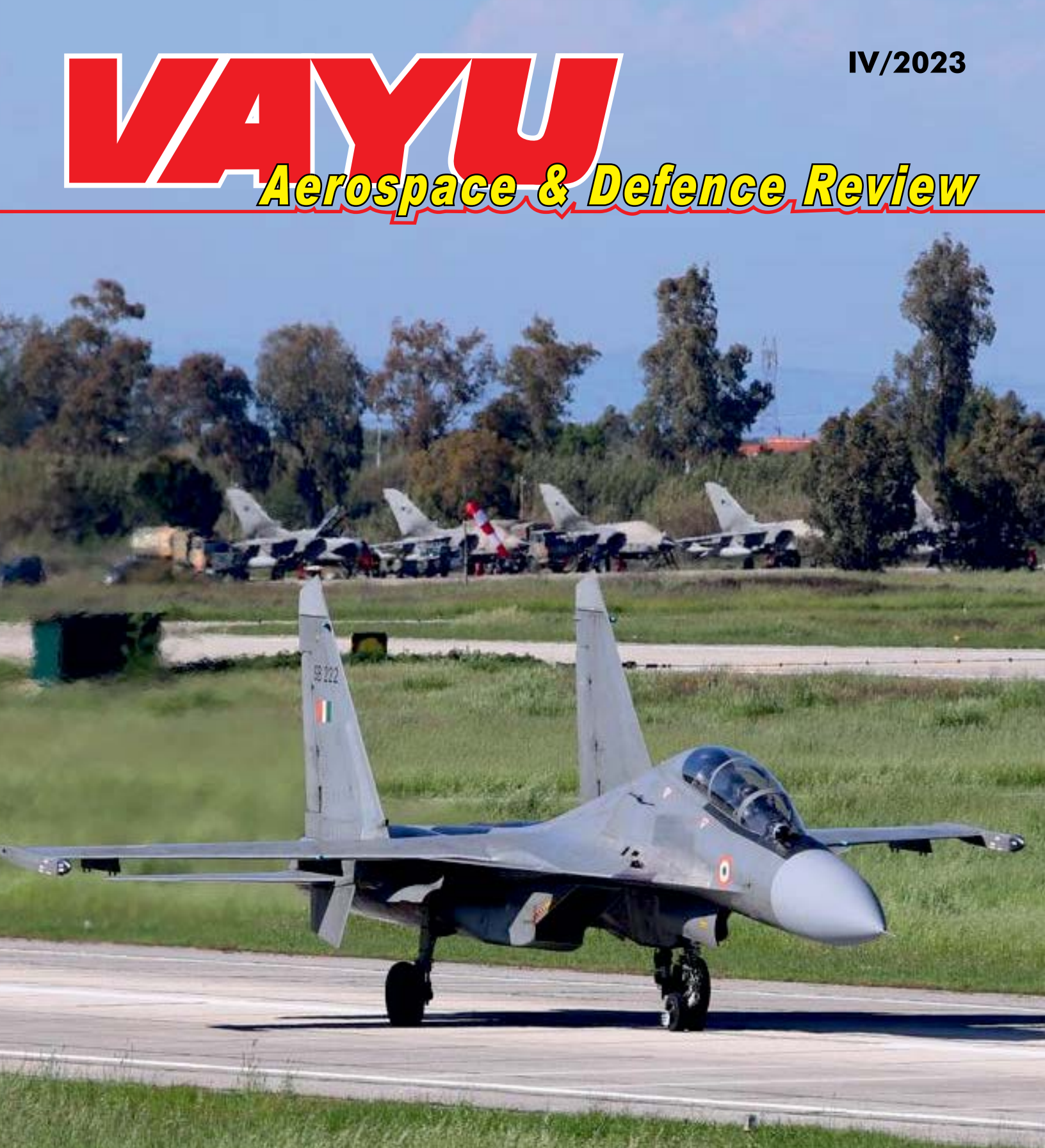
VAYU

Aerospace & Defence Review

IV/2023



IAF at Exercise Iniochos

Orders, AONs and contracts

ISRO successes & Chandrayaan

Indian exercises and visits

Airline profitability outlook

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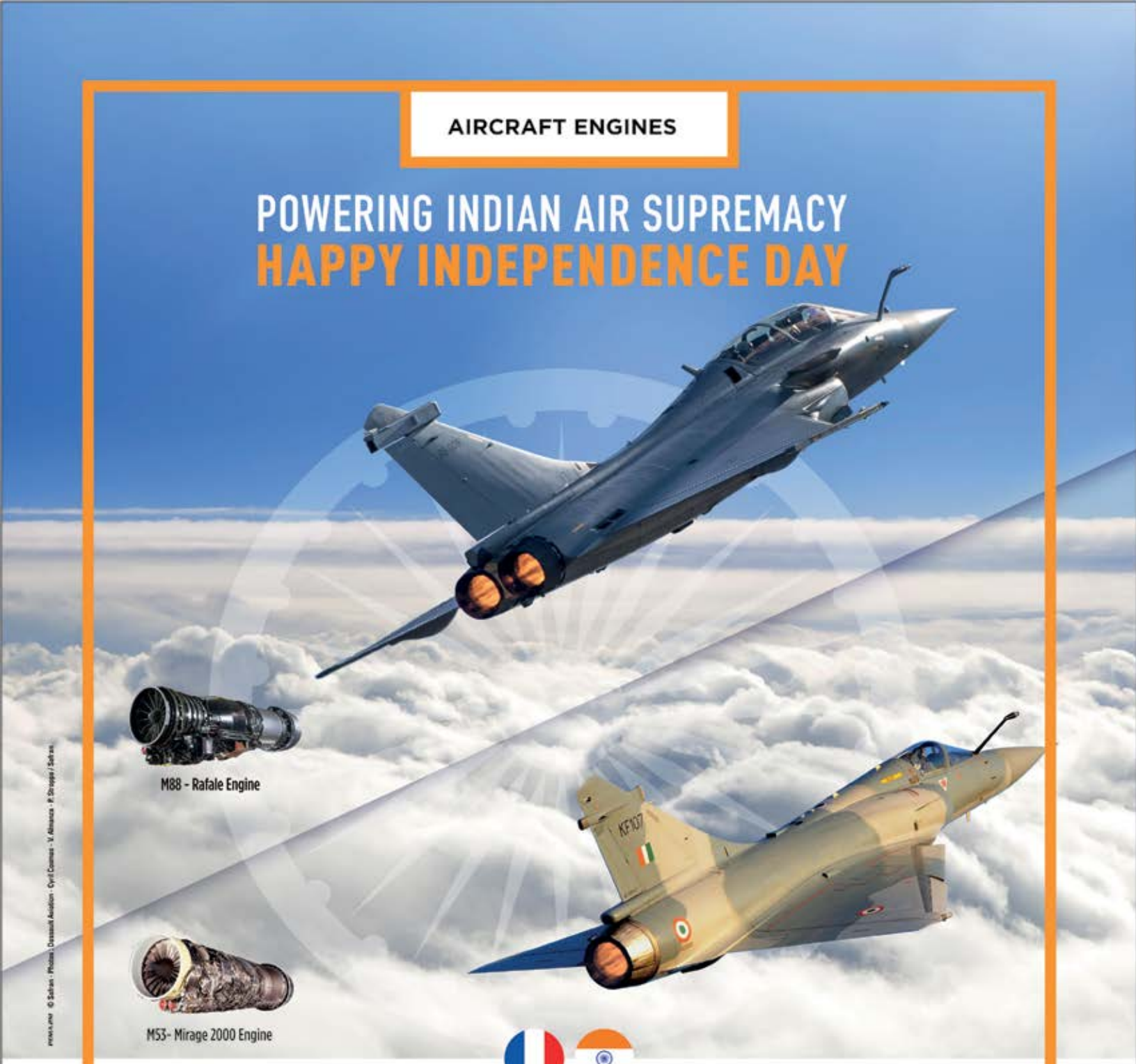
AIRCRAFT ENGINES

POWERING INDIAN AIR SUPREMACY
HAPPY INDEPENDENCE DAY



M88 - Rafale Engine

M53- Mirage 2000 Engine

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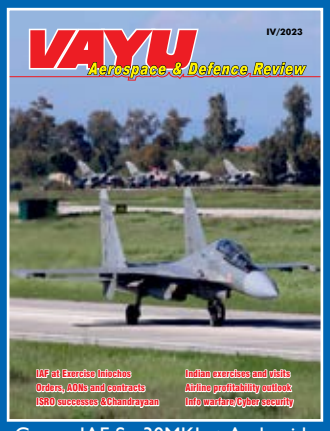

Cover: IAF Su-30MKI at Andravida AFB, Greece for Exercise Iniochos. Photo by Philipp Vallianos and article by Marcus Vallianos.

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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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Admiral (Retd) Arun Prakash says....

The new give and take

Prime Minister Narendra Modi's evocative mention of, "the dark clouds of coercion and confrontation… casting their shadow on the Indo–Pacific," in his recent address to a joint–sitting of the US Congress, reminded one of Mark Twain's aphorism that, "history does not repeat itself, but it rhymes".

A similar situation prevailed in early April 1942, as imperial Japan, seeking a "greater Asia co–prosperity sphere," overran Malaya, Singapore and Burma, and devastated the British Eastern Fleet, sinking the aircraft carrier HMS Hermes off Ceylon. As Japanese bombs fell on the east coast ports of Visakhapatnam and Kakinada, India steeled itself for an invasion.

An alarmed US President, Franklin Roosevelt, fearful of losing India's massive contribution to the Allied war effort made earnest but futile appeals to Churchill to accord dominion status to India. He also extended to India the "lend–lease" programme, under which it received munitions for the army and industrial materials for its ordnance factories, railways and ports. As payment, India provided $280 million worth of rations, goods, services and real estate to American and Kuomintang Chinese forces camping in Bihar.

Eight decades later, as we see another rising Asian hegemon, China, seeking to expand its sphere of influence across the Indo–Pacific and beyond, will the US and India join hands in the spirit of "lend–lease" and agree to mutual use of logistics, repair and maintenance facilities, thus re–writing a "historic rhyme"?

China is using the Belt and Road Initiative and the Maritime Silk Road not only to inveigle developing nations via "debt diplomacy", but also to camouflage its actual aim, which is regional domination. China's intent is manifest in its claims of sovereignty over part of the South China Sea (SCS), via the mythical "9 dash line," its dispute with Japan over East China Sea islands, and its illegal creation/militarisation of artificial islands in the SCS. The most volatile and persistent threat to regional peace lies in Beijing's ambition of "reunifying" Taiwan with mainland China, by force.

As far as India is concerned, the roots of Sino–Indian discord go back to China's annexation of Tibet and the grant of asylum to the Dalai Lama in 1959. The 1962 India–China war resolved nothing and created the anomalous "line of actual control" (LAC). The past few years have seen growing Chinese belligerency along the LAC, accompanied by persistent territorial claims over Arunachal Pradesh, as "Southern Tibet."

Given its growing asymmetry vis–à–vis China in the economic, military and technological domains, and the existence of a menacing Sino–Pakistan military axis, India finds itself in a difficult situation. But despite the balance of power heavily tilted in China's favour, it is incumbent upon India, as a nuclear weapon state, a significant economic, military and demographic entity, and, above all, a democracy, to stand up to its hegemonic neighbour.

In 1971, in a major deviation from its policy of non–alignment, India signed a Treaty of Friendship and Cooperation with the USSR. While this alliance did deter both Beijing and Washington from meddling in the ensuing Bangladesh War, it also ensured that India became a weapon–client of USSR/Russia. This arms dependency, once a minor

handicap, has now become an albatross around India's neck since not only has Russia allied itself with China, its military–industrial complex is no longer capable of supporting India's armed forces due to the Ukraine war and US sanctions.

Under these circumstances, the timing of PM Modi's state visit to the US could not have been better, nor his fulsome reception more welcome. The decade–long Indo–US courtship, embellished with an alphabet–soup of agreements and initiatives, was supposed to have climaxed in the pathbreaking 2008 Indo–US civil nuclear agreement, which, unfortunately, remained unconsummated. Signing of the fourth and last of the Indo–US "foundational agreements" in 2020 had again raised hopes, but stasis continued to prevail.

With Russia's steady decline, New Delhi has kept alive the hope that the US will, one day, become a source of high–technology that would help it close the yawning gap with China. The US, on its part, has viewed India as the world's most populous nation and a huge Asian power that dominates critical Indian Ocean sea lanes. Apart from being the world's fifth–largest economy, and a huge market, India produces cohorts of gifted young professionals, many of whom enrich the US talent–pool. The clinching factor is their common concern regarding a pugnacious China's challenge to the existing economic and geopolitical world order.

Consequently, casting aside reservations about the erosion of India's democratic and liberal values, as well as its disinclination to join formal alliances, President Biden has decided that it was worth having India "inside the tent" rather than sitting on the fence. As experts evaluate the outcomes of Modi's US visit, there is need, on the one hand, to shun euphoria and hyperbole, and on the other, to remind ourselves of a tenet of realism, enunciated by a British PM, in 1848: "There are no eternal allies, and no perpetual enemies. National interests are eternal and perpetual, and those interests it is our duty to follow."

Therefore, not only should we expect the US to adopt a "transactional" approach and strike deals that buttress its interests, but we must reciprocate by seeking to advance our own national interests at every step. Whether it is the HAL–General Electric deal for F–414 turbojet co–production, the supply of armed MQ–9B drones, cooperation in semiconductor manufacturing, or joint space–exploration, Indian experts must closely scrutinise the fine–print of every contract and agreement, and modify it if required.

We must never forget that having licence–produced thousands of aircraft, aero engines, ships, tanks, diesel–engines and electronic/avionic devices, of Russian, British and French design at home, we failed to ensure that our technical fraternity acquired the skills to design, develop or innovate on their own. This time around, we must incorporate clear guarantees to ensure that "value addition" takes place in terms of key technological skills and knowledge being imparted to technical personnel.

Finally, the "foundational agreements" provide for much give and take between the militaries in many spheres and we must take as much as we give.

India–United States Defence Acceleration Ecosystem (INDUS X) launched

India–United States Defence Acceleration Ecosystem (INDUS X) was launched at an event in Washington DC, USA on 21 June 2023. The INDUS X event was co–organised by Innovations for Defence Excellence (iDEX), Ministry of Defence, and US Department of Defence (DoD) and hosted by US–India Business Council (USIBC). Anurag Bajpai, Joint Secretary (Defence Industries Promotion), MoD, led the Indian delegation in the two–day INDUS–X event on 20–21 June 2023. A reception for Indian and US Government representatives, defence start–ups, think tanks, incubators, investors, industries and other stakeholders was orgainsed on 20 June 2023. Ambassador Eric Garcetti, the US Ambassador to India, gave the keynote address. Mr. Frank Kendall, US Secretary of the Air Force, gave the opening keynote address on 21 June at the INDUS–X event. He stated that the India–US relationship was growing exponentially. He emphasised that there was enormous potential for startups of both nations to collaborate in deeptech innovations, especially in Space and Artificial Intelligence (AI) domain. Anurag Bajpai, in his welcome remarks on "Investing in the Future of US–Indian Defence relations", hailed the launch of iCET as a landmark event in India–US relationship. He said this was an opportune moment for this event, as the leaders of the two largest and oldest democracies of the world meet in Washington.

The Joint Secretary stressed on the co–development and co–production of advanced technologies by Indian and US start–ups. He further asked the participants to develop mechanisms for future collaboration across industries, academia and investors. The Joint Secretary also gave an overview of the Make in India initiative, focussing on Aatmanirbhar Bharat and the philosophy of "Make in India, for the world".

The event also saw a first–of–its–kind joint showcasing of innovative technologies by Indian and US start–ups. 15 Indian start–ups and 10 US start–ups, from multiple domains of maritime, AI, autonomous systems, and space, showcased their technologies to Indian and US stakeholders. The exhibition was visited by senior US officials, including Congressman Ro Khanna, who serves on the House Armed Services Committee as ranking member of the Subcommittee on Cyber, Innovative Technologies and Information Systems (CITI) and as co–chair of the Congressional Caucus on India and Indian Americans, and by Radha Iyengar Plumb, Deputy Under Secretary of Defense for Acquisition and Sustainment, US DoD.

Two panel discussions and two roundtables were held, focussing on deepening collaborations across various domains, including government, academia, and industry especially startups. Discussion on export control regulations were also held. An INDUS X factsheet was released at the event.

Air Marshal (Retd) Brijesh Jayal says....

As India works on 'theatre commands' it shouldn't undermine strategic value of air power

Addressing the recently–concluded Combined Commanders Conference 2023 in Bhopal, the Prime Minister directed the commanders to push for 'Integration and Operational synergy,' a vision that is not only worthy and long overdue, but one that is inescapable when preparing for modern–day warfare. However, this complex though desirable objective has of late been reduced to a hastily conceived concept of 'Theatre Commands,' where there are problems and differing perceptions. The choice of an administrative route to a major national security reorganisation effort, rather than following a deliberative process right up the chain to the Parliament enacting a law, is where the problem lies.

What perhaps is less evident to those out of uniform is the unique character of each of the three services, which not only are governed by their respective service acts but also have their own ethos of service tradition, pride and sense of comradeship which in combination with evolving technologies make for a cohesive fighting force that makes self–sacrifice an accepted element of one's profession.

Any changes to the existing structure of how the services train and fight must be approached with due care and sensitivity, such that this uniqueness of professional skill, ethos of comradeship and self–sacrifice is not dented.

That there are differing perceptions amongst the forces towards the proposed model of theatre commands, is public knowledge. Subsequent reports indicate that whilst the implementation of the concept is irreversible, the delay is only to bring about a wider consensus. Clearly, it would appear that in the eyes of the department of military affairs, the optimum route to greater integration and jointmanship remains via the proposed model of theatre commands where air power potential remains emasculated. It needs to be recalled that the first Secretary DMA under whose authority the proposed model of theatre commands was initially conceived had during an interview with a TV channel stated, "Do not forget the IAF continues to remain a supporting arm just as artillery support or engineers support the combatant arm in the Army. They will be a supporting arm." This was not the IAF's view, reflected in a response of the then chief to the same channel when he said, "It's not a supporting role alone. Air power has a huge role to play. In any of the integrated battle areas, it's not an issue of support alone. A whole lot of things go into any air plan that's made. And those are the issues that are under discussion."

Looking back, one can only conjecture that at the stage when the model of theatre commands was conceived, the strategic and deterrent value of air power was not considered worthy of note by the planners in the newly created DMA in the MoD. Ironically, this would still appear to be the position to this day!

Since history helps us understand and grapple with complex dilemmas by studying how the past shaped the evolution of modern militaries and the deeper strategic import of air power, the youngest of air/land/sea fighting domains, it is perhaps worth delving briefly into some aspects of air power's historic and somewhat troubled evolution and the challenges this new element in warfare brought about by technological evolution faced in its formative years.

With the arrival of the first dirigibles followed by fixed–wing aircraft at the turn of the 19th century, it was Major Giulio Douhet, a commissioned engineer in the Italian army, who had the vision to recognise the military potential of this new technology. Even at that infant stage, he saw the pitfalls of allowing air power to be fettered by ground commanders and began to advocate the creation of a separate air arm commanded by airmen. When WW1 began, he reportedly said: "To gain command of the air was to render an enemy harmless." Writing in the Air Force Magazine of April 2011, Robert Dudney quotes Phillip S Meilinger, an airpower historian and analyst, calling Douhet "the first great air theorist" and "perhaps the most important air theorist." He termed Douhet's basic work 'The Command of the Air' published in 1921, as the first comprehensive analysis of airpower. In this book, Douhet argued that air power was revolutionary because it operated in the third dimension. Aircraft could fly over surface forces, relegating them to secondary importance. The vastness of the sky made defence almost impossible, so the essence of air power was the offensive and this in turn was good defence. The air force that could achieve command of the air by bombing the enemy air arm into extinction would doom its enemy to perpetual bombardment. Command of the air meant victory.

Looking back, by emphasising only the strategic offensive, Douhet underplayed the potential of air power towards other roles of air defence and tactical support of the ground battle. But those were formative years of military aviation and not surprisingly, Douhet's visionary journey in furtherance of the potential of air power would have evolved with military aviation's maturing. Ironically, faced as he was with opposition, his journey was by no

means smooth and took him through a court martial, imprisonment, exoneration, and subsequent promotion to General rank.

In many ways, air power in our country faces a similar challenge. Today, we are proposing to tie down our air power resources tactically to theatre commands tied to the land borders. This not with standing peace–time lessons like one of Balakot and the deterrent value that the strategic potential and reach of our air power pose to potential enemies. This self–inflicted emasculation of air power potential will no doubt be music to our potential adversaries.

In the US, till 1935, command of all combat air units resided with the army. The formation of General HQ Air Force in 1935 represented a compromise between strategic airpower advocates and ground force commanders who wanted the air corps mission to remain tied to that of the ground forces, a mindset and debate that still seems to prevail within our DMA. Finally, it was with the introduction of the National Security Act of 1947, that the US department of the air force was created signalling the birth of the USAF as a separate force.

This happened over continuing objections from the navy as well, which feared losing its air arm and strategic role to the newly created air force, a fear that it had long harboured. Indeed, in the 1920s Brigadier General Billy Mitchell, the then Deputy Director of Air Service sought to wrest control of coastal defence from the navy and in the ensuing tussle was court martialled, convicted and resigned. At the time, aviation was in its infancy and there was considerable interest in this field amongst the American public which, in turn, resulted in Mitchell not just becoming a public icon, but compelling the war department to strengthen the air corps. Mitchell's main argument was that air power had to be autonomous and had to be controlled by fliers who understood the new technology, new tactics, and new strategies, and who would not waste precious air assets in trying to assist old–fashioned armies and navies.

Canada went a step further in exploring the unification of the three armed forces and a white paper towards this was introduced in Parliament in 1964. The public explanation for the reorganisation was that unification would achieve cost savings and provide improved command, control, and integration of the military forces, an argument that is familiar in the context of our own efforts at attempting reorganisation into proposed theatre commands.

