red carpet for us everywhere.

Thereafter came Air Commodore KB and Padmini Menon, the person who served the longest in Hasimara though Padmini spent perhaps the shortest time after getting married to KB. KB was actually in 37 Squadron when I first arrived in Hasimara on 4 December 1968 having served in a Toofani squadron in Hasimara itself for some years before that but soon thereafter he went for the Flying Instructors' Course in Tambaram and was attached back to the Squadron for the War along with Flight Lieutenants "Billoo" Sangar and SG Khonde, who were also ex–37.

Wing Commanders VK "Actor" Vasudeva, with wife Indu, and PN "Chick" Paralkar, with wife Ritu, are both my course mates and were in 37 Squadron with me for almost the entire duration including the War. Chick was the tall handsome guy in the Squadron and perhaps the whole station, as you would see from the squadron armament detachment photograph of October 1970 in Jamnagar. Chick has remained youthful in more ways than one, as seen even in this visit. Actor on the other hand, left the Air Force early for greener pastures in Air India.

Armt Dett 37 Jamnagar Oct 1970.

Then came Air Marshal PK "Polly" Mehra, with Sarita, Wing Commanders Dev "DebDa" Ghosh, with Amrita and SK "pet name in the squadron prohibited" Sharma with Sushma, all of 99th GD(P). While DebDa and SK were in 37 Squadron with me and Deb was my roommate for over two years, Polly was in 17 Squadron at that time. Polly rose to be an Air Marshal and C–in–C while also having commanded Hasimara from December 2000 for over a year. Both Deb and SK again left for Air India early in their careers. The attached Group Photo, taken on the 5th with 20 Div Commander in Binaguri, would help identify each, as they look today.

The two escorts to the ladies–Buxa Tiger Reserve.

I came on my own and was popularly known as "Khappe" in the squadron and even flew the War with that callsign. Since I was organising and coordinating the whole event, all the brickbats for some minor hiccups due to last minute changes in the programme and other minor problems that always come up in a group outing, along with some accolades, came my way but all in a lighter vein

Phuntsholing lunch at Asian Kitchen.

166 Presentation.

Cooch Behar Palace with Subedar Mandeep Singh.

and good humour with Amrita even calling me "Harris The Harassed". Quite frankly, all this leg–pulling was a lot of fun and I don't think anyone took offence to anything while riding together long ways from Bagdogra to Hasimara or during the visits to various places. To be honest, I haven't laughed as much for a long long time and would narrate some of the funny stories of this visit later in this piece. Fortunately for us, I had found out in October when I attended the raising Day of 7 Para, the Battalion in which my younger brother Bharat had served during the War, in Jim Corbett Park that the Brigade in Hasimara was being commanded by Brigadier Ajinkya Jhadav, who was also from 7 Para. I had spoken to Ajinkya and the amount of support he provided us by going out of his way was truly remarkable in the true spirit of jointness, As a matter of fact, in the briefing and lunch hosted by the Brigade for all of us on the 6th, he made a specific mention that I was more a member of 7 Para. Between him and the Wing,

All in with 20 Div.

Another one of Buxa–Ms Chatrath looking up at Harsh.

Reception at Bagdogra.

With Sushil and Madhuri Shinde, Pragya and FL Prajul.

With Pragya and her husband.

With Asha Cariappa.

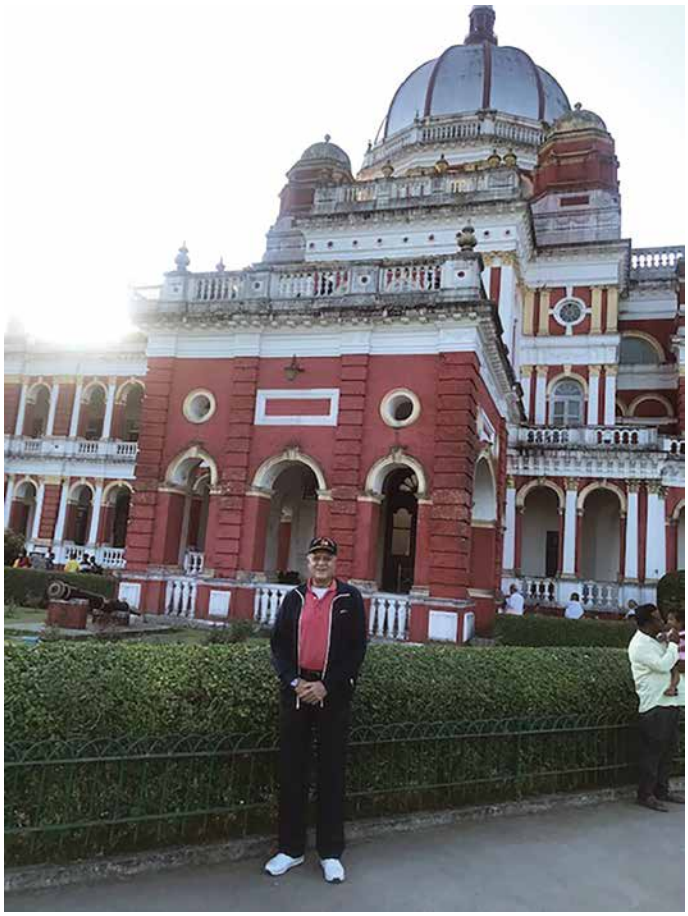
commanded by Air Commodore Ashish Kumar, the visit went amazingly smoothly due to the support they provided us. While Ashish was away during the visit for some work in Air HQ, I had been in touch with him as well as AOC Bagdogra for months and he had left the task to his 2 i/c and Chief Ops Officer, Group Captain Saurabh Pachauri and the Chief Adm Officer, Group Captain Pradeep Sharma. Both of them rose to the occasion admirably and supported us whole heartedly confirming the lesson that the unit must be capable of meeting every task even in the absence of its leader.