The proposal faced strong opposition from personnel of all three services and resulted in the dismissal of a senior naval commander as also forced retirements of other senior military ranks. Notwithstanding this, the government implemented the ill–fated scheme in 1968. Over the ensuing decades, as the futility of unifying the armed forces sunk in, many elements of unification were incrementally reversed to reflect the original individual armed forces till in 2011 the Canadian Armed Forces reverted back to their historical independent service designations, namely 'Royal Canadian Army/Navy/Air Force.'

In the US, problems of inter–service rivalry that had emerged during the Vietnam War and during later joint operations resulted in the framing of 'The Goldwater–Nichols Department of Defence Reorganisation Act of 1986.' This brought in the most sweeping changes since the department was established in 1946. Recognising that resolving challenges was a long–term exercise, the US defence department's Joint Vision 2010 (of 1996) and Joint Vision 2020 (of 2000) flowing from this Act, accepted that for the US military forces to be fully joint intellectually, operationally, organisationally, doctrinally, and technically, was a progressive and on–going task.

Clearly, whatever spin we may want to put on the present model of theatre command debate, it boils down to one of inter–service rivalry borne not out of any personal issues, but the medium and at the way each of the forces views and trains for their respective operational missions and indeed the special character of each warfighting domain. When viewed from the brief historical perspective, it is worth reflecting on whether in our enthusiasm to implement the proposed model of theatre commands, without studying other operationally viable organisational options, we are not underestimating the human resource challenges that such a major and challenging reform will entail. Indeed mere administrative reorganising without the accompanying human ethos of jointness in intellectual, operational, doctrinal and technical terms, may well have negative consequences.

If indeed the PM's vision of integration and jointness with a corresponding enhancement of our deterrent posture and warfighting potential is to be achieved, then one lesson that emerges from the past is not to underestimate the strategic value of air power both in terms of its deterrent potential and its first strike impact. Towards this, much like the US, we too need to bring into being a National Security Act (suitably debated in Parliament) that not only paves the way for military forces to be fully joint intellectually, operationally, organisationally, doctrinally and technically, but one that identifies a clear road map towards its ultimate achievement whilst recognising that this must be a long and deliberate process not amenable to artificial deadlines. Rushing through half–baked reforms will cause irreversible harm to the fighting ethos of the Indian soldier, sailor and airman and in turn, to national security at a time when we are faced with two hostile neighbours.

In the photos above is Air Marshal (Retd) Brijesh Jayal

Admiral (Retd) Arun Prakash says....

An Outpost in the Sea

Since 2013, China has engaged in an intense campaign of building artificial islands in the South China Sea. Using a huge fleet of dredgers, it has created over 3,000–4,000 acres of new land atop reefs and rocks. Three such maritime outposts — Fiery Cross, Mischief and Subi Reefs — have been provided with runways and harbours as well as guided–missile batteries. China's island strategy has two objectives. By developing a capability to monitor all traffic that moves under or above the sea — termed "maritime domain awareness" — a nation can extend its defensive perimeter well beyond the homeland. Moreover, by providing island outposts with surveillance facilities and fortifying them, a nation can project power over a huge oceanic expanse.

India is fortunate to own strategically–located island territories in the Bay of Bengal as well as the Arabian Sea. The Andaman and Nicobar (A&N) group of 572 islands, closer to South East Asia than to peninsular India, forms a springboard from where India can project power, exert influence, or strike friendships in its eastern neighbourhood. They could also be objects of desire for any country that wants to dominate the Bay of Bengal.

On 1 October 2001, India took a giant leap of faith by placing all Armed Forces located in the A&N Islands, including the Coast Guard, under the unitary command of a newly created Commander–in–Chief, A&N (CINCAN) to be nominated, in rotation, from the three services. Apart from ensuring defence of the territory, waters, airspace and the exclusive economic zone of the islands, the ANC was charged with safeguarding the eastern approaches to the Indian Ocean and establishing an air defence identification zone (ADIZ) over the islands.

By the turn of the century, all our South East Asian neighbours were becoming wary of China and expected that India would assert regional influence by positioning substantial forces with trans–national capabilities in the A&N. Significantly, soon after the establishment of ANC, then Premier Hu

Jintao had warned his countrymen about the "Malacca Dilemma" that China could face.

On Raisina Hill, however, it was considered that any overt show of force by India in the Bay of Bengal would be seen by neighbours as "muscle–flexing" and was, hence, undesirable. Thus, despite frequent pleas by successive CINCANs, the tri–service force levels remained ridiculously small and inadequate for ocean surveillance or establishment of an ADIZ. Regrettably, the services too, individually and collectively failed to lend support and reinforce the fledgling ANC.

Apart from the operational roles assigned, ANC was also the "crucible" for testing the feasibility of implementing "jointness" in India's military milieu. Once staff, logistics and operational procedures were evolved, the ANC template could, thereafter, be replicated elsewhere. As the first CINCAN, I recall, that after the initial hiccups and once inter–service suspicion and mental barriers had been demolished, the ANC became a well–oiled, efficient and functional joint command. Proof came during the 2004 tsunami when the ANC, commanded by a dynamic Lieutenant General, rendered invaluable humanitarian assistance and disaster relief to the people of these islands. In its 22 year long existence, the ANC has provided live proof that units of India's three armed forces can march, sail, fly and fight "jointly" and seamlessly, under a single commander. Regrettably, not only has the ANC model and framework not been replicated anywhere else, the latest theatre command model under consideration recommends the abolition of ANC and its absorption by the Eastern Naval Command.

The 1999 Kargil episode, the 2004 tsunami and successive military face–offs with China culminating in the 2020 Galwan clash, offer stark reminders that crisis situations can develop in the blink of an eye. Hence, preparedness is mid ally important, especially for a remote island entity. To guard against future surprises, the ANC needs to be suitably fortified and its force levels and firepower urgently augmented. To this end, the command must be invested with capabilities for: (a) Maintaining comprehensive, three–dimensional maritime domain awareness; (b) defending the archipelago against military intrusions (c) tracking and interdicting hostile ships/submarines; and (d) launching a rapid reaction force, when required. via airlift or sealift.

From a larger geostrategic perspective, the ANC can contribute to Indo–Pacific security given China's display of increasing belligerence in the Himalayas as well in the Pacific.

PLA Navy (PLAN) warships. submarines and intelligence–gathering vessels have become frequent visitors to our waters. As the PLAN grows in numbers and capability, and when an aircraft carrier becomes available, we may well see a permanent Chinese naval presence in the Indian Ocean to safeguard its shipping and other strategic interests.

Since the Indian Navy cannot contemplate matching the PLAN "force–on–force", it must adopt alternatives for power–balancing via existing partnerships like the Quad and Malabar which have the US, Japan and Australia as other members. Whenever the (recently postponed) Quad summit takes place, the four leaders must accost the bull by the horns and take some bold decisions about checkmating China's unrelenting belligerence in the region. Even without becoming a military alliance, the Quad would gain in stature and credibility if it sheds its political coyness and crafts an agenda and charter— no matter how innocuous — for itself.

India could play a key role in infusing dynamism into the Quad/Malabar construct by offering Port Blair in the Andamans as the location for a shore–based secretariat and "watering hole" for member navies. Having attained an adequate level of "inter–operability", it is also time for the four Quad navies to graduate from multinational "exercises" to multi–national "operations".

The domain of "non–traditional threats" provides enough scope for Quad navies to undertake benign and utilitarian operations. By honing their skills in areas like disaster relief, humanitarian assistance, medical aid, submarine and aircraft rescue and maritime security operations, the Quad will send out a dual message of comfort and reassurance to smaller Indo–Pacific nations, and of dissuasion to potential hegemons. For the ANC to become India's maritime bastion in the Bay of Bengal and to play a significant role in the ongoing Indo–Pacific "Great Game", it must be adequately bolstered and retained as an independent joint command.

In the photos above is Admiral (Retd) Arun Prakash

Defence production crosses Rs 1 lakh crore mark

As a result of the consistent efforts of Ministry of Defence, the value of defence production in Financial Year (FY) 2022–23 has crossed the figure of Rs one lakh crore for the first time ever. The value currently stands Rs 1,06,800 crore and it will go further up once the data is received from the remaining private defence industries. The current value of defence production in FY 2022–23 is a rise of more than 12 per cent over FY 2021–22, when the figure was Rs 95,000 crore.

The Government is continuously working with defence industries and their associations to remove the challenges faced by them and promote defence production in the country. A number of policy reforms have been taken to achieve the objective of ease of doing business, including the integration of MSMEs and start-ups into the supply chain.

Due to these policies, the industries, including MSMEs and start–ups, are forthcoming in defence design, development and manufacturing and there is almost a 200 per cent increase in the number of defence licenses issued to the industries in the last 7–8 years by the Government. These measures have given a boost to the defence industrial manufacturing ecosystem in the country and generated tremendous employment opportunities.

Training launch of Agni-1

A successful training launch of a Medium-Range Ballistic Missile, Agni–1 was carried out by the Strategic Forces Command from APJ Abdul Kalam Island, Odisha on 1 June 2023. The missile is a proven system, capable of striking targets with a very high degree of precision. The user training launch successfully validated all operational and technical parameters of the missile.

Agni Prime ballistic missile tested

New Generation Ballistic Missile 'Agni Prime' was successfully flight–tested by Defence Research and Development Organisation (DRDO) from Dr APJ Abdul Kalam Island off the coast of Odisha on 7 June 2023. During the flight test, all objectives were successfully demonstrated. This was the first pre-induction night launch conducted by the users after three successful developmental trials of the missile, validating the accuracy and reliability of the system. Range Instrumentation like Radar, Telemetry and Electro Optical Tracking Systems were deployed at different locations, including two down-range ships, at the terminal point to capture flight data covering the entire trajectory of the vehicle.

HTT-40 metal cutting

HAL launched the metal cutting for series production of HTT–40 (Basic Trainer Aircraft) at its Nasik Division on 22 May 2023. Mr. Saket Chaturvedi, CEO (MiG Complex) formally initiated the programme in the presence of senior officials from DGAQA, CEMILAC, IAF and HAL. This is a major milestone in manufacturing of HTT–40 giving thrust to self–reliance. HTT–40 aircraft is indigenously designed and developed by HAL with initial contract to supply 70 HTT–40.

MoD approves 4th Positive Indigenisation List

To promote 'Aatmanirbharta' in defence and minimise imports by Defence Public Sector Undertakings (DPSUs), Raksha Mantri Rajnath Singh, on 14 May 2023, approved 4th Positive Indigenisation List (PIL) of 928 strategically–important Line Replacement Units (LRUs)/Sub-systems/Spares and Components, including high–end materials and spares, with import substitution value worth Rs 715 crore. These will only be procured from the Indian Industry after the timelines indicated in the list.

This fourth list is in continuation to the previous three PILs involving LRUs/Sub–systems/Assemblies/Sub–assemblies/Spares and Components which were published in December 2021, March 2022 and August 2022 respectively. These lists contain 2,500 items which are already indigenised and 1,238 (351+107+780) items which will be indigenised within the given timelines. Of 1,238, 310 items (1st PIL – 262, 2nd PIL – 11, 3rd PIL – 37) have been indigenised, so far.

Brahmos Firing

On 14 May 2023, INS Mormugao, the latest guided-missile Destroyer, successfully hit 'Bulls Eye' during her maiden Brahmos Supersonic cruise missile firing. The ship and her potent weapon, both indigenous, mark another "shining symbol of Aatmanirbharta and Indian Navy's firepower at sea".

IN P8I's clock 40K hours

INAS 312 squadron operating P8I aircraft based at Arakkonam clocked 40,000 hrs as the aircraft completed a decade of diverse naval operations. The first P8I landed at INS Rajali on 15 May 2013 with Capt H S Jhajj as the first Commanding Officer. Popularly known as Albatross, INAS 312 has been at the forefront of all naval operations. P8I over

the decade has spearheaded operations in all three dimensions air, surface and subsurface. "The Squadron has been rendering yeoman service, safeguarding national interests being the first responder in IOR".

MRSAM Firing

Indian Navy's latest indigenous guided missile destroyer INS Mormugao successfully carried out engagement of sea skimming supersonic target with an MRSAM on 23 May 2023. This maiden endeavour showcases IN's combat readiness & commitment towards Aatma Nirbhar Bharat and "quest for accurate delivery of Ordnance on Target".

Night landing of MiG-29K on R11

INS Vikrant, the first Indigenous Aircraft Carrier and the most complex warship ever built in our country by Cochin Shipyard Ltd, has undergone extensive Sea trials since her maiden sailing on 4 August 2021. Commissioned into the Indian Navy on 2 September 2022 in the presence of the Prime Minister of India, the Carrier is a big boost to the Aatmanirbhar Bharat vision of the Government of India.

The Carrier is presently undergoing Air Certification and Flight Integration Trials with rotary wing and fixed wing aircraft for achieving 'Combat ready' state at the earliest. As part of the trials, maiden day landing of MiG-29K and the indigenous LCA (Navy) was achieved on 6 February 2023. Since then, day and night landing trials of all helicopters in the naval inventory have been progressed. In continuance with the impetus on the aviation trials, the Navy has achieved another historic milestone by undertaking maiden night landing of MiG-29K on 24 May 2023. This challenging accomplishment, within three months of maiden day landing "demonstrates the resolve, skill and professionalism of the Indian Navy, Vikrant crew and Naval Pilots".

MH–60R on R11

Another milestone for Indian Navy as its new acquisition, the MH60R, undertook its maiden landing on INS Vikrant on 31 May 2023. "A major boost to Indian Navy's Anti-Submarine Warfare and Fleet Support capability".

OSK India agreement for MRO

Crown Group Defence company, OSK India Pvt Ltd (OIPL), one of India's largest independent defence MRO major dealing in Naval Weapon System Repairs/MRO has signed a partnership agreement with a major OEM of electronic and weapon system to carry out activities pertaining to post warranty maintenance and repairs, supply of spares, rendering of technical assistance, participation of foreign specialists in various types of repair, training of personnel, upgrade of infrastructure etc for the Indian Navy.

DCAS visit to NFTC, ADA and HAL

Air Marshal Ashutosh Dixit, Deputy Chief of the Air Staff (DCAS) visited National Flight Test Centre, Aeronautical Development Agency and Hindustan Aeronautics Limited (HAL) Tejas Division to assess the progress of the indigenous combat aircraft projects on 15 June 2023. During his visit, the Air Marshal flew the Series Production Trainer-01 of the Light Combat Aircraft (LCA) Tejas, which is undergoing final developmental test sorties, to get a first hand feel of its capabilities. The IAF is presently operating the LCA Mk.1 aircraft and has a pending order of 83 LCA Mk.1A aircraft.

During the visit to the Tejas Division, the HAL team briefed the DCAS on the production status of trainer aircraft and the plan for deliveries of the LCA Mk.1A. The DCAS also visited the Light Combat Helicopter (LCH) Prachand Production Line to assess the production status of the homegrown combat helicopter. The delivery of 10 LCH Limited Series Production aircraft for the IAF is nearing completion and the production of the Series Production aircraft is likely to commence shortly to meet the order of 145 Series Production LCH for the IAF and Indian Army.

MH-60R landing on INS Kolkata

19 May 2023 was a significant milestone for the Indian Navy when an MH–60R helicopter undertook a maiden landing on the indigenously designed and constructed destroyer, INS Kolkata. This is a major boost to the Indian Navy's anti-submarine warfare capability.

Thyssenkrupp and MDL in MoU

With India being one of Germany's strategic partners, Thyssenkrupp Marine Systems is keen to again demonstrate its expertise in the Indian market. As the market leader for non-nuclear submarines, Thyssenkrupp Marine Systems signed a Memorandum of Understanding (MoU) with Mazagon Dock Shipbuilders Limited on the intended construction of conventional, air–independent propulsion submarines on 7 June 2023.

With the signing of the MoU Thyssenkrupp Marine Systems has laid the foundations for a possible cooperation with Mazagon Dock Shipbuilders Limited to compete in the Indian Navy's tender. The ceremony took place in Mumbai, India in the presence of Boris Pistorius, the German Defence Minister, on 7 June 2023.

Siblings together!

The Indian Navy released some images early June 2023 of its assets. "The seamless operational integration of the two aircraft carriers INS Vikramaditya and INS Vikrant as well as fleet ships and submarines is a powerful testament to the pivotal role of sea based air power and India's role as the preferred security partner in the Indian Ocean and beyond", stated IN officials.

IAI and Elcom Systems in MOU

Israel Aerospace Industries and Elcom Systems Pvt signed an MoU to work collaboratively on MRO and upgrades of unmanned aerial vehicles. The MoU is a further commitment of IAI's support for the Indian government's Aatmanirbhar Bharat/Make in India vision.

This follows previous agreements IAI has made with Elcom Systems to work together on MRO of the Heron UAV and for the maintenance of advanced Heron Mk.II UAVs that IAI provided to the military forces in India.

IA celebrates 75th International Day of UN Peacekeepers

The Indian Army commemorated the 75th International Day of UN Peacekeepers on 29 May by paying homage to the fallen comrades by laying wreath at National War Memorial, New Delhi by the Chief of the Army Staff, Vice Chief of Army Staff and representatives from Navy and Air Force, Ministry of External Affairs and United Nations. This is the day when in 1948 the first UN peacekeeping mission, UN Truce Supervision Organisation (UNTSO) began operations in Palestine.

POP at IMA Dehra Dun

General Manoj Pande, the Chief of the Army Staff reviewed the Passing Out Parade (POP) of Gentleman Cadets at Indian Military Academy (IMA), Dehradun on 10 June. A total of 374 Gentleman Cadets of 152 Regular Course and 135 Technical Graduate Course, including 42 Gentleman Cadets (GCs) from seven friendly foreign countries successfully passed out from the portals of IMA. Parents and family members of the Passing Out Gentleman Cadets also attended the event and solemnised the pipping ceremony to witness the momentous occasion of their wards being granted Permanent Commission into the Indian Army.

IAI acquires India's HELA Systems

Israel Aerospace Industries has signed a deal to acquire HELA Systems Private Limited, an Indian subsidiary of ELTA Systems Ltd. IAI's investment in Aerospace Services India is a strong demonstration of IAI's support for the Indian government's Atmanirbhar Bharat vision. The current deal also shows IAI's commitment to its strong partnership with India's DRDO in developing and supporting advanced systems for India's Armed Forces.

HELA will provide full maintenance, repair and overhaul product support for ELTA Systems, as well as testing and technical services including annual maintenance contracts and supply of spares to Indian defence customers. The company has a large facility in Hyderabad's fast-growing industrial belt. HELA's management and technical team comprise radio frequency and microwave specialists, familiar with cutting-edge technologies and working on futuristic military applications.

MMR radar

GRSE launches 2 warships and lays keel for 3rd

Garden Reach Shipbuilders and Engineers (GRSE) Ltd set a new standard in shipbuilding by launching two warships of different classes together on 13 June 2023. The keel of a third vessel was also laid, highlighting GRSE's professional approach towards the timely delivery of warships to the Indian Navy.

INS Anjadip, the 3rd Anti-Submarine Shallow Water Craft (ASW SWC) was launched by Priya Pandit, wife of Vice Admiral R B Pandit, Commander-in-Chief, Strategic Forces Command, while INS Sanshodhak, the 4th Survey Vessel Large (SVL) was launched by Tanvi Arora, wife of Vice Admiral Adhir Arora, Chief Hydrographer to the Government of India. Keel for the 7th ASWSWC being built by GRSE was also laid during the day, in the presence of Vice Admiral R B Pandit, Commander-in-Chief, Strategic Forces Command.

DRDO and L&T join hands for AIP

Larsen & Toubro and DRDO signed a contract for realisation of two Air Independent Propulsion (AIP) System Modules for Kalvari Class of Submarines of the Indian Navy. These Modules constitute thecore of the fuel cell based AIP System, indigenously developed by Naval Materials Research Laboratory (NMRL) of DRDO with L&T as prime industry partner, an association spanning more than a decade. The Energy Modules (EMs) comprising Fuel Cells produce the required power, along with on-board Hydrogen generation. The technology of this indigenous AIP system is a unique one that generates hydrogen on demand there by obviating the need for carrying hydrogen onboard which is a major safety concern for a submarine.

Ashok Leyland in defence orders worth Rs. 800 Cr

Photo: Wikipedia

Ashok Leyland, the Indian flagship of the Hinduja Group and the largest supplier of logistics vehicles to the Indian Army announced significant order wins, valued at INR 800 Crores in the defence sector. The contracts awarded also include the procurement of the Field Artillery Tractor (FAT 4x4) and the Gun Towing Vehicle (GTV 6x6). The FAT 4x4 and GTV 6x6 are specialised vehicles employed by the Artillery for towing light and medium guns, respectively.

MDL for MLRC of INS Shankush

Ministry of Defence signed a contract on 30 June 2023 for Medium Refit with Life Certification (MRLC) of Sub-Surface Killer (SSK) class of submarine INS Shankush with Mazagon Dock Shipbuilders Limited (MDL), Mumbai at an overall cost of Rs. 2725 Cr. Shankush is a SSK class of submarine to be re-fitted at MDL, Mumbai. Delivery of Submarine post MRLC will be in 2026. After completion of MRLC, INS Shankush will be combat ready and will join the active fleet of the Indian Navy with upgraded combat capability. This project is an important step towards development of MDL as Maintenance, Repair and Overhaul (MRO) hub for supporting the industrial ecosystem of India.

Integrated Simulator Complex Dhruv in Kochi

Raksha Mantri Rajnath Singh inaugurated the Integrated Simulator Complex (ISC) 'Dhruv' at Southern Naval Command, Kochi on 21 June 2023.

The ISC Dhruv hosts modern state of the art indigenously built simulators which will significantly enhance practical training in the Indian Navy. These simulators are envisaged to give real-time experience on navigation, fleet operations and Naval tactics. These simulators will also be utilised for training of personnel from friendly countries.

Delivery of first MCA barge, LSAM 7 (Yard 75)

Contract for construction of 8 x Missile Cum Ammunition (MCA) Barge was concluded with SECON Engineering Projects Pvt Ltd, Visakhapatnam, a MSME, in consonance with Aatmanirbhar Bharat initiatives of the Government of India. First Barge of the series LSAM 7 (Yard 75) was delivered to Indian Navy on 18 July 2023 in presence of Cmde Iftekhar Alam, Commanding Officer, INS Tunir. The Barge has been built under the classification rules of Indian Register of Shipping (IRS) with a service life of 30 years. Induction of MCA Barges will provide impetus to Operational commitments of IN by facilitating Transportation, Embarkation and Disembarkation of articles/ammunition to IN ships both alongside jetties and at outer harbours.

Garuda Aerospace and Naini Aerospace in partnership

Garuda Aerospace and Naini Aerospace engineering limited (NAeL), a wholly owned subsidiary of HAL (Hindustan Aeronautics Limited) under the administrative control of the Ministry of Defence has signed a joint development partnership. The joint partnership will enable Garuda to manufacture Advanced Precision Drones on Indian Soil for various applications. The drones will be able to carry a payload of around 25 kg.

Controp and Paras Defence in JV

At the signing ceremony that was held in Mumbai, India, in the presence of Mr. Hagay Azani, CEO, Controp, and Mr. Munjal Shah, PARAS, MD an important first step was taken- the establishment of a JV for the procurement of innovative, EO/IR state-of-the-art solutions for defense applications, in accordance with Atmanirbhar Bharat initiative implemented by the Indian government for creating and boosting local independent capabilities. Controp Precision Technologies Ltd specialises in the development and production of high-end stabilised EO/IR Multi-Domain systems for intelligence, surveillance, reconnaissance and targeting missions and CUAS for various defence applications.

Garuda in big order

Garuda Aerospace India's leading drone manufacturer, having received dual DGCA certification for their Garuda Kisan Drone, has achieved a significant milestone by securing a substantial order of 400 AgriKisan Drones from Indian Farmers Fertiliser Cooperative Limited (IFFCO). "This achievement takes Garuda Aerospace's order book tally to an impressive 10,000 drones".

CUMI Solidifies Position

Carborundum Universal Limited (CUMI), an organisation in the field of material sciences and part of the 120–year–old Murugappa Group announced a slew of advanced certifications such as EN9100 and STANAG 4569 that endorse its capabilities, regulatory compliance and expertise in aerospace and defence manufacturing. CUMI has had a strong presence in the material sciences industry for almost 70 years. Certifications were from renowned entities such as Terminal Ballistics Research Laboratory (TBRL) and ISRO.

IndiGo's livery takes flight on Boeing 777

IndiGo has revealed its new livery on the newly introduced Boeing 777 aircraft, servicing the Delhi-Istanbul route. The B777 aircraft landed in New Delhi on 28 May 2023 wearing the airline's white and blue livery. The Boeing 777 aircraft has the seating capacity of 400 passengers in a dual class configuration.

AerCap delivers 4 new A321 neo to Air India

AerCap Holdings announced it has completed a mandate for the lease of four new Airbus A321neo aircraft with Air India following the delivery of the fourth aircraft. The aircraft, powered by CFM LEAP-1A engines are the first A321neo aircraft to be inducted into the Air India fleet.

Star Air commences Embraer E175 flights

Star Air, an all-Embraer jet operator in India, has commenced revenue flights on its first E175 aircraft. The flight took place on 13 May 2023 with Star Air's dual-class E175 flying from Bangalore-Hyderabad-Jamnagar-Bangalore. Star Air has leased four E175s and these aircraft will boost the airline's existing fleet of five ERJ 145s, providing the airline greater flexibility and efficiency as it grows its network. The airline flies to multiple destinations across the country, most of which are part of the UDAN scheme. Interestingly, Star Air is the first airline to offer business class seats on regional routes.

Teleport partners with Pradhaan Air

India's youngest cargo airline Pradhaan Air Express and Teleport, the logistics venture of Capital A (formerly known as AirAsia Group) signed a Memorandum of

Understanding (MoU) recently on the sidelines of air cargo Europe/transport logistic trade fair in Munich, Germany. With the capacity sharing agreement, Teleport intends to use the capacity on the world's first A320 converted freighter operated by Pradhaan Air Express to penetrate the Indian and Southeast Asian market further and in particular between New Delhi, Hanoi, Bangkok and Chennai routes.

IndiGo inducts its second wide-body Boeing 777

IndiGo has inducted its second Boeing 777 aircraft, on damp lease, which will operate to and from Mumbai/Istanbul route. The Boeing 777 aircraft has the seating capacity of 400 passengers in a dual class configuration with 24 business and 376 economy class. IndiGo has been operating its first widebody Boeing 777 aircraft on the Delhi/Istanbul route, which had started from February 2023. These aircraft have been introduced to cater to the rising demand for international travel from India.

IndiGo betters its 'Airlines Top 50' ranking

IndiGo has risen in the 'Airlines Top 50 2023' ranking list, advancing from the 34th position to 31st rank. The carrier has maintained its distinction as the only Indian airline brand consistently featured in the 'Airlines Top 50' for three consecutive years.

Jettwings Airways receives NOC

Jettwings Airways has received the NOC to operate Scheduled Commuter Air Transport Services. The airline plans to offer regional connectivity to passengers under the UDAN Scheme to a number of destinations in the Northeast and eastern region initially. The airline, with its base in Guwahati, plans to introduce a fleet of modern turbofan aircraft in addition to turboprops for regional connectivity.

SITA solutions to power AAI

SITA, the technology provider for the travel and transport industry, secured a landmark deal with Airports Authority of India to support one of the biggest growth markets globally, providing technology to 43 of India's biggest airports. The deal will see improvements over 2,700 passenger touchpoints, paving the way for the adoption of new-age solutions to meet the modern passenger's expectations. Initially deployed across 43 airports, the technologies are scalable to an additional 40 airports over the next seven years. Over 500 million passengers are expected to be processed during this period. The rollout of new cloud technology will enable Indian airports to shift to common use passenger experiences where multiple airlines can leverage the same infrastructure, such as check in counters, self-service kiosks and boarding gates.

AB Pradhan is new Director (HR), HAL

Mr. A.B. Pradhan has taken over as Director (Human Resources) of HAL. Prior to this, he was holding the post as Officer on Special Duty at HAL Corporate Office and General Manager (HR) at Bangalore Complex. Mr. Pradhan joined HAL in 2005 and overall has 35 years of varied experience in human resource function in both public and private sectors with exposure to various industries dealing with engineering, metallurgy, paper, and aerospace/defence.

APPOINTMENTS

Air Marshal Ashutosh Dixit takes over as DCAS

Air Marshal Ashutosh Dixit took over as the Deputy Chief of the Air Staff on 15 May 2023. An alumnus of the National Defence Academy, he was commissioned in the fighter stream on 6 December 1986. He is a graduate of the Staff Course, Bangladesh and National Defence College, New Delhi. The Air Marshal is a Qualified Flying Instructor as well as an Experimental Test pilot, with over 3300 hours of flying experience on fighter, trainer and transport aircraft. He participated in Operation Safed Sagar and Rakshak.

Air Marshal RK Anand takes over as AOA

Air Marshal Rajesh Kumar Anand took over as Air Officer-in-Charge Administration (AOA) on 1 June 2023. An alumnus of National Defence Academy, the Air Marshal was commissioned in Administrative Branch of the Indian Air Force as an Air Traffic Controller on 13 June 1987. He has undergone the Higher Air Command Course from College of Air Warfare and Area Control Course from the Singapore Aviation Academy.

Mr. P.Upadhyay is DGONA

Mr. P. Upadhyay has taken over as Director General of Naval Armament (DGONA) at IHQ MoD (Navy) from KSC Iyer, who superannuated on 31 May 2023. P. Upadhyay, belongs to 1987 batch of Indian Naval Armament Service. He joined Naval Armament Organisation of Indian Navy on 12 July 1989. An Electrical Engineering Graduate from SGSITS Indore, he earned his Post Graduate degrees from Devi Ahilya University in Electrical Engineering with specialisation in Digital Techniques and Instrumentation in 1988 and in Mechanical Engineering from University of Pune with specialisation in Guided Missiles, in 1995.

India selects Dassault Rafale for the Indian Navy

On 14 July 2023, the Indian Government announced the selection of the Navy Rafale to equip the Indian Navy with a latest–generation fighter. Following an international competition launched by the Indian authorities, this decision comes after a successful trial campaign held in India, during which the Navy Rafale demonstrated that it fully met the Indian Navy's operational requirements and was perfectly suited to the specificities of its aircraft carrier.

The Indian Navy's 26 Rafales will eventually join the 36 Rafales already in service, which are giving full satisfaction to the Indian Air Force, making India the first country to make the same military choice as France by operating both versions of the aircraft to help consolidate its superiority in the air and on the seas and guarantee its sovereignty. This selection confirms the excellence of the Rafale, the exceptional quality of the link between Dassault Aviation and the Indian Forces, and the importance of the strategic relationship between India and France.

"As we celebrate the 70th anniversary of our partnership with the Indian Forces, I would like to thank the Indian authorities for this new mark of confidence and pledge, on behalf of Dassault Aviation, that we will fully meet the Indian Navy's expectations with the Rafale", stated Eric Trappier, Chairman and CEO of Dassault Aviation.

Text and images: Dassault

Naval Group cleared for 3 additional Scorpenes

Naval Group would like to thank the Indian and French authorities for the announcement regarding the extension of the Indo–French partnership and the objective to explore more ambitious projects to develop the Indian fleet and its performance. Mazagon Dock Shipbuilders Limited (MDL) remains our natural partner. This decision is a testimony of the Indian Navy's trust in the industrial cooperation we have established, and reaffirms the success of the transfer of technology achieved under the P75 programme for six submarines, which were built entirely in India by MDL. The "Make in India" policy in the service of Indian sovereignty (AatmaNirbhar) has been at the heart of the P75 programme, as well as other activities developed by Naval Group and its Indian industrial partners to provide the Indian Navy with the most modern naval defence technologies", stated Naval Group officials.

"We welcome the declarations made during the Indian Prime Minister's historic participation to the French National Day, to continue and further strengthen our 15 year submarine building cooperation, which is a major element of the Indo–French strategic partnership developed over the past decades. Naval Group and its partners will be fully mobilised to meet the expectations of Mazagon Dock Shipbuilders Limited and the Indian industry to fulfil the needs of the Indian Navy", stated Pierre Eric Pommellet, CEO of Naval Group.

6th IN Scorpene commences trials

The sixth submarine of Project 75, Yard 11880, Indian Navy's Kalvari class commenced her sea trials on 18 May 2023. The submarine was launched in 20 April 2022 from the Kanhoji Angre Wet Basin of Mazagon Dock Shipbuilders Limited (MDL). Vaghsheer is scheduled for delivery to the Indian Navy in early 2024 after completion of these trial. MDL has 'Delivered' three submarines of the Project–75 in 24 months and the commencement of sea trials of the sixth submarine is a significant milestone. The submarine will now undergo intense trials of all its systems at sea, these include propulsion systems, weapons and sensors.

Safran and HAL to form JV for new generation helicopter engines

Safran Helicopter Engines and Hindustan Aeronautics Limited (HAL) are to set up their new joint venture company in Bangalore, India. It will be dedicated to the design, development, production, sales and support of helicopter engines, with first objective to build the most adequate propulsion solution for the Indian Ministry of Defence's (MoD) future 13–ton IMRH (Indian Multi–Role Helicopter) and its naval version DBMRH (Deck Based Multi–Role Helicopter). This joint venture will be India's first engine design and manufacturing in house.

This decision was achieved thanks to a dynamic common work cycle between the two companies, following a Memorandum of Understanding (MoU) signed on 8 July 2022 and an agreement on workshare reached between the two partners during Aero India 2023.

The collaboration the Indian and French Aerospace majors is clearly supporting the development of the aerospace strategic roadmap between the two countries while once again endorsing the Indian Government's vision of Atmanirbhar Bharat particularly in defence technologies. Safran Helicopter Engines and HAL see this joint venture as a natural further step in their robust, well balanced and growing relationship.

Mr. Cedric Goubet, Safran Helicopter Engines CEO, stated, "We at Safran Helicopter Engines are truly elated to partner with HAL and India to craft this new turboshaft engine joint venture set to address the Indian market and also future export opportunities. It marks a turning point in not only the longstanding relationship between our two companies but also between India and France. Together we will remain fully dedicated to our customers in India, proud to designing and producing new efficient helicopter engines."

Mr. CB Ananthkrishnan, CMD, HAL stated, "Safran Helicopter Engines has been our valued partner for several decades. We both have embarked on a new journey, leveraging HAL's experience in manufacturing of more than 15 types of aircraft and helicopter engines and Safran Helicopter Engines expertise in desiging turboshaft engines. The objective is to co–develop and co–produce turboshaft engines in India with immediate focus on IMRH and DBMRH. This partnership will engage and harness the Indian defence manufacturing ecosystem towards realising Atmanirbhar Bharat vision of our Hon'ble PM".

Safran Helicopter Engines and HAL already have multiple successful partnerships on helicopter powerplants, including the Shakti engine, which powers HAL-produced helicopters, comprising the Dhruv, Rudra and the Light Combat Helicopter (LCH Prachand). More than 500 Shakti engines have already been produced. The new joint venture further extends the sphere of current cooperation and explores opportunities for strategic business collaboration that leverage the complementary talents and capabilities of the two aviation firms.

Through HE-MRO joint venture in Goa, Safran Helicopter Engines and HAL will also provide MRO (Maintenance, Repair and Overhaul) services for TM333 and Shakti engines in the service of Indian Armed Forces.

GE MoU with HAL to produce fighter jet engines for IAF

On 22 June 2023, GE Aerospace announced that it has signed a Memorandum of Understanding (MoU) with Hindustan Aeronautics Limited (HAL) to produce fighter jet engines for the Indian Air Force, a major milestone amidst Indian Prime Minister Narendra Modi's official state visit to the United States and a key element in strengthening defence cooperation between the two countries.

The agreement includes the potential joint production of GE Aerospace's F414 engines in India, and GE Aerospace continues to work with the US government to receive the necessary export authorisation for this. The effort is part of the Indian Air Force's Light Combat Aircraft Mk2 programme. "This is a historic agreement made possible by our longstanding partnership with India and HAL," stated H. Lawrence Culp, Jr., Chairman and Chief Executive Officer of GE and CEO of GE Aerospace. "We are proud to play a role in advancing President Biden and Prime Minister Modi's vision of closer coordination between the two nations. Our F414 engines are unmatched and will offer important economic and national security benefits for both countries as we help our customers produce the highest quality engines to meet the needs of their military fleet."

GE Aerospace has operated in India for more than four decades with wide engagement in the industry including engines, avionics, services, engineering, manufacturing and local sourcing. In addition to potential new work in India, a number of US facilities that currently support work on the F414 engine will see additional volume as a result of this announcement.

In 1986, GE began working with the Aeronautical Development Agency and HAL to support the development of India's Light Combat Aircraft (LCA) with F404 engines. Subsequently GE Aerospace's F404 and F414 have been part of development and production programmes of LCA Mk1 and LCA Mk2 programmes. In total, 75 F404 engines have been delivered and another 99 are on order for LCA Mk1A. Eight F414 engines have been delivered as part of an ongoing development programme for LCA Mk2.

"This agreement will advance GE Aerospace's earlier commitment to build 99 engines for the Indian Air Force as part of the LCA Mk2 programme. It puts the company in a strong position to create a family of products in India, including the F404 engine that currently powers the LCA Mk1 and LCA Mk1A aircraft and GE Aerospace's selection for the prototype development, testing and certification of the AMCA programme with our F414–INS6 engine. In addition, GE will continue to collaborate with Indian government on the AMCA Mk2 engine programme", stated GE officials.

With more than five million flight hours and eight nations with F414–powered aircraft in operation or on order, the F414 continues to exceed goals for reliability and time on wing. To date, more than 1,600 F414 engines have been delivered globally.

GE's presence in India includes its research and technology centre, the John F Welch Technology Centre at Bengaluru, which opened in 2000 and its multi–modal factory at Pune, which opened in 2015.

LCA Tejas Completes 7 years of service in the IAF

On 1 July 2023, the indigenous Light Combat Aircraft (LCA) completed seven years of service in the Indian Air Force. Christened Tejas in 2003, the aircraft is a multi–role platform that ranks amongst the best in its class. It has been designed to undertake the Air Defence, Maritime Reconnaissance and Strike roles. The inherently unstable Tejas offers carefree handling and enhanced manoeuvrability. This capability is further enhanced with its multi–mode airborne radar, helmet mounted display, self–protection suite and laser designation pod.

The first IAF Squadron to induct the Tejas was No. 45 Squadron, the 'Flying Daggers'. Over the years, the squadron progressed from Vampires to Gnats and then onto the MiG–21 Bis, before being equipped with its current steed. Each of the aircraft flown by the Flying Daggers has been manufactured in India – either under license production or having been designed and developed in India. In May 2020, No.18 Squadron became the second IAF unit to operate the Tejas.

Photo : Vayu

The IAF has showcased India's indigenous aerospace capabilities by displaying the aircraft at various international events, including LIMA–2019 at Malaysia, Dubai Air Show 2021, Sri Lanka Air Force anniversary celebrations in 2021, Singapore Air Show 2022 and Aero India Shows from 2017 to 2023. Whilst it had already participated in exercises with foreign air forces domestically, Ex–Desert Flag in the United Arab Emirates in March 2023 was the Tejas' maiden exercise on foreign soil.

The confidence that the IAF reposes in the Tejas is borne by its order for 83 LCA Mk–1A which will have updated avionics, as well as an AESA radar, updated Electronic Warfare suite and a Beyond Visual Range missile capability. The new variant will be capable of firing a plethora of weapons from increased stand–off ranges. Many of these weapons will be of indigenous origin. The LCA Mk–1A will see a substantial increase in the overall indigenous content of the aircraft. Contracted deliveries of the aircraft are expected to commence in February 2024. In the years to come, the LCA and its future variants will form the mainstay of the Indian Air Force.

Text and additional photos : IAF

Orders, AON's and contracts in India

Approval for 26 Rafale Marine and 3 Scorpene's


Rafale Marine


Scorpene

A meeting of the Defence Acquisition Council (DAC), held under the chairmanship of Raksha Mantri Rajnath Singh, approved three proposals on 13 July 2023. The DAC granted Acceptance of Necessity (AoN) for procurement of 26 Rafale Marine aircraft along with associated ancillary equipment, weapons, simulator, spares, documentation, crew training and logistic support for the Indian Navy from the French Government based on Inter–Governmental Agreement (IGA). The price and other terms of purchase will be negotiated with the French Government after taking into account all relevant aspects, including comparative procurement price of similar aircraft by other countries. Further, integration of Indian designed equipment and establishment of Maintenance, Repair & Operations (MRO) Hub for various systems will be incorporated into the contract documents after due negotiations.

The DAC also granted the AoN for procurement of three additional Scorpene submarines under Buy (Indian) category which will be constructed by Mazagon Dock Shipbuilders Limited (MDL). The procurement of additional submarines, with higher indigenous content, will not only help in maintaining required force level and operational readiness of the Indian Navy, but also create significant employment opportunities in the domestic sector. It will also help the MDL in further enhancing its capability and expertise in submarine construction.

Acquisition of MQ–9B UAVs

The Defence Acquisition Council (DAC), on 15 June 2023, accorded the Acceptance of Necessity (AoN) for acquisition of 31 MQ–9B (16 Sky Guardian and 15 Sea Guardian) High Altitude Long Endurance (HALE) Remotely Piloted Aircraft Systems (RPAS) for Tri–Services from the USA through Foreign Military Sale (FMS) route. The AoN included the number of UAVs to be procured along with associated equipment.

MoD & HAL contract for two upgraded Dornier's for ICG

Ministry of Defence signed, in New Delhi on 7 July 2023, a contract with Hindustan Aeronautics Limited (HAL) for procurement of two Dornier Do–228 aircraft for Indian Coast Guard (ICG) along with associated Engineering Support package at an overall cost of Rs 458.87 crore. The aircraft will be procured under the Buy (Indian) Category. The aircraft will be fitted with a number of advanced equipment viz., Glass Cockpit, Maritime Patrol Radar, Electro Optic Infra–Red device, Mission Management System etc. The addition will further bolster the aerial surveillance capability of maritime areas of responsibilities of the ICG. The Dornier aircraft are

being indigenously manufactured at HAL (Transport Aircraft Division), Kanpur and will significantly contribute in achieving Aatmanirbharta in defence, in consonance with the 'Make in India' initiative of the Government.

Indian Army contract for Tactical LAN Radio

Continuing with the commitment towards 'Make in India' initiative the Indian Army has signed the second procurement contract through Innovations for Defence Excellence (iDEX) on 9 June 2023. The contract with Astrome Tech Pvt Ltd, Bangalore for procurement of indigenously developed 'Tactical LAN Radio' was signed in presence of Lt Gen M V Suchindra Kumar, the Vice Chief of Army Staff at New Delhi. Tactical LAN solution is being developed indigenously for creating secure tactical LAN in remote and difficult terrain. 'Tactical LAN Radio' is a state of the art high bandwidth backhaul wireless radio equipment for provisioning of reliable and failsafe communication.

BEL receives orders worth Rs. 2,191 Cr

Bharat Electronics Limited (BEL) has received new Defence and non–Defence orders worth Rs. 2,191 Cr. The orders are for supply of Long Range Guidance Kit with Warhead, Airborne V/UHF Jammer, Battlefield Surveillance Radar (Short Range) Upgrade, Missile Guidance Radar & Control Centre, Upgraded Radio Relay (F) with Data Modem Encryption Unit Mk II, Identify Friend or Foe Mk XII A, Anti–Submarine Warfare Shallow Water Craft (ASW SWC) Sonar and Spares. These orders are in addition to the Rs. 5,900 Cr orders, which are already received. With this, BEL has in all received orders to the tune of Rs. 8,091 Cr till now in the financial year 2023–24.