The plan was for everyone to assemble in Bagdogra by lunch on 3 December 2024 and ride to Hasimara by that evening. Actor and Deb decided to come on the 2nd and spend the night in Bagdogra due to their flight schedules. Here, I must make a mention of the willing administrative support also provided by Bagdogra. Once again, the AOC, Air Commodore Manish Sharma, who had just taken over command, had to rush off somewhere and his responsibilities were ably discharged by his Chief Ops Officer, Group Captain Anupam Day. Special mention of Mrs Dey is also necessary. She came to meet us all when I reached Bagdogra to pick up everyone and we assembled in the Mess for lunch and she almost got into the bus with us to be with us in Hasimara after seeing the enthusiasm of everyone in the Group. We took the scenic northern route from Bagdogra to Hasimara through the Coronation Bridge on Teesta River to revive old memories of this route and, hopefully, see some wildlife even though this route was a little slower.

I remember an earlier incident of 1970–71 when a planter friend by the name of "Prof" Choudhary in Toorsa Tea Estate asked me to accompany him to pick up two of his Australian friends from Bagdogra, who were visiting him. As soon as we left Siliguri town, these two ladies started asking us to show them the wildlife in the area that they had read about. We told them that though there were some in the area, we didn't normally see the animals on the road because of the traffic and human presence. Lo and behold, soon after the Coronation Bridge, we came across a python lying across the road and had to wait 15 odd minutes before it slithered across and we could ride on. Another 10–15 km later, we came across a herd of elephants and then further on, some wild boars. The

girls looked at us in disbelief as if we didn't know our own country and area. Well, unfortunately this time, we didn't see any wildlife after 50 years of growth in traffic and even when we passed through about 20 kms of Chapramari forest reserve. In any case, it got dark by the time we were half way to Hasimara.

I had reached Hasimara a day earlier on the 2nd, as the organiser, to tie up any loose ends and make sure the programme and our requests on requirements were known to all key appointment holders in Hasimara. For this, I had come through Cooch Behar by train from Delhi so as to be able to visit the palace that I had been to over five decades earlier when Maharani Gina was there and also to see what Cooch Behar airport looked like since I had escorted Rajesh "Laloolee" Lal to it for a forced landing there on the 10 December 1971 after carrying out a close air support mission against the Brigade HQ at Rangpur. Photographs of the palace, now a museum, are attached.



Cooch Behar Palace.

As for the airfield, not much had changed except some new buildings with a proper control tower and better offices. The runway was the same and of the same length of just over 1000 meters except for resurfacing and in use for a single Dornier flight a day. The local Director did not know about the Hunter having landed there during the War but, one of the young controllers, Mr Argha Banerjee, seemed interested in this historic piece of information. We exchanged a few pleasantries and our contact numbers and I sent him the article I had published on this episode by email the very next morning as attached. He confirmed that the article was printed in large fonts, framed and placed in the visitors' gallery for all to know the role played by Cooch Behar during the War. He also seemed enthusiastic on working on an animated reconstruction of the sortie and forced landing and we are collaborating on making that happen. I was the guest of 14 Punjab at Cooch Behar under Brigadier Jadhav who took care of this visit and detailed Subedar Mandeep Singh with driver Havaldar Sushil who stayed with me till I left on the 8th. Lesson learnt was that we tend to take such events as routine when we are young overlooking their historic significance but years later, such events give a new meaning to the current generation and it is important for us to record such events for posterity as soon as we can, something that even I overlooked and am guilty of.