Contract for Indian Army's communication system

Giving a further boost to indigenous manufacturing of defence equipment and incentivise the private sector to engage in realising the vision of Aatmanirbhar Bharat, Ministry of Defence inked a contract on 15 June 2023 in New Delhi with ICOMM Tele Limited, Hyderabad for the procurement of 1,035 numbers of 5/7.5 Ton Radio Relay Communication equipment containers. The value of the contract under Buy (Indian) Category is nearly Rs 500 crore. The delivery of the containers is scheduled to commence from the current Financial Year 2023–24.

Zen Technologies in order from MoD

Zen Technologies Ltd, a provider of military training and anti–drone solutions, has won a significant order win from the MoD valued at Rs. 202 crores. The Company "looks forward to securing additional sizeable contracts within the next quarter". The company specialises in manufacturing state–of–the–art land–based military training simulators, driving simulators, live range equipment and anti–drone systems.

INDRA's LANZA 3D radar for INDIAN NAVY FRONT LINE SHIPS

Indra's Lanza 3D radar continues to strengthen itself as one of the most advanced surveillance systems in the market and continues its international expansion. Indra is currently installing its naval version, Lanza–N 3D, on one of the Indian Navy's destroyer ship, beginning the delivery of the 23 radars that it will provide to the Indian Navy over the next decade.

This milestone is part of the contract signed by the company in 2020 with the Indian company Tata Advanced Systems Limited (TASL), within the framework of a technology transfer programme. This provides for the delivery by Indra of a total of three complete radars, plus the core elements of its system for another 20 radars, destined for ships, which TASL will complete and integrate locally. To them is added an additional reference radar to support this technology transfer during the additional maintenance period of 12 and a half years.

After designing and producing the first radar at Indra's facilities in Madrid, the system passed the factory acceptance tests (FAT) at CEAR, the Radioelectric Analysis Center of the Institute of Aerospace Technology (INTA) in November, to be subsequently shipped to India, where installation has begun once the ship has become available.

The following two radars are already in production and are expected to pass FAT tests this year.

The Lanza–N radar that is being implemented is based on the one fitted to the ship Juan Carlos I of the Spanish Navy, although the system has been adapted to the regulatory requirements of India, for example, in the environmental field to guarantee its optimum performance even in conditions of high humidity and extreme heat. In addition, it incorporates the latest technological and operational updates integrated by Indra to its family of Lanza radars, as well as some improvements, such as greater power for the use of long–range mode or remote monitoring of the pressurisation system.

This project confirms the export potential of the Lanza–N radar, a high–tech Spanish solution for surface ships, designed as a long–range, modular, solid–state pulsed tactical radar, with all the equipment associated with the Lanza–N fully integrated for a naval operation. The primary function of radar is the detection of aircraft within the instrumented coverage volume, even in adverse conditions. It also includes the integration of a Secondary Surveillance Radar (IFF/SSR).

Indra's Lanza 3D family radars have not stopped evolving and improving to become one of the most advanced on the market on a global scale. Thus, Indra has also become one of the main manufacturers of radars in the world, applied not only to the defence sector, but also in the field of mobility and air traffic. The company has one of the largest radar factories in Europe in the Community of Madrid, with more than 7,000 square meters and 200 specialised professionals.

It has also developed one of the most powerful radars in Europe and the world, intended for space surveillance, capable of detecting objects in orbit more than 2,000 kilometers from Earth and which is responsible for protecting launches, satellites and the international space station.

In this area, Indra has signed a collaboration agreement with the Indian company, Centum Electronics, to present a joint proposal to the Indian space agency (ISRO) to manufacture a radar for observing and tracking objects in space with which to protect ones space assets. The agreement is aligned with the "Make in India" strategy of the country's government, which supports the formation of this type of strategic alliances between local companies and leading companies.

Courtesy : Indra

Saab's AT4 for India

When we refer to a modern infantry soldier carrying a weapon, more often than not, we talk about a reusable weapon. The soldier can fire multiple times and engage with targets for a longer duration. Sounds just about right. But did you know that like multiple–use weapons, single–use weapons also make a lot of sense in the modern war theatre?

AT4 equipped soldiers are ready for anything. With all capabilities required for mission success in place, including night and confined space abilities, AT4 soldiers can act quickly without worrying if the surrounding environment is suitable for discharging a weapon. The 84mm caliber provides more than sufficient performance when you need it.

As compared to reloadable weapons that feature sophisticated functions, disposable weapons are often easier to use. "First of all, simplicity of use means soldiers can be immediately deployed with a weapon like AT4 with basic training. We are talking about training of just a day or two. Secondly, the simple functions also mean that soldiers will be able to fire from their instincts during the heat of the battle instead of remembering the workings of the weapon," stated Görgen Johansson, head of Saab's business area Dynamics.

When you have a single–use, non–expert weapon, you can deploy a large number of troops with the weapon. And when multiple AT4 rounds are fired by multiple troops at the same time, the chances of dominating a target gets a lot higher. In the end, it all boils down to the fact that modern troops face a variety of mission scenarios. If a weapon system fulfils the requirements of an operator, it will find a place.

The Indian Armed Forces have selected Saab's AT4 as their new single–shot weapon. Besides the less weight, AT4 offers its users ease of use and handling. For any experience level, a dismounted soldier simply aims, fires and destroys the target before discarding the empty tube. With AT4, the Indian Armed Forces will also have a major advantage in the form of confined space capability. The use of a sea water counter–mass in the AT4 allows it to be used in closed rooms and close to walls without harm to the operator or those around him.

Courtesy: Saab

Saab receives order for AT4 from France

Saab has received an order for the anti–armour weapon AT4 from the French Armament General Directorate (DGA). The order value is approximately EUR 24 million and deliveries will take place in 2023. France has previously ordered Saab's AT4CS ER (Extended Range), the AT4CS HE (High Explosive) and the AT4CS AST (Anti–Structure). The AT4 family is known as the Roquette NG (Nouvelle Génération) in France.

VAYU Interview with SURENDRA AHUJA

Managing Director, Boeing Defence India

***VAYU**: How can the services business be a significant driver of defence growth in India?*

Today, India operates 11 C–17s, 22 AH–64 Apaches (with six more on order), 15 CH–47 Chinooks, 12 P–8Is, 3 VVIP aircraft (737 airframe) and two Head of State aircraft (777 airframe), all Boeing platforms. Ensuring mission–readiness for our customers and providing them seamless services and support on our platforms is an imperative for Boeing. If we start with a quick look at the last five years, Boeing has accelerated growth in India with a razor–sharp focus on the key areas of:

- Customer engagement: meeting the Indian Navy (IN) and Indian Air Force's (IAF) modernisation and mission–readiness needs
- Services growth: localisation of our services, and the value Boeing Defence India, our local establishment in India, is able to provide through the lifecycle of platforms offered
- Supplier expansion: building an indigenous and robust supplier–partner network with a focus on Aatmanirbhar Bharat

Hence, we had setup Boeing Defence India (BDI) with an aim to provide holistic lifecycle solutions for defence customers in India. Cost–effective solutions, timely support, and flawless execution are critical elements of BDI's commitment to the market and our customers. Boeing's integrated logistics support is already enabling the highest levels of fleet–readiness. We are seeing growth in our services business and, with it, growth in the value Boeing creates through product lifecycle support and training. From performance–based logistics contracting and integrated fleet support to maintenance, modifications and repairs, Boeing provides a broad spectrum of innovative products and services across platforms which directly support and enhance capabilities while reducing total cost of ownership for our customers globally. Boeing's investments in services infrastructure, building local capabilities, workforce training and partnerships in India are aimed at ensuring the Indian armed

forces successfully complete their missions, operate their assets at peak condition and do so affordably.

In 2021, we launched the Boeing India Repair Development and Sustainment (BIRDS) Hub. BIRDS is an initiative to bring together ecosystem partners to shape India as a strategic destination for aerospace engineering, maintenance, repair and sustainment services. This is a one–of–its–kind initiative that seeks to provide customers with best–in–class solutions, efficient turnaround times, and optimal economical value, all available in–country. Under this programme, we have by now signed strategic partnerships with leading indigenous players like Horizon Aerospace, Air Works, and AI Engineering Services Limited (AIESL). An important aspect of the hub is training programmes to increase skilled manpower by developing sub–tier suppliers and medium, small and micro enterprises (MSMEs) to build high quality MRO capabilities in India. Our programmes have skilled close to 4,000 frontline aerospace manufacturing workers and aircraft maintenance engineers.

***VAYU**: What are the services support packages being offered to the Indian Air Force and the Indian Navy to support the mission readiness of the C–17, P–8I, Apache and Chinook fleet?*

We are working with the Indian Air Force (IAF) and the Indian Navy (IN) to provide operational capability and readiness for the P–8Is, the C–17s, the Head of State aircraft and Chinooks and Apaches. We support the Indian Air Force C–17 fleet under the Globemaster Integrated Support Programme (GISP) that maintains high mission capability rates by providing them access to an extensive support network for parts availability and economies of scale. Boeing provides comprehensive C–17 Globemaster III training solutions for aircrews and loadmasters with advanced simulation, courseware and computer–based training. C–17 operators can practice the complete range of tasks required for tactical military airlift operations and humanitarian missions, along with mission rehearsal of all scenarios including emergency procedures. Boeing's in–country C–17 training center has completed thousands of training hours for aircrews and loadmasters.

Boeing offers long–term Performance Based Logistics (PBL) solutions for the platforms, namely, P–8I, Apache and Chinook, with a promise to provide the armed forces the same level of availability we are currently provide on the C–17 fleet through our GISP programme. Boeing also offers training as a service on simulators on these platforms, just as we do today for the C–17 platform. PBL strategies have a proven track record of transforming the legacy transactional support between Boeing and its customers, to solutions that increase aircraft availability, resolves Aircraft On–Ground (AOG) situations, and reduces the life–cycle cost of operating defence aircraft. A PBL contract guarantees engineering, technical and material support for our customers at any hour and any operating location. Essentially, it ensures the relevant parts, available at the required location and at the right time. PBLs translate to higher aircraft availability through better utilisation of inventory and the requirement for fewer spare parts. Specifically for India, a PBL strategy will help resolve operational issues and enable further growth of Aatmanirbhar Bharat in strengthening India's national defence industry.

Boeing has globally executed over 12 Apache, and over 6 Chinook PBLs, bringing over 30 years of experience to enable long–term success of vertical lift readiness in India.

Notably, our offerings of the PBL solutions (also referred as: Aircraft Support Agreements) include our digital offering, that goes by the name of Mission Accelerator (MA). MA helps enhance availability of platforms significantly by providing predictability into maintenance. It also helps in operations and training of aircrew.

VAYU : And how are your MRO partners supporting you in the upkeep of the fleet?

Boeing has also partnered with customers and local industry to set up MRO facilities in the region to support India's aspiration to become an MRO hub for the region, and we also provide engineering and parts services to directly support regional commercial airline customers. Boeing India's strategic collaboration with Air Works was an important first step under the Boeing India Repair Development and Sustainment (BIRDS) hub that envisions a collaboration with key local companies and businesses to develop India into an aviation and defence repair and sustainment hub. Air Works successfully concluded Phase 32 maintenance checks on six P–8I long–range maritime patrol and anti–submarine warfare aircraft operated by the Indian Navy (IN) so far. Three of them were in heavy maintenance checks concurrently, demonstrating a maturity and scale at par with developed global MRO hubs.

VAYU : Can you share an overview of Boeing's fleet at service in India and the future opportunities being pursued?

Boeing has the largest fleet in defence among any foreign OEM in the country with the 11 C–17s, 22 AH–64 Apaches (with six more on order), 15 CH–47 Chinooks, 12 P–8Is, 3 VVIP aircraft and two Head of State aircraft and is a growing player in the civil market. We're regularly engaging with our defence customers in India on their current and future requirements for national security, and the value our portfolio can deliver to develop capabilities they require for the execution of their missions.

VAYU: Can you share an update on the training centre for the P–8I?

Boeing has built a 60,000 sq. ft. Training Support & Data Handling (TSDH) Centre at INS Rajali, Arakkonam in Tamil Nadu as part of a training and support package contract signed in 2019. The facility was handed over to the Indian Navy, and the trainings commenced in April, 2022. The secondary centre at the Naval Institute of Aeronautical Technology, Kochi was also handed over to the Indian Navy last year. The indigenous, ground–based training will allow the Indian Navy crew to increase mission proficiency in a shorter time, while reducing the on–aircraft training time resulting in increased aircraft availability for mission tasking. We also continue to support the Indian Navy's P–8I fleet through Boeing's services business–providing spares, ground support equipment, and by positioning field service representatives at INS Rajali & INS Hansa so they are available to the Navy on 24x7x365 basis.

More success for ISRO

The launch of ISRO's GSLV–F12/NVS–01 mission was accomplished on 29 May 2023 at 10:42 hours IST from the second launch pad at SDSC–SHAR, Sriharikota. This Geosynchronous Satellite Launch Vehicle (GSLV) mission was designed to deploy the NVS–01 navigation satellite, weighing about 2232 kg, into a Geosynchronous Transfer Orbit. Subsequent orbit raising maneuvers were used for placing the satellite into the intended orbit.

NVS–01 is the first of the second–generation satellites envisaged for the Navigation with Indian Constellation (NavIC) services. NVS series of satellites will sustain and augment the NavIC with enhanced features. This series incorporates L1 band signals additionally to widen the services. For the first time, an indigenous atomic clock will be flown in NVS–01.

Godrej Aerospace delivers 7 engines to ISRO for NVS–01 mission

We extend our heartfelt congratulations to ISRO on the resounding success of the NVS–01 satellite launch. At Godrej Aerospace, we take immense pride in our role in this remarkable mission. We contributed a total of 7 engines to this achievement. Among them were three L40 Vikas Engines, one GS2 Contour Engine, one CUS Engine, and two Steering Engines, all indigenously built by Godrej Aerospace in India. The flawless performance of the second stage Vikas engine and the seamless operation of the cryogenic stage propelled the satellite along its predicted trajectory. This remarkable accomplishment exemplifies our commitment to advancing India's space exploration endeavors using indigenous expertise. It reinforces our determination to shape a brighter future for India's space sector. Godrej Aerospace is honoured to continue our partnership with ISRO as we work together to further the boundaries of India's space exploration. We are excited about the opportunities that lie ahead and are dedicated to playing a pivotal role in shaping the future of India's space industry", stated Maneck Behramkamdin, AVP and Business Head, Godrej Aerospace.

ISRO and Indian Navy firm up CRTP for Gaganyaan

Recovery Operations for the Gaganyaan mission took a major step forward with the release of the Gaganyaan Recovery Training Plan at the Water Survival Training Facility (WSTF) at INS Garuda, Kochi on 24 May 2023. The document highlights the training plan for the recovery of the crew module for the mission. It defines overall requirements with respect to training of various teams participating in Recovery operations viz marcos, parajumpers, medical specialists, technicians etc. The recovery training is planned in incremental phases starting from unmanned recovery to manned recovery training in harbour and open sea conditions. The overall recovery operations of the crew module are being led by the Indian Navy in coordination with other maritime agencies.

The Crew Module Recovery Model was formally handed over to Indian Navy at Water Survival Training Facility (WSTF) at INS Garuda, Kochi. The mass and shape simulated mock–up will be used for familiarisation and training of Gaganyaan recovery teams. WSTF is equipped with its state–of–the–art facility in the new avatar with a team of highly qualified divers all set to assist ISRO by undertaking a series of trials and fine–tuning of Standard Operating Procedures to train the crew and recovery team of Gaganyaan.

ISRO's mandate to Tata Elxsi for CMRM

Tata Elxsi, a leading global design company that blends technology, creativity and engineering has partnered with Indian Space Research Organisation (ISRO) to enable the upcoming Gaganyaan Mission. Through the association, Tata Elxsi has designed and developed Crew Module Recovery Models (CMRM) for recovery team training of the space Mission.

ISRO's Gaganyaan project envisions a demonstration of human spaceflight capability by launching the crew into a 400 kilometer orbit for a three day mission and safely bringing them to Earth by landing in Indian sea waters. One of the key requirements of this project is the safe recovery of the crew, which must be carried out with minimum lapse of time. This is where the crew recovery models come into use. For recovery team training, CMRMs designed and fabricated by Tata Elxsi, that simulated the Mass, Centre of gravity, Outer Dimensions, interfaces and Externals of the actual Crew Module. Tata Elxsi effectively executed activities right from developing the design configuration in accordance with the initial requirements provided by ISRO, to carrying out structural analysis for various load cases, material procurement and testing, fabrication, carrying out load tests, and transportation of the CMRM and the Ground Support Fixture (GSF). The project marked Tata Elxsi's foray into the mechanical design for space, as this is the first time ISRO has outsourced the mechanical design and development work for a critical system to an external partner. Tata Elxsi has also emerged as the preferred partner for similar ISRO projects.

Chandrayaan 3: A New Chapter in India's Space Odyssey

On 14 July 2023, the Indian space exploration desires embarked on a new adventure as the nation witnessed the launch of the LVM–3 rocket from Satish Dhawan Space Centre in Sriharikota, piercing the barriers of the atmosphere with full afterburner.The Chandrayaan–3 is another attempt by India to conduct a successful soft landing on the surface of the moon. Till now only nations like US, Russia and China are able to conduct such kind of missions successfully. The Chandrayaan–3 consists of a lander and rover, which is similar to those used in Chandrayaan–2 but with some modifications. The lander and rover of the Chandrayaan–3 would be communicating back to Earth through the lunar orbiter delivered into the moon's orbit by the Chandrayan–2 mission.

What distinguishes India's lunar missions from the same type of missions by other nations so far is the fact that ISRO is always more interested in exploring the South Pole region of the moon. It is because this region has never been in direct contact with sunlight, due to which it still preserves a lot of essential minerals like ammonia, sodium, mercury and silver. The craters at the south pole of the moon are also expected to have nearly 100 million tonnes of water. By exploring this region of the moon, scientists can learn a lot about the origin of Earth and the universe.

The Chandrayaan–3 is also going to be the fastest mission to the lunar surface by ISRO as compared to the Chandrayaan–1 and Chandrayaan–2, taking almost 40 days to reach the moon. The increase in speed of the mission is only possible due to Launch Vehicle Mark–3 (LVM–3) which is a three–stage medium lift launch vehicle with better payload capacity than the previous GSLV family.

The Pragyan rover of Chandrayaan–3 is equipped with modern instruments like Alpha Particle X–ray Spectrometer and Laser Induced Breakdown Spectrometer which would help the rover to conduct chemical and mineralogical study of lunar surface. The rover weighs about 26 kg and has a range of 500 meters with an expected lifespan of 14 Earth days.

Apart from this, some major structural changes have been done to the lander of Chandryaan–3. The lander responsible for soft landing on the lunar surface will now have four throttle engines with stronger legs in case of harsher impact. The lander is packed with various kinds of equipment like altimeters, velocimeters, navigation guidance and control and two hazard detection and avoidance cameras instead of one.

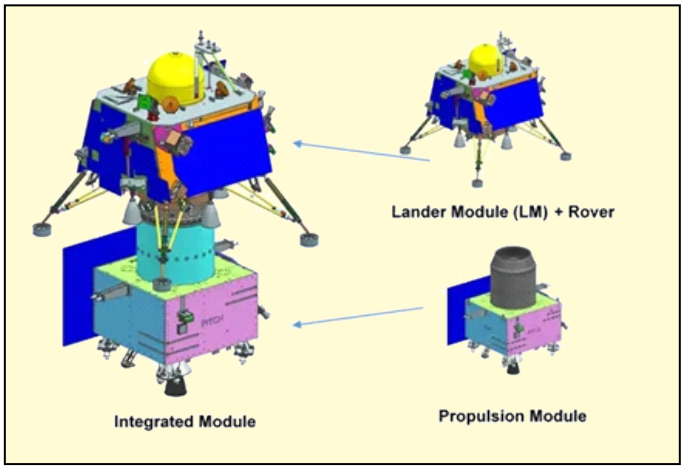
It further has some mission oriented payloads like Radio Anatomy of Moon bound hypersensitive ionosphere and atmosphere (RAMBHA) and Langmuir probe to study near–surface plasma density, Chandra's Surface Thermophysical Experiment (ChaSTE) to study about thermal properties of the lunar surface and Instrument for Lunar Seismic Activity (ILSA) to study about the lunar crust and mantle.

The propulsion module attached to the lander will have a Spectro–polarimetry of Habitable Planet Earth (SHAPE) payload which could be used for search for habitable exoplanets outside our solar system. The propulsion module will also behave like a communication relay satellite.

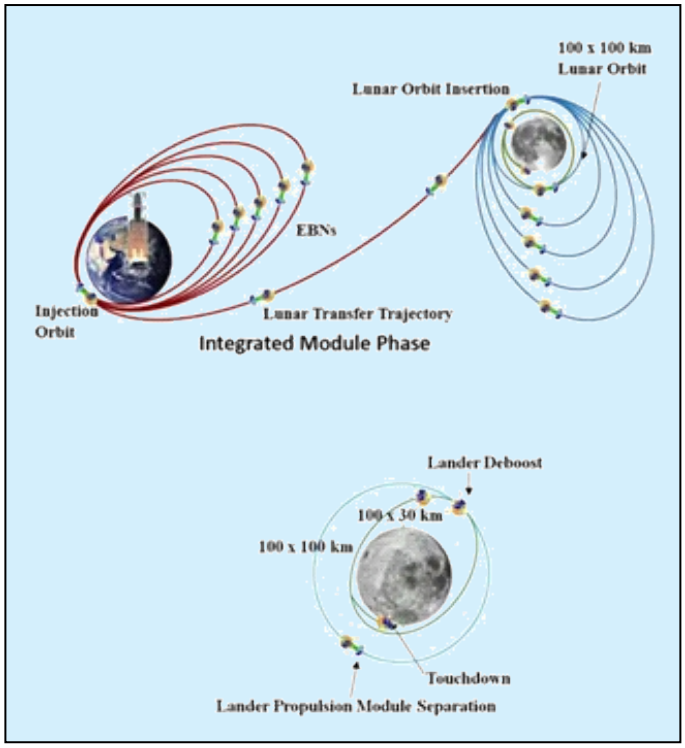
History of Chandrayaan missions

India's Chandrayaan missions have marked significant milestones in the country's space exploration endeavors. The first mission, Chandrayaan–1, was launched on 22 October 2008. It was India's entry into the realm of deep space exploration. Chandrayaan–1 carried 11 scientific instruments, including a Moon Impact Probe (MIP) that crash-landed near the lunar South Pole. The mission provided valuable data on the Moon's topography, mineralogy and the presence of water molecules in the lunar soil.

3D Render of the Lander



Planned Flight Path



Lander and "Pragyaan" Rover Render

Chandrayaan–2, launched on 22 July 2019, was a more ambitious mission due to the fact that the objective was to conduct a soft landing. It aimed to land a rover, called Pragyan, on the lunar surface. The mission consisted of an orbiter, a lander named Vikram, and the rover. Unfortunately, during the final stages of the landing, communication with the lander was lost, and it crash–landed near the lunar South Pole. Despite the setback, the orbiter continues to function and collect valuable data about the Moon.

Article by Rishav and Pratisht Chaudhry
All images: ISRO

Exercises and Visits

Indian High Commissioner to the UK Vikram Doraiswami meets the troops of the UK and Indian Armies at the exercise

British and Indian Army at Exercise Ajeya Warrior

The UK and India concluded the seventh edition of the biennial exercise, Ajeya Warrior on 11 May 2023. Contingents from the British and Indian Armies had been undertaking demanding training on the Salisbury Plain Training Area in the UK for the two weeks. This year, Exercise Ajeya Warrior involved troops from the UK's 16 Air Assault Brigade Combat Team and 2nd Battalion the Royal Gurkha Rifles, and India's 6th Battalion of the Bihar Regiment.

Increasing the scope, complexity and dynamism considerably from previous iterations of the exercise, a company from the Bihar Regiment was integrated into the 2nd Battalion the Royal Gurkha Rifles battlegroup to conduct high tempo operations in a pioneering simulated training environment.

Alex Ellis, British High Commissioner to India, stated, "The UK and India are natural partners in defence and have increasing levels of interoperability, as shown by this highly complex and hands–on interaction between our militaries. The UK has made the Indo Pacific 'tilt' a permanent pillar of our international policy. The region is critical to our economy, our security, and to our interest in an open and stable international order."

Brigadier Nick Sawyer, Defence Advisor, British High Commission, stated, "Exercise Ajeya Warrior has been thoroughly testing the soldiers of both our nations, encompassing the uncertainty and complexity experienced in contemporary multi domain operations. Throughout the exercise, both the armies have had an opportunity to showcase their capabilities and emerging military technologies, as part of their respective drives toward modernisation. There is no doubt we will have learned from each other, yet again. Ajeya Warrior leaves us with an increased understanding about each other's military capabilities and tactics, which is vital for a stronger UK–India strategic partnership."

Sea Phase of ASEAN–India maritime exercise

The inaugural ASEAN India Maritime Exercise (AIME–2023) successfully culminated in the South China Sea on 8 May 2023. Approximately 1400 personnel manning nine ships participated in the Sea Phase of the multilateral naval exercise. India's indigenously designed and built ships–destroyer INS Delhi and stealth frigate INS Satpura, maritime patrol aircraft P8I and integral helicopters exercised with ASEAN naval ships from Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam.

The two–day sea–phase witnessed a wide spectrum of evolutions at sea including tactical manoeuvres, cross deck landings by helicopters, seamanship evolutions and other maritime operations. Apart from honing skills in the maritime domain the exercise enhanced interoperability and demonstrated the ability of Indian and ASEAN navies to operate as an integrated force to promote peace, stability and security in the region.

35th Indo–Thai CORPAT

The 35th edition of India–Thailand Coordinated Patrol (Indo–Thai CORPAT) between the Indian Navy and the Royal Thai Navy was conducted from 3–10 May 2023. Indian Naval Ship (INS) Kesari, an indigenously built LST (L) and His Thai Majesty's Ship (HTMS) Saiburi, a Chao Phraya Class Frigate, along with Maritime Patrol Aircraft from both navies participated in the CORPAT along the IMBL in the Andaman Sea. Towards reinforcing maritime linkages between the two countries and with an aim of keeping this vital part of the Indian Ocean safe and secure for international trade, the Indian Navy and the Royal Thai Navy have been undertaking CORPAT bi–annually since 2005 along the International Maritime Boundary Line (IMBL).

Indian naval ships visit Sihanoukville, Cambodia

As part of Indian Navy's deployment to ASEAN countries, Indian Naval ships Delhi and Satpura, under the command of Rear Admiral Gurcharan Singh, Flag Officer Commanding Eastern Fleet (FOCEF), made a port call at Sihanoukville, Cambodia from 11–14 May 2023. The port call demonstrated India's cordial ties with the Kingdom of Cambodia. During the port call, personnel from both the navies engaged in a wide range of professional interactions, deck visits and sports exchanges, aimed at enhancing interoperability and mutual understanding. INS Delhi is India's first indigenously built guided missile destroyer and INS Satpura is an indigenous multi–purpose stealth frigate. The two ships are equipped with a versatile array of weapons and sensors and can carry multi–role helicopters.

India–Indonesia Samudra Shakti

INS Kavaratti, indigenously designed and built ASW Corvette, arrived at Batam, Indonesia to participate in the 4th edition of India–Indonesia Bilateral exercise Samudra Shakti–23 from 14–19 May 2023. An Indian Navy Dornier Maritime Patrol aircraft and Chetak helicopter also participated. The Indonesian Navy was represented by KRI Sultan Iskandar Muda, CN 235 Maritime Patrol Aircraft and AS565 Panther Helicopter. Exercise Samudra Shakti was aimed at enhancing interoperability, jointness and mutual cooperation between both the navies. The Harbour phase comprised cross deck visits, professional interactions, Subject Matter Expert Exchanges and sports fixtures. During the Sea Phase, weapon firing, helicopter operations, anti–submarine warfare and air defence exercises and boarding operations were carried out.

Indian naval ships visit Da Nang, Vietnam

As part of Indian Navy's deployment to ASEAN countries, Indian Naval ships Delhi and Satpura, under the command of Rear Admiral Gurcharan Singh, Flag Officer Commanding Eastern Fleet, arrived at Da Nang, Vietnam on 19 May 2023. The ships were accorded a warm welcome by the Vietnam People's Navy. The visit was aimed at strengthening bilateral ties and enhancing cooperation between the navies of both countries. During the visit, personnel from both the navies engaged in a wide range of professional interactions, deck visits, social interactions and sports fixtures, to further strengthen their bonds of friendship.

Exercise Samudra Shakti–23 concludes

The 4th edition of the Indo–Indonesia bilateral Exercise Samudra Shakti–23 concluded in the South China Sea. The sea phase held from 17–19 May 2023 witnessed the

participation of ASW corvette INS Kavaratti with integral Chetak helicopter and a Dornier Maritime Patrol Aircraft. The Indonesian Navy assets included KRI Sultan Iskandar Muda with integral helicopter Panther and a CN 235 Maritime Patrol Aircraft. A series of complex exercises including tactical manoeuvres, weapon firings, helicopter operations, air defence and anti–submarine warfare exercises were undertaken that enhanced interoperability between the two navies.The sea phase was preceded by a fruitful harbour phase which saw professional interactions, table top exercises and sports exchanges.

Indian–Saudi Arabia Al Mohed Al Hindi 23

The sea phase of second edition of bilateral exercise 'Al Mohed Al Hindi 23', between Indian Navy and Royal Saudi Naval Force (RSNF) was held from 23–25 May 2023 off Al Jubail, Saudi Arabia. INS Tarkash, INS Subhadra and Dornier Maritime Patrol aircraft (MPA) participated in the exercise from the Indian side. The RSNF was represented by HMS Badr and Abdul Aziz, MH 60R helo and UAV. The three–day exercise at sea witnessed a wide spectrum of maritime operations. The exercise culminated with debrief at sea followed by traditional steam past. The successful conduct of 'Al Mohed Al Hindi 23' showcased high degree of professionalism, interoperability and exchanges of best practices between the two navies. The bilateral exercise met all its objectives and both sides intend to graduate to more advanced level of exercises in the next edition.

Indian Army exercises

End May 2023, Indian Army's Tiger Division carried out an exercise with troops to validate its operational readiness and mission reliability in a networked operational environment with integration of all arms and services. The exercise was reviewed by GOC Rising Star Corps. In another exercise, Double Victory Brigade validated sub unit tactical and technical skills. Troops honed their skills on equipment in a battle simulated condition for mission readiness.

IN P–8I's in Bahrain

On 28 May 2023, Indian Navy P–8I aircraft from INS Hansa undertook a maiden landing at Bahrain International Airport to participate in Operation Compass Rose, as part of Combined Maritime Force (CMF), followed by interaction with representatives of participating countries.

INS Trishul at Port Anjouan, Comoros

As part of the Indian Navy's long range deployment, INS Trishul visited port Anjouan, Comoros from 31 May to 2 June 23. The ship anchored off Anjoun Island on 31 May 23 and was received by civil–military leadership. As part of the visit, Captain Kapil Kaushik, the Commanding Officer, called on senior government officials at Anjouan. Professional interactions with Comoros Armed Forces and Comoros Coast Guard, sports fixtures and a joint Yoga session with Comoros Defence forces were undertaken by the ship during the stay in harbour.

Indian Navy at Durban

The Indian Navy participated in a commemorative event to mark 130 years of the start of struggle against apartheid at the Pietermaritzburg, Railway Station near Durban. INS Trishul, a frontline warship of the Indian Navy visited Durban from 6–9 June 2023 to commemorate the 130th anniversary of the 7th June 1893 incident at Pietermaritzburg, Railway Station as also 30 years of re–establishment of diplomatic relations between India and South Africa.

India, France and UAE in maiden maritime exercise

India, France and UAE trilateral cooperation achieved another milestone with successful completion of first ever trilateral Maritime Partnership Exercise between three navies from 7–8 June 2023. During the maiden edition of the exercise, a wide spectrum of operations at sea such as surface warfare involving tactical firing and drills for missile engagements, close quarter manoeuvres, advanced air defence exercise with French Rafale and UAE Dash 8 MPA, Helicopter Cross Landing Operations, Drills for Replenishment at sea were undertaken by the participating units. The exercise also saw cross embarkation of personnel that facilitated exchange of best practices.

"Ex Khaan Quest 2023" in Mongolia

Multinational Peacekeeping Joint Exercise "Ex Khaan Quest 2023" featuring participation from military contingents and observers from over 20 countries commenced in Mongolia on 19 June 2023. Mr Ukhnaagiin Khurelsukh, the President of Mongolia inaugurated the Exercise in a ceremony organised at the exercise location in Mongolia. The exercise was co–sponsored by Mongolian Armed Forces (MAF) and United States Army Pacific Command (USARPAC).

The Indian Army was represented by a contingent from the Garhwal Rifles. The 14–day exercise was aimed at enhancing interoperability of the participating nations, for sharing experience and to train uniformed personnel for the United Nations Peacekeeping Operations (UNPKO). The exercise prepared participants for future UN Peacekeeping missions, develop peace operations capabilities and enhance military readiness.

INS Sunayna visits Mombasa, Kenya

INS Sunayna visited Mombasa, Kenya from 20–23 June 2023 towards strengthening bilateral ties with maritime neighbours on the theme of Ocean Ring of Yoga. On arrival, the ship was received by the High Commission of India. The Commanding Officer called upon Brigadier Y S Abdi, Deputy Commander of Kenya Navy and highlighted the significance of Yoga towards bringing the world together. A Maritime Partnership Exercise was conducted between the two navies. The crew of both Indian and Kenya Navy conducted drills in Firefighting and Damage Control, boarding exercises, asymmetric threat simulations and VBSS during the harbour phase. A HADR capsule was also conducted onboard for the Kenya Navy.

INS Trishul visit to Port of Toamasina

INS Trishul made a port call at Toamasina, Madagascar from 19–22 June 2023 as part of Operational Deployment reflecting India's cordial ties with its maritime neighbours. As part of the theme 'Ocean Ring of Yoga', 9th International Yoga Day was celebrated wherein 352 personnel comprising ship's company, officials from Governor's and Mayor's office, Malagasy Armed Forces, Women Police, members of Indian Embassy (including the Ambassador of India), doctors, nurses, members of Indian diaspora and local citizens participated in the event. Mr. Rafidison Richard Theodore, Governor of Antsiranana Region, Madagascar was the Chief Guest for the event.

INS Tarkash at Muscat

Indian Naval Ship Tarkash made a port call to Muscat, Oman from 19 to 22 June 2023. During the visit, the ship undertook a myraid of activities. On 21 June, Commanding Officer along with ship's crew participated in Oman Yoga Yatra held at Indian School Muscat organised by EoI. The Ambassador of India to Oman felicitated Commanding Officer, INS Tarkash prior commencement of Yoga, amidst some 2000 participants present at the venue. During the port call, the ship's crew interacted with the Sultan of Oman's Armed Forces, wherein an organised visit was conducted to Sultan's Armed Forces Museum and Maritime Security Centre, Muscat, Oman.

INS Trishul paricipates in Seychelles National Day

INS Trishul made a port call at Seychelles as part of Operational Deployment reflecting India's cordial ties with her maritime neighbours on 28 June 2023. During the visit, the Commanding Officer paid courtesy calls to Mr Sylvestre Radegonde, Minister of Foreign Affairs and senior defence Leaders of Seychelles Armed Forces. He also called on High Commissioner of India to Seychelles, Mr Kartik Pande. The ship prior entry into port, undertook joint EEZ surveillance. His Excellency Mr. Sylvestre Radegonde, Minister of Foreign Affairs of the Republic of Seychelles welcomed the joint EEZ surveillance with Indian Navy which has helped in fostering the existing maritime cooperation between the two countries.

INS Kirpan sets sail to Vietnam

During the recent visit of Gen Phan Van Giang, Minister of Defence of Vietnam, to India from 17–19 June 2023, Raksha Mantri announced gifting of in–service missile corvette INS Kirpan to Vietnam. Towards executing the same, INS Kirpan cast–off from Visakhapatnam on her final journey from India to Vietnam. INS Kirpan is the third indigenously built Khukri class missile corvette, currently in active service in the Indian Navy. The ship is fitted with an array of weapons and sensors and has participated in various operational and humanitarian assistance operations. As part of her final journey from India to Vietnam, INS Kirpan set sail from Visakhapatnam and was handed over to Vietnam People's Navy post arrival in Vietnam.

INS Sunayna enters Beira, Mozambique

INS Sunayna, based at Southern Naval Command Kochi, entered Port Beira, Mozambique on 28 June 2023. The ship was received by Mozambique Navy personnel and DA Pretoria, amidst fanfare of military band. To enhance Maritime partnership and interoperability, both Navies engaged in professional exchanges, cross deck visits and sports fixtures. The ship conducted a medical camp as part of Indian Navy's community outreach programme.

IN–FN maritime partnership exercise

Indian Naval ships INS Rana, a guided missile destroyer and INS Sumedha, an indigenously built offshore patrol vessel undertook a Maritime Partnership Exercise (MPX) with French Navy ship FS Surcouf, in the Bay of Bengal on 30 June 2023. The French Navy's La Fayette class frigate Surcouf visited Visakhapatnam from 26–29 June 2023 and participated in a variety of activities with Indian Navy ships which included professional and social interactions, sports fixtures and cross deck visits.

On departure from Visakhapatnam, FS Surcouf undertook various exercises with IN ships Rana and Sumedha, which included tactical manoeuvres, replenishment at sea (RAS) approaches, air defence against fighter aircraft and cross deck helicopter operations. The MPX culminated with a customary farewell steampast between the ships reaffirming the close friendship between the two navies. The visit of FS Surcouf to India signifies the strong navy–to–navy links, interoperability and strong bonds between Indian Navy and French Navy.

Earlier, this year, FS La Fayette, a frigate and FS Dixmude, a Mistral–class amphibious assault class ship had participated in an MPX with INS Sahyadri, a guided missile frigate from 10–11 March 2023.

The Uncharted Frontier

Synergising Aerospace, Defence and Cyber Capabilities for Next–Generation Security

In the ever–evolving landscape of today's interconnected world, the fusion of aerospace, defence and cyber security has become paramount. The dynamic nature of technological progress necessitates a comprehensive and integrated approach to address emerging security challenges. By synergising aerospace, defence and cyber capabilities, we unlock unparalleled possibilities for enhancing situational awareness, fortifying critical infrastructure and deploying proactive defence strategies. This article delves into the uncharted frontier where these domains intersect, illuminating the areas where their symbiotic relationship flourishes. Through a thorough exploration of this convergence, we can grasp the far–reaching implications it holds for next–generation security, empowering us to shape a more resilient and safeguarded future. By harnessing the collective power of aerospace, defence and cyber capabilities, we can forge a new paradigm of security that adapts to the ever–changing threats of our interconnected world, ensuring a future that is both resilient and safeguarded.

Aerospace reconnaissance and cyber threat intelligence

Aerospace surveillance technologies, such as satellites and Unmanned Aerial Vehicles (UAVs), have revolutionised defence and intelligence operations by providing critical information about potential threats and vulnerabilities. However, in today's rapidly evolving cyber landscape, their capabilities can be further enhanced by integrating cyber threat intelligence.

Cyber threat intelligence involves the collection, analysis and interpretation of information regarding cyber threats, their actors, and their methodologies. By integrating cyber threat intelligence with aerospace surveillance, nations can achieve a more comprehensive understanding of their security landscape. This integration enables early warning systems that provide timely alerts and insights into emerging threats, allowing for proactive defence measures.

One way to leverage this integration is by combining satellite imagery with cyber analytics. Satellites capture vast amounts of data, about various locations and infrastructure, including critical networks and systems. By analysing this imagery using advanced cyber analytics, patterns and indicators of cyber threats can be detected. Unusual network activities, such as an increase in data exfiltration or suspicious communications, can be identified through the combination of satellite imagery and cyber analytics.

For instance, if satellite imagery reveals a significant increase in network traffic or the presence of unauthorised devices near a military installation, it may indicate a potential cyber–attack in progress or an attempt to breach the security perimeter. By promptly detecting and analysing such anomalies, proactive defence measures can be initiated to mitigate the potential impact.

Moreover, the integration of aerospace reconnaissance and cyber threat intelligence allows for the identification of potential vulnerabilities in critical infrastructure. Cyber threat intelligence can provide insights into the tactics, techniques and procedures employed by cyber threat actors. This information, when combined with aerial surveillance data, can identify potential weak points that adversaries may exploit.

By analysing the cyber threat landscape and identifying potential vulnerabilities, nations can prioritise their defence efforts and allocate resources effectively. Furthermore, the

integration of aerospace and cyber capabilities enables a more proactive approach to security, where potential threats are identified before they materialise, allowing for timely response and mitigation.

Integrating cyber threat intelligence with aerospace surveillance technologies unlocks significant potential for enhancing situational awareness and proactive defence measures. By combining satellite imagery with cyber analytics, nations can detect patterns, indicators and anomalies that may signify cyber threats. This integration enables early warning systems, providing timely alerts and insights into emerging threats. By leveraging the power of aerospace reconnaissance and cyber threat intelligence, nations can achieve a more comprehensive understanding of their security landscape and bolster their defences in an ever–evolving cyber landscape.

Cyber–Physical Defence Systems

In an increasingly connected world, safeguarding critical aerospace infrastructure from physical and cyber threats has become of paramount importance. The integration of cyber resilience and robustness into physical defence systems creates a layered approach to security that enhances the overall protection of these vital assets.

Airports, military bases and spaceports are complex environments with numerous interconnected systems, making them vulnerable targets for cyber–attacks. By incorporating cybersecurity measures into these physical defence systems, vulnerabilities can be mitigated. For example, deploying intrusion detection systems and firewalls helps monitor and control network traffic, reducing the risk of unauthorised access and potential cyber breaches. Network segmentation further enhances security by isolating critical systems from less secure areas, limiting the potential impact of a cyber–attack.

Real time monitoring and analysis of cyber threats play a crucial role in identifying potential weaknesses in physical defences. By continuously monitoring for suspicious activities and analysing incoming data, security personnel can proactively detect and respond to cyber threats before they can compromise critical infrastructure. This proactive approach allows for timely mitigation measures to be implemented, minimising potential damage and disruption.

The convergence of cyber and physical defence systems offers a holistic approach to protecting critical infrastructure. It recognises that cyber–attacks can have physical consequences and vice versa. By integrating cyber resilience into physical defence systems, the overall security posture is strengthened, ensuring a comprehensive defence against both cyber and physical threats.

Furthermore, the integration of cyber and physical defence systems enables a more coordinated and efficient response to security incidents. In the event of a cyber–attack, physical defence systems can be synchronised with cyber defences to automatically activate countermeasures, such as shutting down affected systems or isolating compromised areas. This synchronised response reduces response time, minimises potential damage, and enhances overall incident management capabilities.

The integration of cyber resilience and robustness into physical defence systems provides a layered and proactive approach to safeguarding critical aerospace infrastructure. By incorporating cybersecurity measures, such as intrusion

detection systems and network segmentation, vulnerabilities can be mitigated, reducing the risk of cyber breaches. Real–time monitoring and analysis of cyber threats complement physical defence systems, enabling timely detection and response. The convergence of cyber and physical defence systems offers a comprehensive defence against both cyber and physical threats, ensuring the protection of critical infrastructure in an increasingly interconnected world.

Autonomous Systems and Cyber security

The development and deployment of autonomous systems in aerospace and defence introduce a new realm of challenges and opportunities. Unmanned aerial vehicles (UAVs), drones, and other autonomous platforms rely on robust cyber security measures to ensure their trustworthiness and resilience in the face of potential cyber threats.

Securing the communication channels through which autonomous systems operate is paramount. Encryption and authentication protocols play a crucial role in protecting the integrity and confidentiality of the transmitted data. By implementing secure communication channels, the risk of unauthorised access or interception of critical information can be minimised.