On arrival at Hasimara, I was met by the Officiating Commander, the COO, Gp Capt Saurabh Pachauri, the C Adm O Gp Capt Pradeep Sharma and the rest of the staff of the Mess and we quickly went over the room allocations and the rest of the arrangements before I charged off to a very pleasant evening hosted by the Brigade Commander and his charming wife, Rachna. Hasimara had also detailed an LO for us, a young and handsome Flying officer Harsh from 101 Squadron who had just joined the Squadron after his training on Hawks. Unfortunately, he was recovering from jaundice and while he was not flying, he also did not have a drink but stayed with me through my stay helping with odd knick–knacks and tie–ups everyday due to last minute changes in the programme necessitated by circumstances. This led to many minor cribs but more laughs when we recounted these later in the day over a drink. Frankly, while I was sometimes called "Harris The Harassed", I haven't laughed like this for a long long time. As for Harsh, Mrs Chatrath commented the very first evening in the Bar that Harsh reminded her of me in the younger days in Hasimara, apart from the similarity in names. I don't know whether Harsh was as harassed by me but all of us enjoyed his company through our stay.

The reception at Hasimara on the evening of the 3rd when we came from Bagdogra swept everyone of us off our feet and was even more than what had been tied up. Almost every key appointment holder in Hasimara was there to welcome us and Saurabh had organised not just bearers to be at hand but also some female attendants to look after the ladies. Throughout our stay in the Mess rooms and the MES Inspection Bungalow, we were made very comfortable. Initially, I had planned that we would stay in the Hasimara Officers' Mess premises with some spreading out to the Brigade Mess, if required, depending on the numbers. AOC Ashish had told me that they had 12 comfortable rooms for us but considering the initial 18 yeses and that we all should stay in one place to really enjoy these few days together, I had changed over to the Jungle Resorts in Madarihat. When the numbers dropped to 11 and less, we went back to the original plan of staying together in the Mess. There were some who felt that Mess rooms would not be as comfortable or interesting as the resort. Some others felt that the rank wise juniors would be given less comfortable rooms. I made sure that the rank bit did not come in our calculations; the best VIP rooms

With 20 Div Cdr-Vanthanu Raghu.

10 AF Hospital.

were allocated to the two single ladies, Mrs Chatrath and Mrs Cariappa, with others getting equally comfortable rooms. I chose the smallest staff officer's room because I was not accompanied by my current wife. As it turned out, even the naysayers were more than happy and glad that we stayed on–base in familiar surroundings and were looked after much better than we would have been in a private resort.

The party started the very first evening with everyone quickly gathering in the Mess Bar like old times and exchanging jokes and funny anecdotes of our time in the 1960s and early 70s. Since it was a weekday and the station was flying the next day, we were not joined by any of the serving officers and we didn't expect them to, except the Base Commander, Gp Capt Saurabh "Pach" Pachauri. To our good fortune, as per command directives, 101 Squadron was to fly all their aircraft together the next morning when we were planned to be taken around the base and we made sure that we were at the Air Traffic Control to watch all the take–offs and many landings of the latest aircraft in the IAF's inventory, the Rafale. Thereafter, we were driven around the Base trying to identify our old dispersals, runway, Base Ops centre, married quarters where the seniors amongst us had stayed and, of course, the place where "Sam" Shekhar and "Doc" Lawrence had hijacked the Jonga of the ADC to the Div Cdr, Major General Zorawar Singh, and toppled it over at high speeds in the early hours of the morning after a party.

First evening at the bar.

What everyone felt like!

Doc was supposed to join us for this visit but couldn't while Sam has been with the Valhalla for some time now. I also got to visit the 10 Air Force Hospital where our daughter was born in October 1981 where I took some pictures and sent these on to her. Surprisingly, I found out later in the evening that even Saurabh Pachauri was born in the same hospital in August 1982 when his father was serving with the Thunderbolts of 20 Squadron.

(To be continued in our next edition Issue 2 Mar/Apr 2025)
Stay tuned!!

25 Years Back

From Vayu Aerospace Review Issue I/2000

Red Arrows over Hindon

On 22 November 1999, the IAF base across the Jamuna river north of Delhi played host to the "Red Arrows" of the Royal Air Force, the internationally reputed aerobatic team which performed to a selected and appreciative audience. This was the third visit of Red Arrows to India.

Indian defence spending going up to 3% of GDP

India's defence expenditure for 1999–2000 is now being projected at about three per cent of the GDP, up from 2.6 per cent originally envisaged. Significantly, bulk of the increase has come on the account of additional revenue outgo in the form of pensions, salary arrears and DA payments.

IAF's AJT Programme

The already long dragged out programme of the Indian Air Force (IAF) for an Advanced Jet Trainer (AJT) may have run into new and unexpected problems with the newly constituted Parliamentary Standing Committee on Defence demanding that the Government virtually "throw open" the competition to aircraft manufacturers worldwide.