Moreover, safeguarding the integrity of data inputs is essential to prevent malicious manipulation or tampering. Autonomous systems heavily rely on accurate and reliable data to make informed decisions. By implementing measures to validate and verify the authenticity and integrity of data inputs, the trustworthiness of autonomous operations can be ensured.

Incorporating secure software and hardware systems is another crucial aspect of cyber security for autonomous systems. By designing and deploying robust and tamper–resistant hardware components, vulnerabilities associated with physical attacks or unauthorised modifications can be mitigated. Additionally, implementing secure software development practices, such as rigorous code reviews, vulnerability assessments, and regular software updates, helps maintain the security and resilience of autonomous systems.

The fusion of cyber security and autonomous systems presents opportunities to leverage advanced artificial intelligence (AI) algorithms for real–time threat detection and response. AI–powered systems can continuously analyse incoming data, identify patterns, and detect anomalies that may indicate cyber threats. By integrating AI–based cybersecurity solutions into autonomous systems, potential risks can be swiftly identified and mitigated, ensuring the safety and security of operations.

Integration of cyber security and autonomous systems in aerospace and defence enables safer and more efficient operations. Autonomous systems have the potential to revolutionise various aspects of aerospace and defence, including surveillance, logistics and reconnaissance. By ensuring the cyber security of these systems, their reliability and resilience are bolstered, leading to increased operational effectiveness and reduced risks.

The development and deployment of autonomous systems in aerospace and defence require robust cyber security measures to safeguard their trustworthiness and resilience. Securing communication channels, protecting data inputs, and implementing secure software and hardware systems are critical for ensuring the integrity and security of autonomous

operations. The fusion of cybersecurity and autonomous systems also opens doors to leverage advanced AI algorithms for real–time threat detection and response. By incorporating cybersecurity into autonomous systems, safer and more efficient operations can be achieved, paving the way for the future of aerospace and defence.

Cyber Warfare and Aerospace Operations

The emergence of cyber warfare has brought about a fundamental shift in the landscape of military conflict. Cyber capabilities now serve as force multipliers, offering the potential to disrupt enemy command and control systems and disable adversary aerospace assets. This integration of cyber warfare and aerospace operations creates new challenges and necessitates a comprehensive cybersecurity approach to safeguard critical systems.

Defending aerospace systems from cyber–attacks is a complex and multifaceted task. Comprehensive cybersecurity measures are vital to ensuring the resilience of aerospace operations. Network segmentation, for instance, helps isolate critical systems from potential threats, limiting the spread of cyber–attacks. Strong authentication protocols, such as multi–factor authentication and robust access controls, help prevent unauthorised access and ensure the integrity of data and communications.

Continuous monitoring is essential to detect and respond to potential cyber threats in real time. By employing advanced threat detection technologies and implementing security information and event management (SIEM) systems, anomalies and malicious activities can be promptly identified and addressed. Rapid incident response capabilities are critical in minimising potential damage caused by cyber threats and maintaining operational continuity.

Moreover, robust incident response plans tailored to the unique challenges of cyber warfare are essential. These plans outline the steps to be taken in the event of a cyber–attack, including containment, eradication, and recovery procedures. Regular drills and simulations can help validate and refine these plans, ensuring that personnel are well–prepared to handle cyber incidents effectively.

Cyber warfare training for personnel is also a crucial aspect of integrating cyber warfare and aerospace operations. By providing comprehensive training on cybersecurity best practices, threat detection techniques, and incident response protocols, personnel can become a formidable line of defence against cyber–attacks. Regular training ensures that they stay up–to–date with the evolving cyber threat landscape and can proactively identify and respond to potential cyber threats.

Cyber warfare and aerospace operations demands a proactive and adaptive security approach. Cyber threats are constantly evolving, and adversaries are becoming increasingly sophisticated. Therefore, cyber security measures must continually adapt and improve to stay ahead of potential attacks. Collaboration between defence organisations, cyber security experts and aerospace industry stakeholders is essential to share knowledge, exchange best practices, and collectively strengthen the security posture of aerospace operations.

Space–Based Cybersecurity

Space–based assets, such as satellites and space

exploration missions, play a pivotal role in communication, surveillance and navigation systems. However, they are not impervious to cyber threats. Safeguarding these assets necessitates a comprehensive approach that encompasses robust cybersecurity measures.

Encryption and authentication protocols are essential for securing space–based assets. Encrypting the data transmitted to and from satellites ensures its confidentiality and protects against interception by malicious actors. Strong authentication protocols help verify the identity of authorised users and prevent unauthorised access to critical systems.

Establishing secure communication channels is crucial to protect space–based assets from cyber–attacks. By employing secure communication protocols and implementing measures to detect and mitigate potential threats, the integrity and reliability of data transmission can be maintained.

Conclusion

The convergence of aerospace, defence and cyber capabilities represents an exciting frontier in security, presenting transformative potential through their integration. This article has explored key areas where their synergy manifests, highlighting the power of aerospace reconnaissance, cyber threat intelligence, integrated cyber and physical defence systems, autonomous systems and cyber warfare. These advancements unlock unprecedented potential for next–generation security. By leveraging aerospace technologies, robust defence systems, and cutting–edge cybersecurity measures, nations can proactively safeguard their interests in an interconnected world. To fully realise the benefits, ongoing collaboration and research are vital for developing adaptive and resilient security frameworks. As we venture into this uncharted frontier, the synergistic approach to aerospace, defence and cyber capabilities will shape the future of security, paving the way for a safer and more secure world.

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All images created by Ms. Antara Jha

Winning battle of minds instead of arms: The importance of Information Warfare

Illustration of Information Warfare (Source: Unrevealed Files)

The modern form of combat is not only restricted to war machines or men operating them on battlefield, rather it has moved a large distance away from battlefields, which is the minds of people. The ideology that being victorious on battlefield really means one has won a battle is slowly becoming an outdated one, since in the modern world if one is not able to win in minds of people and prove victory, the chances are low that people will really believe in such kind of victory.

The warfare inside the minds of the people is conducted through what is known as Information Warfare. The information is the most dangerous weapon anyone can possess today in modern world, and what makes this weapon even more special is that it doesn't require any kind of bloodshed or millions of dollars to operate, and still the operator could emerge victorious using it. The importance of information and its use in warfare has been stressed since eternity as justified by quotes like "A well placed word can be more powerful than a thousand bullets" or "The greatest victories are achieved by controlling the narrative, not the battlefield".

The Information Warfare uses information and communication technologies to achieve strategic objectives. It involves the manipulation, exploitation and dissemination of information to influence perceptions, undermine adversaries and shape the narrative in favour of one's own interest.

Why Information Warfare holds significance?

The Information Warfare is a very broad term that encompasses various strategies and tactics that includes cyber warfare, psychological operations, influence operations, counterinte–lligence and media manipulation as its subparts. The aspect of Information Warfare that one would be considering will majorly include psychological operations.

The Indian Parliament Standing Committee on defence recently said that the Forces should have only one–third of its equipment vintage, however in reality almost 60% of equipment used by our forces is outdated as of current scenario, and even in the remaining 40% category, there's hardly 10–12% of weaponry which can be called as true state of the art weapons. It can be understood very clearly that India hugely neglects investment in procuring such equipment that will be appropriate for future and hence this data also gives a slight indication of how rarely things like Information Warfare and operations are discussed in our defence planning.

The impact of this negligence on info–ops is that it is now very common to observe in India that even a normal protest takes form of riots or separatist movements which are often found to be fuelled up by circulation of misinformation which at last undermines the national security and

Aspects of Information Warfare (Image: US Army)

integrity of the country. It should be also understood that not only India, but rather many nations have suffered very badly due to play of information. For example, prior to 2003 invasion of Iraq, there was a widespread belief that Iraq possessed weapons of mass destruction which later became one of the excuses to invade Iraq; eventually no such weapons were found. The result was destabilisation and civil unrest which led the nation to almost collapse.

The Importance of Information Warfare can also be understood by considering the case of Russia–Ukraine war, as on one end Russia is the more dominant power by capturing almost 25% of Ukraine's territory, but still media outlets and social media platforms all over the globe portray Russia as a nation which is losing the war. The Russian agencies like their media houses and influential personalities also use information to undermine Ukraine and its allies.

India and the use of Information Warfare against it

It is important to acknowledge that India has failed several times in the domain of info–ops in past as can be seen by examples of 1962 and 1967 conflicts with China. People are aware of India's defeat in 1962 war but a very small segment of the population is aware of what happened during India's clashes with China in 1967. This clearly shows that our country wasn't able to create an appropriate narrative in minds of the Indian and the rest of the world.

The recent Galwan Valley clashes were indeed better at info–ops as compared to 1960's era, as now at least the video clips of Indian soldiers clashing with Chinese soldiers on borders near Sikkim and Ladakh surfaced. External affair ministry along with Indian media channels were providing factual information regarding the conflict, however it should also be highlighted that on the other side of border too, the Chinese government along with Chinese media were trying their way best to convey to their population of their victory by creating morphed images. The Indian map is another such example where this play of information is clearly visible as now days it has become very common for foreign websites, popular social media platforms and search engines to clearly show POK as part of Pakistan rather than India. While living in India it seems like such moves don't make any difference. A very famous saying goes like, "If you repeat a lie often enough it becomes the truth", hence the effects of such distorted maps of Indian territory would be that the future generations would really start to believe POK as a part of Pakistan since people usually believe information shown to them first hand and rarely try to investigate the truth behind it. China also on other hand has now started again to show Arunachal Pradesh as a part of its territory which they justify as being part of Southern Tibet. Recently, the Chinese government announced renaming of 11 towns inside Arunachal Pradesh. In response, the Government of India categorically stated that, "Arunachal Pradesh is an integral and inalienable part of India. Indian leaders visit Arunachal Pradesh from time to time, as they visit other parts of India. This consistent position has been conveyed to Chinese side on several occasions". However, this is a more reactive/defensive position from India's side rather than actually countering propaganda.

While it seems that such moves occur from time to time, one needs to think what would be impact of this and other examples around the world when people of nations are constantly exposed to propaganda of one nature of the other.

The way ahead

The Indian government has finally started to give attention to Information Warfare and has taken several steps to prevent circulation of false information internally by ways like cyber laws and regulations, fact checking organisations, public campaigns and rapid response units that decrease the chances of civil unrest hence ensuring integrity and national security of country.

The Indian government and its external affairs ministry have become quite active as could be observed from several examples like the Indian external ministry debunking false claims about territorial incursions and providing information to ensure transparency during the Galwan clashes. Another example of the Indian Government conveying to all that Jammu and Kashmir was very much part of the country, recently India held the G–20 summit in Jammu and Kashmir which was attended by 60 foreign delegates, making it crystal clear that "Kashmir is and will always be an inalienable and integral part of India". The Indian government with its intelligence agencies should also respond more aggressively against anti–India movements by using tactics of Information Warfare like conducting specific cyber–attacks and influencing operations abroad. Lastly, it wouldn't be wrong to say that information is like a hidden force, invisible yet mighty, capable of shaping minds, molding perceptions and ultimately destroying nations.

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(Photo: ANI)

Indian Army's impending Mechanised Revolution

The Indian Military is at the cusp of a revolution. In the 2020s, the Indian Military is undertaking its biggest transformation yet. It is revamping everything from recruitment schemes and fighting formations at the highest level to practically all old hardware. Such a period was seen almost half a century ago as well, when the modernisation of the 1980s was undertaken by the likes of General Krishnaswamy Sundarji. Not only did all service arms get new hardware, they also spent that tumultuous decade integrating them into their operational plans and developing operating procedures with them. That process transformed the Indian Army as we know it today.

First Revolution

The Indian Army's first mechanised revolution came in the aftermath of 1965 Indo–Pakistan war. A need to mechanise our infantry arose, and to mitigate it the first APCs for the Indian Army, the OT62 TOPAS and OT64 were ordered in 1967 and 1969 respectively. OT62s came in 1969 and by 1970, 10 battalions were equipped with the type. By 1971, the deliveries of about 300 ordered OT64s started coming in. They would go on to participate in the 1971 war, with OT64s present in the battle and subsequent liberation of Jessore. Seeing the impressive performance of OT62/64s in the 1971 war, the Army finally decided to double down and ordered about about 800 BTR 60PBs starting from 1975 and later BMP–1s.

This was followed by the first revolution in manoeuvre warfare. The importance of armoured and mechanised units was pushed by General KV Krishna Rao, and later perfected by General K Sundarji who developed the ideas of RAPIDs and RAMIDs and emphasised the importance of mechanisation and mechanised infantry within the army's broader strategic goals.

Second Revolution

The second mechanised revolution in the Indian Army happened when the Army finally raised Mechanised Infantry as a separate regiment on 2 April 1979, and the regiment was equipped with new APCs which were

(Photo: outlookindia.com)

recently acquired from USSR (1977–78), BMP–1. Before the raising, 10 Battalions across the regiments were equipped with APCs separately, merging them all together with the raising of a new regiment.

Where this revolution faltered was with the subsequent disinterest of the Indian Army with the idea of wheeled APC, which are generally faster but less armoured than their tracked counterpart. In line with that general disinterest, Army kept BRDMs for forward recce units, equipped with ATGMs, and mainstay of Indian Army's Mechanised forces ended up on initially the BMP–1s and then later in BMP–2s at the turn of the century.

This general disinterest wasn't unwarranted either. The subsequent conflicts that the Army faced were in mountainous regions, or away from flat fields of Rajasthan, where a combined arms push with armour and mechanised infantry against Pakistan would have taken place.

The 80s and later ops like Sumdorong Chu standoff, Kargil, Operation Falcon, Operation Chequerboard all saw deployments in mountainous regions with very little to no infrastructure, and Army traced back to its primarily infantry routes in the mountains. The lessons of mechanised warfare weren't lost, but warfare in sectors like Rajasthan, Punjab or Kutch region without sufficient roads and infrastructure are more within the realm of tracked vehicles rather than wheeled ones.

Where the lessons for mechanised infantry weren't overtly seen was the deployment in Sri Lanka. IPKF had mechanised infantry and armour as well, but utility was limited, due to the terrain and nature of operations. So the weight of Mechanised Infantry was carried by the Army's trusted steed, the BMP–2s, for the major part of the last three decades. Having been developed and used in the form of 10 different variants, Army has really doubled down on BMP–2s.

While the Indian Army was fighting with infantry and artillery in the mountains of Kargil, which is probably the best way to fight in the mountains since India's neighbour towards the north had started a revolution of its own.

Modernisation models

There are two major stories to look at when we want to talk about modernisation and conflict with respect to mechanisation in the region.

The Russian army's mechanisation of its army in the form of BTG or Battalion Tactical Groups and PLA's mechanisation in form of the Hi–Mobility Combined Arms Battalion Concept. One of them is going through a baptism of fire of its own as the BTG concept being applied in the Ukraine war will be the first of the concepts to be tested in war. Both the Chinese CAB and India's IBGs can draw big immediate lessons.

The mechanisation of the Russian army took place through the formation of mechanised units, or Battalion Tactical Group. These units were designed to provide mobile firepower and armoured protection to infantry units, and were equipped with a mix of tanks, infantry fighting vehicles, and armoured personnel carriers. Hi–mobility was a key focus with self–sufficient firepower, a trend replicated by the PLAGF's CAB. A lot has been written on BTGs as a concept but this article would like to focus more on PLAGF's CAB concept as they carry more real word implications vis–a–vis an Indian context.

PLAGF started its mechanisation revolution in 2009, converting one of its mechanised infantry divisions into a new 'digitised' unit including heavy tracked armoured units complemented by the medium high mobility wheeled units. In their quest to mechanise the light infantry to ensure high mobility in those units to carry rapid response in a future battlefield, a newer standard light armoured wheeled vehicle in form of CSK 131 was developed (Dongfeng basing it on its Mengshi 4x4 vehicle, which itself was a Chinese copy of humvee exported in the 80s) and adopted. By 2012, first PLA units had started adopting the vehicle and after the 2017 reorganisation of PLAGF, CSK 131 and its subsequent variants like CSK 141 etc had become the backbone of the hi–mobility combined arms concept of PLA, providing much needed capabilities to the infantry to catch up with the mobile formations without compromising much on the firepower. The reorganisation of 2017 completely did away with all infantry and armour brigades, having reorganised into permanent combined armed brigades.

One of the jolts that the Indian Army received in the 2020 Ladakh border Crisis was the quick infrastructure development by the PLA and then deployment of light armoured wheeled vehicles, like CSK 131s on the said infrastructure in the forward areas. The Indian Army had till now discounted the deployment of armoured vehicles in those sectors as it was viewed to be unsupporting of such deployments, at least from the Indian side.

In high altitude areas, wheeled armoured vehicles have several advantages over tracked vehicles. One of the main advantages is their ability to traverse rough terrain more easily. The wheels of a wheeled armoured vehicle are able to adapt to uneven terrain and maintain traction, while the tracks of a tracked vehicle can become bogged down

(Photo: Wikipedia)

(Photo: Alexei Alexandrov/AP)

or damaged in rough terrain. This makes wheeled armoured vehicles more mobile and reliable in high altitude areas, where the terrain may be rocky or uneven. Additionally, wheeled armoured vehicles are generally lighter and more fuel efficient than tracked vehicles, which can be an important consideration in high altitude areas where the air is thinner and fuel may be scarce. Finally, wheeled armoured vehicles are often easier to maintain than tracked vehicles, as they have fewer moving parts and require less frequent maintenance. This can be a significant advantage in high altitude areas where access to maintenance facilities may be limited.

The impending revolution

This brings us to the Indian response, which has been commendable both in terms of infrastructure development and finally ordering a whole plethora of wheeled armoured vehicles to rapid deployment in the region. The Army isn't just looking for purpose built high altitude vehicles, but rather is looking to procure them across multiple classes and for multiple purposes.

These requirements of wheeled APCs are the biggest in the Indian Army's history. With the Indian Army also looking at the combined arms concept by forming more mobile and agile Integrated Battle Groups, the exact structure of these IBGs is still unknown but hopefully places a greater emphasis on the same concepts as any modern combined arms concept would.

The number of vehicles being ordered range in thousands, with about 1300 LSV from Mahindra, 60 KSSL M4 (the order is likely to increase in the future), WhAPs being finally ordered and promptly deployed in the region, 200 ATGM equipped WhAP variants, 700 PMV for standard operations, and 500 PMV for High Altitude Operations, 800 LAMVs, 375 LBPV, 91 hi-mobility reconnaissance vehicles (again order possibly going to increase in future) being looked on and RFIs for them released till early 2022. These are just prompt orders/RFIs, the Army is still working towards a long drawn battle of procuring ~1700 FICVs, ~1700 FRCVs, ~300 Light tanks for high altitudes, new generation Battle Tanks etc. What the Indian Army would lack after this would still be a standard LAMV like the CSK131.

Challenges

One of the primary challenges posed by the impending procurement of a large inventory of vehicles is the acquisition, maintenance and training required for such a sudden influx of vehicles with varying levels of complexity. This could present initial teething problems as the Army adjusts to managing and operating a diverse fleet.

(Photo: Sansad TV Youtube)

Another factor to consider is the limited use cases for these vehicles. While they would undoubtedly enhance mobilisation and mission capabilities, especially in the Western Theatre, the overall theatre strategy and the extent to which these vehicles will be utilised in the region will depend on the Army's broader strategic approach, which has traditionally been more infantry–centric. The western strategy is what led to the current inventory with current strategies. This challenge becomes even more pronounced in the context of the border situation with China. The unique topography of many areas, and infrastructure on the Indian side along the China–India border is not conducive to mechanised warfare, even if purpose–built vehicles are employed. Only a few specific regions, such as Ladakh and northern Sikkim, where mechanised warfare is possible, may see a notable impact from this mechanisation effort in relation to China.

Conclusion

In conclusion, the impending procurement of armoured vehicles by the Indian Army is a significant step in the modernisation and strengthening of the military's capabilities. The mechanisation, if and when completed, would bring the army more mobility and would help in further modernisation.

The procurement of new tracked and wheeled armoured personnel carriers, as well as the upgrade of existing vehicles, will enhance the mobility and firepower of the Indian Army, enabling it to better respond to a range of challenges, including those posed by China. In the coming years, it will be important to carefully monitor the progress of this procurement and ensure their utility in the Indian Army's IBG concept. By doing so, the Indian Army can maximise the benefits of this procurement and continue to evolve and adapt to meet the changing demands of modern warfare in the 21st century.

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Dr. Kandarpa Kumar Sarma's analysis on

Russian EW systems in Ukraine

1L269 Krasukha 2 (Source: MoD Russia)

One clear indication that is emanating from the Ukraine war is the preeminent position that electronic warfare systems (EW) are attaining while other arms of warfare are facing fluctuating fortunes. When the war started, drones, aircraft, artillery, and similar electromagnetic (EM) signal dependent systems, including those requiring global positioning system (GPS) inputs, demonstrated individual prowess and precision to the extent that disruptive technologies and asymmetric warfare tactics appeared to gain the upper hand. But EW systems started to change the scenario and attain pivotal positions.

Electronic warfare is a complementary component of traditional combat arms designed and deployed to deny and degrade the opponent's advantage in the radio frequency (RF) spectrum and disturb all means of communication. EW systems are applied to detect, disrupt, and deceive the RF systems of the opponent and deny the capability to use tactical radios, radar, positioning and navigation signals, weapons systems, and various detectors to coordinate precision operations and find the enemy. These have become vital and play decisive roles in ensuring all round dominance. The EW spectrum is constituted by electronic attack, electronic countermeasures, and electronic support.

In an electronic attack, the transmitter overwhelms the waveform and signals of an enemy radar or radio, preventing them from functioning properly. This is also known as "jamming" or "signal deception." Deception can spread false messages and traps, while jamming guarantees that crucial signals and messages cannot pass through. Techniques used to safeguard the integrity of signals and keep them from being intercepted or jammed in the first place are referred to as electronic protection and countermeasures. Typically done by passive listening of radio frequency electromagnetic radiations, electronic support is used to comprehend and

R–934B Borisoglebsk–2 (Source: Defence Express)

Krasukha–4 complex (Photo: theaviationist.com)

reveal weaknesses in the enemy's radar and communications equipment.