Sokoi show–off Indian MiG–21–93

Indian visitors to the recent Dubai Air Show were surprised to see one of the two upgraded MiG–21bis (or MiG–21–93) presently being developed by the Russian Company Sokoi for the Indian Air Force, on display there. The aircraft had been flown to Dubai on board an Il–76 freighter.

Army Aviation squadrons honoured

Amongst the formations and units honoured with Unit Citation by the COAS on Republic Day are Nos. 663 R&O Squadron and 666 R&O Squadron, both flying the HAL Cheetah, for their superb performance during the Kargil operations in the summer of 1999.

The "Big 5" airports to be leased out

The Union Cabinet has decided to lease out five major airports in the country to private parties, to allow foreign direct investment (FDI) upto 74% in the establishment and operation of Indian satellite systems, and to promulgate an ordinance to amend the Recovery of Debts.

Aviation Security Force to be raised

The Government is to raise an Aviation Security Force and deploy commandos on air flights operating on 37 "sensitive" domestic and international routes, according to the Minister of State for Civil Aviation Chaman Lal Gupta. The 37 routes have been selected in consultation with the Union Home Ministry.

Virgin, Air India to set up five working groups

To cement their new found relationship, Virgin Atlantic and Air India (AI) will be setting up at least five working groups to sort operational, commercial and passenger related issues between them. The groups are expected to be operational from January 2000.

US and India JWG on counter–terrorism

A landmark decision taken at the 10th round of meetings between India's External Affairs Minister Jaswant Singh and US Deputy Secretary of State Mr. Strobe Talbott at London on January 19 pertains to establishment of a Joint Working Group (JWG) on counter–terrorism.

Pakistan N–bomb as an "absolutely last resort"

On his return from a 48 hour visit to China, Pakistan's Chief Executive General Pervez Musharraf has stated that his country's nuclear–bomb capability is "a minimum deterrence" and has not denied its use as "an absolutely last resort – when the security and integrity of Pakistan is at stake."

Pentagon hopes for better defence ties with India

The US Pacific Forces C–in–C Admiral Denis Blair is to visit India later this year to restore ties aimed partly at countering "increasing military cooperation between India and Russia" as also helping the US defence industry even as New Delhi continues to modernise its armed forces.

US Mach 5 bombers as "deterrence against India, Pakistan"

According to Popular Science magazine, published from the United States, the USA is developing new supersonic stealth bombers with speeds upto 3,500 to 7,000 miles per hour to meet "its strategic need for deterrence against countries such as India, North Korea and Pakistan till 2030 AD and beyond".

Tale Spin

Simply amazing!

In November 2024, the 47 year–old Voyager 1 spacecraft was back in touch with NASA – but not out of the woods – after a technical issue caused a days–long communications blackout with the historic mission, which is billions of miles away in interstellar space. Voyager 1 is now using a radio transmitter it hasn't relied on since 1981 to stay in contact with its team on Earth while engineers work to understand what went wrong.

NASA's Voyager 1 spacecraft is depicted in this artist's concept (NASA/JPL–Caltech)

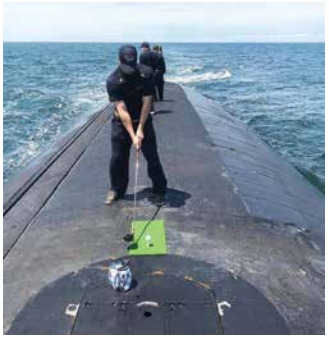
As the spacecraft, launched in September 1977, ages, the team has slowly turned off components to conserve power, allowing Voyager 1 to send back unique science data from 15 billion miles (24 billion kilometers) away. A pure technological marvel indeed!

IAF in a new look?

Who says the IAF isn't modernising? The entrance gates to the IAF Station Kasauli (Himachal Pradesh) a few years ago (Right) and now (Bottom). Tourists can enter from here to go to the Monkey Point temple situated on the mountaintop. To be honest, we prefer the old black gate instead of the slightly "Bollywood" looking one.

A whiff of fresh (salty) air!

This golf course may be fun to play on (but impractical) but this is what cooped up submariners need time and again! No pressure to score a Birdie, Albatross or Eagle though these 'birds' can be seen for real while out at sea.



Ho Ho Ho!!

In December 2024, the festive season was in full swing, bringing snow, carols and holiday cheer. With Christmas fast approaching, Santa Claus embarked on his world tour, swapping Rudolph's sleigh for his official airline, Finnair (Finland's national flag carrier). Following visits to London, Berlin and Japan, Santa arrived in India to share the magic of a Nordic Christmas. Ofcourse, nothing less than Business Class! With all the turmoil on worldwide, this was surely some cheerful news!!

Afterburner

Reaching for the skies together

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