From the beginning, Russia deployed EW systems to deny and disrupt the capability of the Ukrainian forces to maintain communication between units and command centres. Within the first few weeks of the attack around Kiev, Ukrainian forces seized a Krasukha–4 system, which is a critical element of Russia's EW repository. The Krasukha–4 is used to jam higher–frequency X–and Ku–band airborne or satellite–based fire control radars and works along with the Krasukha–2, which is generally used to target lower–frequency S–band search radars. Later, the Russian EW assets started to target the drones, and neutralised the threat of armed unmanned combat vehicles (UAV) considerably. Russian forces deployed a range of EW systems at intervals of 10 kilometres in the areas under their dominance. Further, the Russian EW

Murmansk–BN Electronic Warfare System (Photo: armyrecognition.com)

Table 1: Russian EW systems available for deployment in Ukraine

Name	Introduced first in	Frequency bands	Purpose and arrangement
1RL257 Krasukha–4	2014	X–band and K u–bands	Used for jamming of radars onboard airborne platforms including those carried by drones, missiles and satellites; Consists of one a command post and the other outfitted with sensors deployed on two KamAZ–6350 trucks;
1L269 Krasukha–2	2011	S–band	Airborne platforms are targeted; Hosted on two KamAZ–6350 trucks
RB–341V Leer–3	2015	VHF and UHF	Attacks wireless communication networks and military radios, range hundreds of kilometers; Truck–based command; works with Orlan–10 drones for range extension
RH–330Zh Zhitel	2011	GPS and satellite communication channels	GPS and satellite communications over a radius of tens of kilometers; A command post on truck and a pack of quadruple telescopic–mast phased–array antennas
Murmansk–BN	2020	HF band	Long–range identification and jamming of radios over hundreds of kilometers
R–934B Borisoglebsk–2	1996	VHF/UHF	Disrupts wired and wireless communication networks; Unit has a towed 16–kilowatt generator and either a truck or a tracked vehicle; MT–LBu ground vehicle mounted, multi–functional electronic warfare (EW) weapon system
SPN–2, 3, 4	(not available)	X– or K u–band guidance–control radars	Targets airborne platforms including missiles; Unit formed by a combat–control vehicle and an antenna vehicle
Repellent–1	2016	All of drone frequencies	Targets drones; Bulky system with over 20 tons of weight
Moéskva–1	2015	HF/ VHF	Performs passive coherent location of hostile ships and aircrafts; range upto 400 km
Palantin	2019	Below VHF	Jamming radio communication and electronic intelligence systems in a 1,000 km wide area; Palantin can also be used to create a system–of –systems by combining various EW and electronic reconnaissance systems into a single coordinated network to enhance efficiency; cellular communication jamming; discrete radio frequency object targeting, bandwidth and frequency–specific jamming

Repellent-1 (Photo: Maksim Panasovskyi)

proved to be effective and has contributed to the shooting down of 10,000 Ukrainian drones every month, or around 333 drones per day, according to a report by the United Kingdom's Royal United Services Institute (RUSI).

The Ukrainian air effort has also faced the hammer of the Russian EW deployments, with pilots noting failure of communication links in air–to–air and air–to–ground modes, navigation and guidance equipment becoming useless under heavy jamming. It has also affected precision artillery strikes requiring GPS signal receivers, which have been rendered ineffective due to the Russian EW systems. A partial list of Russian EW systems available for deployment in Ukraine is shown in Table 1.

Among a range of Russian EW systems, the Palantin is considered to be the most advanced. It is used for jamming cellular communication, discrete radio frequency object targeting, bandwidth and frequency–specific jamming, radio communication, and electronic intelligence systems in a 1,000 km2 area. The Palantin can also be used to create a system of systems by combining various EW and electronic reconnaissance systems into a single coordinated network to enhance efficiency. During the 2nd week of February 2023, Ukraine claimed to have destroyed a Palantin EW system using precision artillery fire without providing specific details or location.

Contrary to this, the Ukrainian forces deployed a range of systems of Soviet origin and a few others developed indigenously. Ukraine's EW effort has been primarily to contain the Russian drone and UAV threat. To oppose Russia's Orlan–10 UAV, Ukraine has created the Bukovel–AD anti–UAV system. It has an effective range of up to 50 km and can detect UAVs at 100 km. Its defences can interfere with communication between the UAV and its ground control station (GCS) and disrupt control and navigation signals sent by GPS and GLONASS.

Another important Ukrainian system is called Nota. The Nota EW system is a crucial set–up that offers perimeter defence, RF signal detection and jamming (including GSM, VHF, LTE, and CDMA), RF signal detection (radar emissions in the L, S, C, and X frequency bands), and satellite navigation system tracking (GPS, GLONASS, and BeiDou). The Mandat–B1E R–330UM has been used by the Ukrainian armed forces to cancel out ground communication channels using HF and UHF frequency hopping at rates of about 1000 hops per second, regardless of the modulation type. In addition to enabling barrage jamming, knowing a frequency's range allows for more targeted forms of frequency and time–based interference. The Anklav is another crucial Ukrainian system, and it has been shown to successfully jam the control and telemetry channels of precision–guided bombs and UAVs operating between 400 and 2,500 MHz, with a range of up to 40 kilometres when using directional antennas and up to 20 kilometres when using omnidirectional antennas.

Another important system the Ukrainian forces are using is the Khortytsia–M. It is a mobile radio reconnaissance complex intended to search for, intercept, acquire, and analyse radio signals in real time, including pseudo–random controlled frequency–hopping, in order to pinpoint the position of the RF sources using the frequency range of 25 to 6000 MHz.

Bukovel-AD anti-UAV electronic warfare system (Photo: ukrspecexport.com)

Nota EW system (Photo: Wikimedia)

Additionally, the complex may search for, intercept, acquire, and analyse radio signals. The complex has the ability to function either alone or in conjunction with other radio reconnaissance facilities, allowing it to control any mode of operation. Since 2018, the Khortytsia–M has been distributed to various units of the Ukrainian Armed Forces and is useful for decentralised deployments.

Russia has used EW technologies in recent years in combat in Syria and the Donbas region of eastern Ukraine. Russia has been successful in negating the threat posed by the Ukrainian drones. As a counter to it, Ukraine is desperate to deploy EW–resistant and laser–based drones. There are reports of the use of software defined radio (SRD) systems as well, which have much better EW–resistance capability. Ukraine is also exploring laser–aided drone/UAV control, which, though resistant to

Moéskva-1 (Photo: Oleg Belov/Alamy)

Anklav ("Enclave") Radio location system (Photo: ukrspecexport.com)

electronic jamming, will be constrained by environmental factors.

With all the strategic capability at its disposal, Russian strategy has favoured extensive employment of EW resources to deny and deprive itself of the advantages offered by wireless and wired communication systems. Despite early setbacks due to heavy resistance offered by the Ukrainian forces, Russia has made its EW coverage near complete to make it a sword and a shield to gain the upper hand in the conflict. During the initial stages, Russian advance didn't accord the importance to EW resources at tactical level, for which Ukrainian counter offensives adopting drone and UAV aided innovation succeeded. Later, Russian road bound extended moving/stationary military columns started to adopt EW as an essential element of warfighting. Further, operational level preparation and deployment strategy started to give

Khortytsia-M system (Photo: ukrspecexport.com)

RB341V Leer with Orlan 10 (Source: Vitaly V. Kuzmin)

EW a prominent position with planning, coordination, and training oriented towards achieving the outlined military objectives. This helped to nullify the threat of RF aided systems, including the much hyped Turkish TB–2 drones, of which about 100 have reportedly been shot down.

For Ukraine, the use of electronic countermeasures and perimeter defence have been key challenges. Further, masking, protecting, and constraining RF imprints including radio and cellular communications and electronic signals emitted by combat vehicles and systems, have been critical issues. The immediate response has been to adopt a highly decentralised approach without much command control or other remote or telemetry support for intelligence gathering and targeting. As a result, artillery assaults have lost precision and impact and are contributing to the quick exhaustion of stocks. The US and NATO efforts to help Ukrainian forces will expand the EW scenario and expose the Russian electromagnetic signatures of RF linked equipment and employment tactics.

Appreciating the key lessons from the Russia–Ukraine conflict, the Indian Army recently conducted the Sudarshan Shakti Exercise 2023 during the last week of May 2023 and validated concepts by integrating EW resources as part of large and tactical level formations. The key takeaways have been to accept EW as an integral element of warfighting so as to design, develop, and deploy techniques and tactics to disrupt the enemy's capability to communicate and launch a coordinated counterattack. Similarly suppression/destruction of enemy air defences (S/DEAD) will require support of EW capability. Future wars will tilt more towards the integration of EW resources at the tactical and operational levels and cyber–attack capability integration at the strategic level, with close coordination and synchronisation between the two domains.

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(All images for representational purposes only)

Palantin (Source: Militarnyi/open source)

The 50 million dollar 'toilet buster'

Puranjay Chawla recalls a story by Vladimir Konduarov* on the first missile test of the Kh–29

Outdoor toilet in Huliaipol. (Representative image)

The Russian invasion of Ukraine has engulfed the cover pages of newspapers and headlines on our TV screens for more than a year. Amongst the flurry of news hitting us every day like a never ending tornado, once in a blue moon, even war presents stories that are often hard to believe, for the lack of a better word, 'Je ne sas quoi' in their nature.

A snippet of news, which allowed us to have a laugh, that too rather ironically, came in the form of a Russian air to surface missile Kh–29, hitting outdoor toilets within the interiors of the Ukrainian countryside. Many of us might have disregarded this piece of news owing to its pantomime nature, although, venturing into the lost records of time, often discarded into the bin of history allows us to understand why this news should not be thrown away as just another form of propaganda.

The story of this missile starts with a small lesson on the Russian language focusing on a particular word, spelled in all its glory as 'Smakalka'. The Russian military is rather synonymous with the use of this word and is often hailed by the populous as being a rather ingenious way of solving problems. Squalid in expression as the English language often is, the only word familiar to us Indians which does justice in describing the meaning of Smakalka is 'Jugad'. The romanticisation of Smakalka in the culture of the Russian military has solved problems, but more often than not, created new ones.

In the septuagint Russia, the Kremlin held at gunpoint, many missile designers and engineers and made them slog in the bleak offices of the era to create modern within visual range, and beyond visual range missiles in order to gain an edge in the ongoing fisticuff with the hellion West. The result of one such development programme by Matus Bisnovat and Geaorgiy Khoklov resulted in the nascency of the Kh–29, a within visual range, air to surface missile which used state of the art television seeking technology in order to identify and lock onto a target.

The Kh–29. (Source: Vijainder K Thakur/The Eurasian Times)

The vicenarian designers were extremely proud of their invention like a father is of a successful son, but soon their son would deceit its way onto glory.

Hearing the news of the kindling of a state of the art missile, the Soviet high command wished to witness their paragon in action. A holidaying test pilot, Vladimir Kondaurov received a message from his commanding officer to report immediately. The young pilot's dream of partying on the beach was wiped away the very instant. After a day long journey, Vladimir reported to his usual office, an airfield in the erstwhile Soviet Republic of Kazakhstan. Unlike his usual days at the base, he witnessed an upsurge unparalleled. For a brief moment he thought the Westerners have waged war owing to the chaos on the base, not knowing that something worse was awaiting the young officer– a visit by the Commander in Chief of the Soviet Air Force.

A visibly distressed commanding officer approached the astray officer and demanded for him to report to his office immediately. Cravenly as one is in front of their boss, Vladimir was informed that he would be the first pilot in the world to test the new state of the art Kh–29 missile. His disdain slowly transformed into a light smirk, "but there is a small issue" exclaimed his commanding officer just as the young lad saw a glimpse of delight. "The missile wants to lock onto random objects just before it hits the target, sometimes a tree, a random road, even a deer!" stated the commanding officer in a rather confused tone, but with a sign of fear. "I want you to check what the issue is, immediately." With his orders in place, the unassuming man walked into the changing room to put on his G–suit and grab his helmet. His dressing now in order, Vladimir walked onto the tarmac and climbed into his MiG–23, the USSR's primary ground attack aircraft of the time. He carried out his usual checks and then went ahead for the take–off.

"The bright and sunny day offered amazing views of the countryside", the young man thought to himself just as his target, a decommissioned army truck was spotted through his naked eyes. As he tried to lock onto the target, he would soon find out that despite his best efforts, the seeker of the missile would refuse to put its crosshairs onto the truck and would instead lock onto a muddy road on the way, or worse, an innocent deer.

Upon landing, he explained the same issue to his commanding officer, only this time he posed a solution alongside. For the demonstration the very next day, their target–an aircraft hangar now used as storage for harvest by village folk during the winters would have to be repainted by night. Painting hangars was not an unusual practice, it is often done in a camouflage pattern to fool primitive seeker systems, just that this time around the hangar was to be painted a bright yellow!

During his flight, Vladimir observed that the seeker always locked onto a bright object on the yellow spectrum of colour. His idea was rather straightforward, paint the hangar the brightest yellow the human eye has ever seen. His commanding officer, overcome with a feeling of trepidation decided to go ahead with the idea, and the hangar was soon painted a bright yellow. Vladimir got a pat on his back owing to his 'Smakalka' solution.

The very next day, as helicopters carrying the top brass of the Soviet airforce landed at the airbase, Vladimir was instructed to be ready in his aircraft with the engines switched on, since one of the air marshals had to leave early to attend his daughters 'sweet sixteen.' Upon receiving a command from his superior, Vladimir took off. The sound of the whirring engines of the MiG–23 engulfed the airfield as the aircraft headed towards its objective. As his mind subconsciously prayed to the Gods above, Vladimir thought to himself whether his prayers would even reach fruition as the God was banned in Communist Russia!

The target appeared at the corner of his eye, he carefully moved his hand over to the guidance systems, and alas! At last, the seeker had locked onto the brightest building in the monochromatic forest. With great caution and a garnish of fear, Vladimir launched the missile which only managed to hit the muddy road in front of the hangar, since the seeker thought it to be more colourful than the target itself.

Two years later, the Indian Air Force purchased the Kh–29 and it continues to be in service as a part of the nonpariel Su–30MKI's weapons package. We hope it does not hit toilets any time soon!

By Puranjay Chawla

(*Kondaurov, Vladimir. "Chapter 2, My Experiences in the Airforce." The Life Long Runway, Roscow, Moscow, 1994, pp. 114–210)

Mikoyan Gurevich MiG–23 (Representative image)

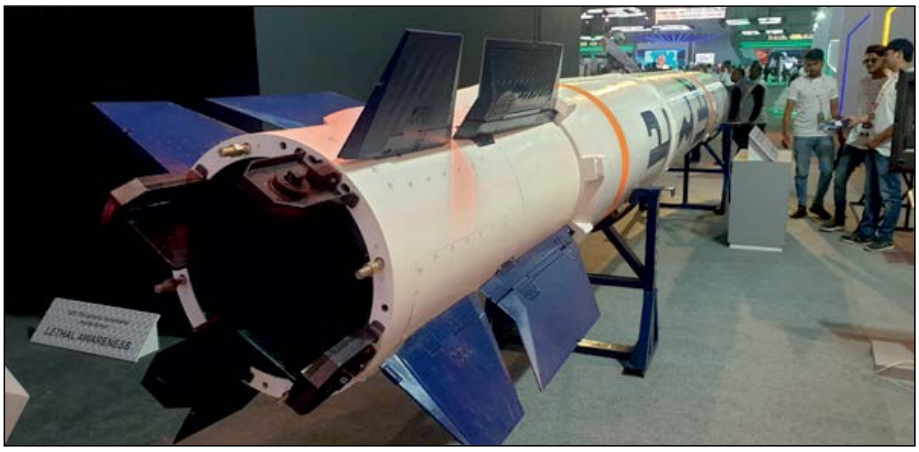
Pralay SRBM : The Conventional Spear

Pralay (Apocalypse), sanctioned in March 2015, is a canisterised, tactical Short Range Ballistic Missile (SRBM) for battlefield use developed by the Defence Research & Development Organisation (DRDO). The missile is an amalgamation of technologies developed for exoatmospheric interceptor missile Prithvi Defence Vehicle (PDV) and Prahaar tactical missile. Research Centre Imarat (RCI) is the lead integrator in this project. Powered by two–stage solid fuel rocket motor, the Inertial Navigation System (INS) guided missile follows quasi ballistic trajectory and able to perform mid air manoeuvres using Manoeuvrable Reentry Vehicle (MaRV) to defeat Anti Ballistic Missile (ABM) interceptors.

Pralay SRBM uses the same composite propellant developed by High Energy Materials Research Laboratory (HEMRL) for submarine launched Sagarika/'K' missile family. The composite solid propellant is highly efficient and generates more energy compared to propellant used in Agni missile series. Road mobile (on 8 x 8 BEML–Tatra Transporter Erector Launcher) Pralay SRBM carries 350–kg to 700–kg High Explosive (HE) preformed fragmentation warhead, Penetration Cum Blast (PCB) and Runway Denial Penetration Submunitions (RDPS) at a range of 150 km to 500 km. Pralay SRBM is designed to target radar and communication installations, Command & Control nodes and airfields using conventional warhead. The missile weighs 5 tonnes and sports a maximum speed of Mach 1.6 at terminal phase and promises high accuracy with a Circular Error Probable (CEP) of less than 10 metres.

On 25 December 2022, Ministry of Defence (MoD) cleared the order for 120 missiles to be operated by Indian Air Force (IAF). This was followed by another order of two more units of 250 Pralay SRBM to be operated by Indian Army (IA) in April 2023. The project would provide a significant boost to the armed forces' efforts to develop a strategic rocket force, as advocated by late Chief of Defence Staff, General Bipin Rawat. Pralay SRBM, along with the BrahMos supersonic cruise missile as well as the Smerch and indigenous Pinaka Multi Barrel Rocket Launchers (MBRL), plus a few other systems under development, will form the crux of India's planned Rocket Force.

Sayan Majumdar



Airline profitability outlook strengthens

On 5 June 2023, the International Air Transport Association (IATA) announced an expected strengthening of airline industry profitability in an upgrade of its outlook for 2023. Highlights include:

- Airline industry net profits are expected to reach $9.8 billion in 2023 (1.2% net profit margin) which is more than double the previous forecast of $4.7 billion (December 2022).
- Airline industry operating profits are expected to reach $22.4 billion in 2023, much improved over the December forecast of a $3.2 billion operating profit. It is also more than double the $10.1 billion operating profit estimated for 2022.
- Some 4.35 billion people are expected to travel in 2023, which is closing in on the 4.54 billion who flew in 2019.
- Cargo volumes are expected to be 57.8 million tonnes, which has slipped below the 61.5 million tonnes carried in 2019 with a sharp slowing of international trade volumes.
- Total revenues are expected to grow 9.7% year over year to $803 billion. This is the first time that industry revenues will top the $800 billion mark since 2019 ($838 billion). Expense growth is expected to be contained to an 8.1% annual increase.

"Airline financial performance in 2023 is beating expectations. Stronger profitability is supported by several positive developments. China lifted COVID–19 restrictions earlier in the year than anticipated. Cargo revenues remain above pre–pandemic levels even though volumes have not. And, on the cost side, there is some relief. Jet fuel prices, although still high, have moderated over the first half of the year," stated Willie Walsh, IATA's Director General.

The return to net profitability, even with a 1.2% net profit margin, is a major achievement. First, it was achieved at a time of significant economic uncertainties. Second, it follows the deepest losses in aviation's history ($183.3 billion of net losses for 2020–2022 (inclusive) for an average net profit margin of –11.3% over that period). It should be noted that the airline industry entered the COVID–19 crisis at the end of a historic profit streak that saw an average net profit margin of 4.2% for the 2015–2019 period.

"Economic uncertainties have not dampened the desire to travel, even as ticket prices absorbed elevated fuel costs. After deep COVID–19 losses, even a net profit margin of 1.2% is something to celebrate! But with airlines just making $2.25 per passenger on average, repairing damaged balance sheets and providing investors with sustainable returns on their capital will continue to be a challenge for many airlines," further stated Walsh.

Outlook Drivers

Revenues are rising (9.7%) faster than expenses (8.1%), strengthening profitability.

Industry revenues are expected to reach $803 billion in 2023 (+9.7% on 2022 and –4.1% on 2019). An inventory of 34.4 million flights is expected to be available in 2023 (+24.4% on 2022, –11.5% on 2019).

Passenger revenues are expected to reach $546 billion (+27% on 2022, –10% on 2019). With COVID–19 restrictions now removed in all major markets, the industry is expected to reach 87.8% of 2019 levels of revenue passenger kilometers (RPKs) for the year with strengthening passenger traffic as the year progresses. The high demand for travel in many markets is keeping yields strong with a modest 1.1% decline expected in 2023 compared to 2022 levels (following increases of 9.8% in 2022 and 3.7% in 2021).

Efficiency levels are high with an expected average passenger load factor of 80.9% for 2023. That is very near the 2019 record performance of 82.6%.

IATA's May 2023 passenger polling data supports an optimistic outlook, with 41% of travellers indicating they expect to travel more in the next 12 months than in the previous year and 49% expect to undertake the same level of travel. Moreover, 77% of respondents indicated that they were already traveling as much or more than they did pre–pandemic.

Cargo revenues are expected to be $142.3 billion. While that is down sharply from $210 billion in 2021 and $207 billion in 2022, it is well above the $100 billion earned in 2019. Yields will be negatively impacted by two factors: (1) the ramping–up of passenger capacity which automatically increases available belly capacity for cargo and (2) the potential negative effects on international trade of economic cooling measures introduced to fight inflation. Yields are expected to correct with a 28.6% decline this year, but still remain high by all historical comparisons. Note that yield increases of 54.7% were recorded in 2020, 25.9% in 2021 and 7.4% in 2022.

Expenses are expected to grow to $781 billion (+8.1% on 2022 and –1.8% on 2019). Jet fuel costs are expected to average $98.5/barrel in 2023 for a total fuel bill of $215 billion. That is cheaper than the $111.9/barrel previously expected (December 2022) and the average cost of $135.6 experienced in 2022.

High crude oil prices were exaggerated for airlines as the crack spread (premium paid to refine crude oil into jet fuel) averaged more than 34% for 2022—significantly above the long–run average. As a result, fuel was responsible for almost 30% of total expenses. In recent months, the crack spread has narrowed, and the full year average crack spread is expected to fall to around 23%, which is more closely aligned with the historical average rate. Fuel costs will account for 28% of the average cost structure, which is still above the 24% of 2019.

Non–Fuel expenses have been controlled well by airlines despite inflationary pressures. With fixed costs being distributed over a larger scale of activity, non–fuel unit costs per available tonne kilometre (ATK) are expected to fall to 39 cents per ATK. That is –6.4% compared to 2022 (41.7 cents/ATK) and marks a return to about pre–COVID levels. Total non–fuel costs are expected to reach $565 billion in 2023.

Risks

The economic and geopolitical environment presents several risks to the outlook. With just $22.4 billion of operating profit (2.8%) standing between $803 billion of revenues and $781 billion in expenses, industry profitability is fragile and could be affected (positively or negatively) by a number of factors. In particular, consideration should be given to:

- Inflation fighting measures are maturing at different rates in different markets. Central banks are calibrating the best levels for interest rates to have a maximum cooling effect on inflation while avoiding tipping economies into recession. An early or lower end to rate rises could stimulate markets for a stronger year–end outlook. Equally, the risk of recession remains. Should recession lead to job losses, the industry's outlook could shift negatively.
- War in Ukraine is not having a major impact on profitability for most airlines. A currently unanticipated peace could carry the potential for cost improvements with lower oil prices and efficiencies from the removal or easing of airspace restrictions. An escalation, however, would likely have negative prospects for global aviation. Already broader geopolitical tensions are weighing upon international trade and any escalation of such tensions represents a downside risk to the industry outlook.
- Supply chain issues continue to impact global trade and business. Supply chains are shifting to fill gaps in resilience caused by current geopolitical tensions and the challenges experienced during COVID–19. Airlines have been directly impacted by aircraft parts supply chain ruptures which aircraft and engine manufacturers have failed to sort out. This is negatively impacting the delivery of new aircraft and the ability of airlines to maintain and deploy existing fleets.
- Regulatory cost burdens are at risk of increase from increasingly interventionist regulators. In particular, the industry could face rising costs of compliance for increasingly punitive passenger rights regimes and regional environment initiatives.

2022

The improvement in industry financial performance in 2022 outpaced previous expectations. Net industry losses for 2022 are now estimated to be –$3.6 billion, a strengthening from the previously estimated $6.9 billion loss (December 2022). At the operating level, and notwithstanding the wide variation in performance, the latest data point to the industry having returned to profit in 2022 on a pre–tax basis.

Bottom Line

"Resilience is the story of the day and there are many good reasons for optimism. Achieving profitability at an industry level after the depths of the COVID–19 crisis opens up much potential for airlines to reward investors, fund sustainability, and invest in efficiencies to connect the world even more effectively. That's a big 'to do' list to achieve with just a 1.2% net profit margin. That's why we call on governments to keep their focus on initiatives that will strengthen safe, sustainable, efficient, and profitable connectivity. Priorities for 2023 include SAF production incentives to accelerate progress toward net zero carbon emissions, ensuring the integrity of CORSIA as the economic measure applied to international aviation, eliminating inefficiencies in air traffic management and applying global standards consistently," stated Walsh.

Courtesy: IATA
(Photos: VAYU)

Bundeswehr orders fifty Puma IFVs

Germany's two top military vehicle makers, Krauss–Maffei Wegmann (KMW) and Rheinmetall, have been awarded an order to build a further fifty Puma infantry fighting vehicles. Including value added tax, the total value of the order comes to €1.087 billion. Of this amount, €574 million will go to KMW and €501 million to Rheinmetall Land systeme GmbH, both of which are serving as subcontractors in the project.

Ryanair for 300 737 MAX

Boeing and Ryanair announced Europe's leading low cost airline has selected the largest 737 MAX model to power its future growth with an order for up to 300 airplanes. The purchase agreement is the biggest in Ryanair's history and includes a firm order for 150 737–10 jets and options for 150 more.

Ryanair for 150 CFM LEAP–1B powered 737–10

Ryanair and CFM International have signed a Letter of Agreement (LoA) for the purchase of LEAP1B engines to power 150 Boeing 737–10 aircraft. The LoA also includes spare engines and options for 150 additional aircraft. Ryanair has been a CFM customer since 1998, operating the largest fleet of CFM–powered Boeing airplanes and the largest CFM56–7B powered Boeing Next Generation 737 fleet in Europe. The Irish–based airline currently operates a fleet of 103 LEAP–1B powered 737–8–200 aircraft.

PAL selects A 350–1000

Philippine Airlines (PAL) has signed a Memorandum of Understanding (MoU) with Airbus for the purchase of nine A350–1000s. The new aircraft will join two A350–900s already in service at the airline and currently flying to destinations in North America, Asia and Australia.

Slovakia to buy 192 JLTVs

Slovakia has requested to buy one hundred ninety–two (192) M1278A1/A2 Heavy Gun Carriers Joint Light Tactical Vehicles (JLTVs) as well as M153 Common Remote Weapons Stations (CROWS) with Display and Control Panels (DCP) etc.

Poland for 34 Sniper pods

Poland has requested to buy thirty–four (34) AN/AAQ–33 Sniper Advanced Targeting Pods (ATP) with Shipping Containers. Also included are system support and support equipment; spare parts, consumables, etc.

NGC's AARGM–ER completes 5th test

Northrop Grumman announced the fifth consecutive successful flight test of the US Navy's AGM–88G Advanced Anti–Radiation Guided Missile Extended Range (AARGM–ER). The missile successfully detected, identified, located and engaged an advanced, land–based, emitter target.

Archer rolls out 1st Midnight

Archer Aviation Inc, a leader in electric vertical takeoff and landing (eVTOL) aircraft, announced it had now completed the final assembly of its first Midnight aircraft. With final assembly and initial testing complete, the aircraft was shipped from Archer's Palo Alto facility to its flight test facility in Salinas, California and reassembled. Archer will now take this aircraft through a series of ground tests leading up to its planned first flight later this year.

Rockton for 40 ES–30 airplanes

Swedish investment and aircraft leasing company Rockton will acquire up to 40 of Heart Aerospace's regional electric airplane, the ES–30, converting an earlier letter of intent with the Swedish airplane maker into firm purchase orders for 20 airplanes with purchase rights for 20 more.

Eviation order for 30 all–electric Alice aircraft

Eviation Aircraft, a manufacturer of all–electric aircraft, announced that MONTE, a UK based regional aircraft lessor focused on sustainable aviation, had signed a Letter of Intent (LOI) for up to 30 all–electric commuter Alice aircraft. MONTE will provide financing and leasing solutions for the Alice and its associated charging infrastructure to its global customer base of regional aircraft operators.

VSR700 tested at sea

Airbus Helicopters and the French Armament General Directorate (DGA) tested the unmanned aerial system (UAS) VSR700 for the first time in an operational configuration from a ship at sea. At the beginning of May, the VSR700 performed 80 fully autonomous take–offs and landings from a civil vessel equipped with a helicopter deck, cruising off the coast of Brittany in the west of France.

Embraer and NetJets Deal for 250 Praetor 500s

NetJets Owners and their guests, NetJets has signed a new deal with Embraer for up to 250 Praetor 500 jet options, which includes a comprehensive services and support agreement. The deal is valued in excess of US $5 billion, with deliveries expected to begin in 2025, and will be NetJets' first time offering the midsize Praetor 500 to customers.

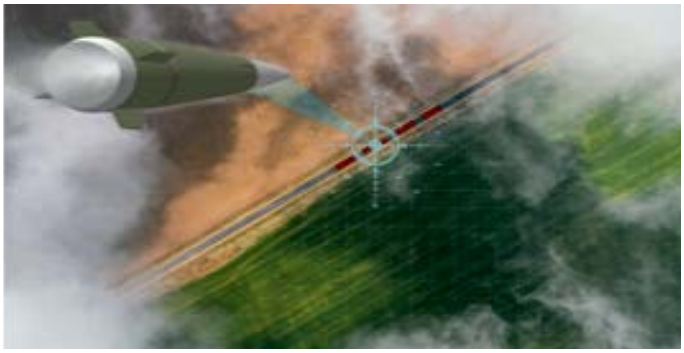
Avolon delivers 100th A320 neo

Avolon, the international aircraft leasing company, announced the delivery of its 100th Airbus A320 neo. The delivery to Cebu Pacific is the second A320 neo delivery under an agreement made earlier this year for the Philippines low–cost carrier to lease three new A320 neos.

MBDA's mid–life refurbishment of SCALP

MBDA strengthened its close relationship with Greece with a contract for mid–life refurbishment (MLR) of the SCALP missiles of the Hellenic Air Force. This MLR contract is dedicated to the SCALP missiles of the Hellenic Air Force (HAF) and includes the procurement of mission planning products, maintenance and technical assistance. This will prolong the operational superiority of the weapon against future threats.

BAE Systems in PGM contract



US Army Combat Capabilities Development Command Armaments Centre has awarded BAE Systems a three–year contract for continued research and development efforts in the advancement of precision guided munitions (PGM) to support the Army's long–range precision fire modernisation efforts.

Bombardier Defence and GDMS Canada to deliver MMA

Bombardier Defence and General Dynamics Mission Systems–Canada are collaborating to deliver the

next–generation Multi–Mission and Anti–Submarine Warfare (ASW) aircraft that will meet the requirements set by the Government of Canada for the Canadian Multi–Mission Aircraft (CMMA) programme. Both long–standing Canadian–based companies are leveraging their extensive networks to prepare for success in a competitive, open and transparent procurement process, and are joining forces as Canada's Multi–Mission Aircraft Team.

100th Citation Longitude

Textron Aviation announced that the 100th production unit of the company's flagship Cessna Citation Longitude business jet rolled out of the factory and is expected to deliver later this year.

Textron Aviation delivers Sky Courier

Textron Aviation announced the recent delivery of the first passenger unit of the twin–engine, large–utility turboprop, the Cessna Sky Courier, for use by Western Aircraft, Inc, doing business in Hawaii.

VIP customers order 4 BBJ's

Boeing announced orders for up to four premium, ultra–long–range Boeing Business Jets (BBJ). The orders to undisclosed VIP customers include two BBJ 787–8s, one BBJ 737–7 jet and an option to purchase a BBJ 777–9.

Rolls–Royce Pearl 10X running full steam ahead

Rolls–Royce announced the progress of its Pearl 10X engine development programme at the European Business Aviation Convention & Exhibition (EBACE) in Geneva. The programme is advancing at pace and has successfully accumulated more than 1,500 testing hours, both on the Advance 2 demonstrator and the Pearl 10X engine configuration.

Upgraded Gray Eagle ER UAS demo

General Atomics is supporting a demonstration that began in March and is featuring two US Army–owned Gray Eagle Extended Range (GE–ER) Unmanned Aircraft Systems (UAS). GA–ASI, the developer of the GE–ER platform, was contracted by the Army to integrate and operate an array of new capabilities on the versatile UAS platform as part of an ongoing effort to modernise GE–ER for Multi–Domain Operations (MDO).

Air Corporate for 43 Airbus helicopters

Air Corporate placed a firm order for 43 helicopters from Airbus on the concluding day of EBACE 2023. The helicopters include 40 single–engine helicopters (H125/H130) plus three ACH160s from Airbus Corporate Helicopters in Line configuration with the Lounge package to add to two ACH160s already on order.

Malaysia for two ATR 72 MPA

Ministry of Defence of Malaysia signed a contract with Leonardo to supply two ATR 72 MPA (Maritime Patrol Aircraft) platforms. This contract follows the selection of the solution offered by Leonardo announced last October, and includes the supply of two ATR Special Mission aircraft in Maritime Patrol configuration plus the related integrated logistic support and training services.

BAE Systems in contract for 246 CV90s

The Czech Republic has completed negotiations with Sweden, the Swedish defence procurement organisation FMV and BAE Systems Hägglunds to buy 246 CV90 MkIV infantry fighting vehicles in seven different variants.

Air Algérie for A330–900s and A350–1000s

Air Algérie, the national airline of Algeria, has signed a firm order for seven wide body aircraft to support its commercial development. This order will allow Air Algérie to "take full advantage of the flexibility of the Airbus product range, strengthen its regional services and offer an ambitious plan for transcontinental destinations".

Argentina to acquire 6 Bell 407GXi

Bell Textron announced the purchase agreement for six Bell 407GXi helicopters. The government–to–government contract was executed between the Ministry of Defence of Argentina and the Canadian Commercial Corporation. The Bell 407GXi helicopters will be operated by the Argentinean Air Force and Army to assist in Search and Rescue Missions.

Finland for 91 Patria vehicles

The Finnish Defence Forces are to purchase Patria 6x6 armoured vehicles as a part of the multinational Finland–led CAVS (Common Armoured Vehicle Systems) programme that also features Latvia, Sweden and Germany. Patria signed the agreement for 91 vehicles with the Finnish Defence Forces Logistics Command. In addition to the vehicles, the purchase also includes spare parts, tools as well as operation and maintenance training, in addition to a purchase option for 70 vehicles. Deliveries of the vehicles will begin during 2023.

Netherlands for 8 MK 41 VLS

Netherlands has requested a possible purchase of eight (8) eight–cell MK 41 Vertical Launching Systems (VLS) Baseline (B/L) VII Strike Length Launcher Modules (either system or standalone).

1st Flight of HFE for Gray Eagle ER

General Atomics conducted the first flight of its new 200–horsepower heavy fuel engine on a Gray Eagle aircraft at its El Mirage flight facility. The Heavy Fuel Engine (HFE) 2.0 is being considered by the US Army to become the fleet replacement for the current 180–horsepower engine used by the Gray Eagle Extended Range (GE–ER) Unmanned Aircraft System (UAS).

Netherlands for 4 MQ–9A Block 5

Netherlands to buy up to four (4) MQ–9A Block 5 aircraft and up to three (3) UAV MQ–9 Mobile Ground Control Systems (MGCS), etc.

Latest AMRAAM configuration

Raytheon has been awarded a $1.15 billion contract for AIM–120 D–3 and C–8 AMRAAM missiles. This is the largest AMRAAM missile contract to date and the fifth production lot of the highly advanced missiles developed under the Form, Fit, Function Refresh, also known as F3R, which updates both the missile's hardware and allows for Agile software upgrades.

Norway for 580 SDB II's

Norway has requested to buy up to five hundred eighty (580) GBU–53/B Small Diameter Bombs–Increment II (SDB–II) All–Up–Rounds (AURs) that will be added to a previously implemented case. The original foreign military sales (FMS) case, valued at $18.9 million, included twenty (20) GBU–53/B, SDB–II AURs.

Bell H–1 fleet surpasses half a million FH

The current H–1 fleet of AH–1Z Vipers and UH–1Y Venoms reached a major flight milestone by surpassing the 500,000–flight hour mark. Nearly 400 AH–1Z and UH–1Y helicopters, built by Bell Textron Incand operated by the US Marine Corps and their allies, combined to achieve the milestone.

RAF Typhoons for latest radar capabilities

The Ministry of Defence (MOD) has awarded BAE Systems a £870m contract to deliver a new radar to enhance the Royal Air Force's (RAF) Typhoon fighter jet fleet and strengthen the aircraft's control of the airspace whilst providing cutting–edge electronic warfare capabilities.

New CH–47 Chinook production

As part of a US Department of Defence Foreign Military Sale (FMS), Boeing received a contract to produce 18 CH–47F Block I Chinooks for South Korea and one additional aircraft for Spain. As Boeing continues transitioning to building the advanced Block II configuration, the deal valued at up to $793 million represents the final aircraft to be ordered on the current CH–47F Block I FMS contract with the U.S. government.

Sweden for 250 AIM–120C–8's

Sweden has requested to buy up to two hundred fifty (250) AIM–120C–8 Advanced Medium Range Air–to–Air Missiles (AMRAAM) and up to six (6) AMRAAM C–8 Guidance Sections.

France for 1,515 Hellfire's

France has requested to buy up to one thousand five hundred fifteen (1,515) AGM–114R2 Hellfire Missiles. Also included is technical assistance; non–standard books; publications; other Hellfire publications; integration support; and other related elements of logistical and programme support. The estimated total cost is $203 million.

AIM–120D–3 for final flight test

The US Air Force and Raytheon have successfully completed all developmental and operational testing of the AIM–120D–3, which concluded with an F–16 live–fire of the missile with production hardware and software.

PAC–3 MSE integration with Aegis

For the first time, Lockheed Martin's Patriot Advanced Capability–3 (PAC–3) Missile Segment Enhancement (MSE) interceptor successfully communicated with the AN/SPY–1 Radar, a key component in the Aegis Weapon System. Lockheed Martin is investing in a PAC–3 MSE/Aegis integration that could deliver a proven, integrated air and missile defence capability with growing capacity to help maritime customers defend against advanced, maneuverable threats.

Updates from Israel

FOC Capability of C–Dome on INF Sa'ar 6

Rafael alongside the Israel Missile Defence Organisation (IMDO), in collaboration with the Israeli Navy and Rafael Advanced Defense Systems Ltd announced the successful completion of a series of comprehensive tests for the naval version of the Iron Dome system, known as "C–Dome." These tests mark a significant step towards achieving the final operational capability of the C–Dome system on the Israeli Navy's Sa'ar 6–class corvettes. Through out the rigorous testing process, the C–Dome system, installed on the Sa'ar 6 "Magen" corvettes, demonstrated its "exceptional capability to intercept and neutralise advanced threats" that pose a danger to Israel's strategic assets and infrastructure within its exclusive economic zone.

IAI and Atlas Elektronik unveil Blue Whale

Israel Aerospace Industries (IAI) and Atlas Elektronik, a company of Thyssenkrupp Marine Systems, officially launched their latest joint development for advanced anti–submarine warfare (ASW) missions at the Undersea Defence Technology (UDT) Conference and Exhibition in Rostock, Germany. Based on Elta's BlueWhale autonomous underwater multi–mission platform (a large unmanned underwater vehicle with a wide range of advanced sensor systems), the system incorporates Atlas Elektronik's towed passive sonar triplet array. Unlike existing towed sonars, the combined system can function at depths traditionally exploited by submarines to avoid detection. An Atlas transmitter, deployed from an autonomous (or manned) surface vessel, enables BlueWhale to perform bi–static location and tracking of submarine targets.

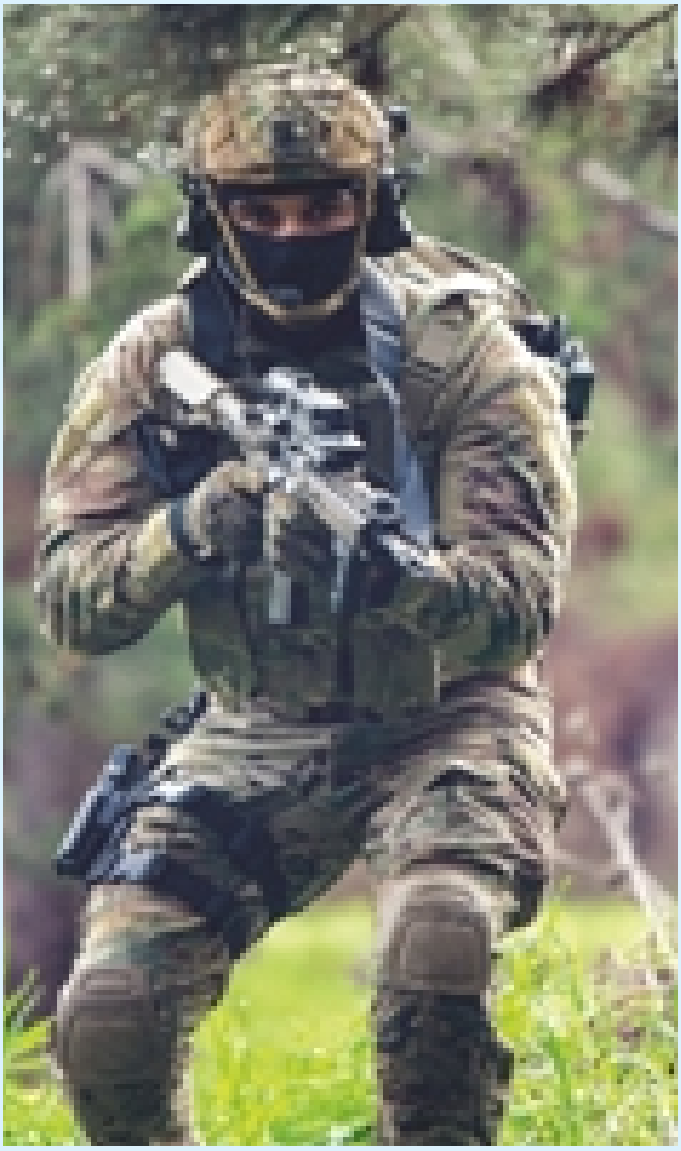
Israel and Montenegro in contracts

Elbit Systems announced that it has been awarded a contract valued at approximately 20 million Euros, as part of a defence export agreement signed between the Israel and Montenegro Ministries of Defence to acquire Elbit Systems–made weapons including mortar munition systems and training equipment.

IWI signs ToT agreement with FAME

IWI – Israel Weapon Industries, a member of the SK Group and a global leader in the production of combat–proven small arms for military forces, police units, law enforcement agencies, and governmental entities around the world, announced the signing of a ToT (Transfer of Technology and Knowledge) agreement with FAME, under which both companies will establish an assemblance and production line in Peru for the ARAD family of assault rifles.

Under the terms of the agreement, IWI will provide FAME



with technological knowledge regarding small arms assembly, advanced quality assurance and maintenance processes. In the future, the companies will also explore the possibility of expanding production to include additional weapons and relevant optical sights for the country's defence and security forces.

Elbit UK to deliver 130 GBSR to UK

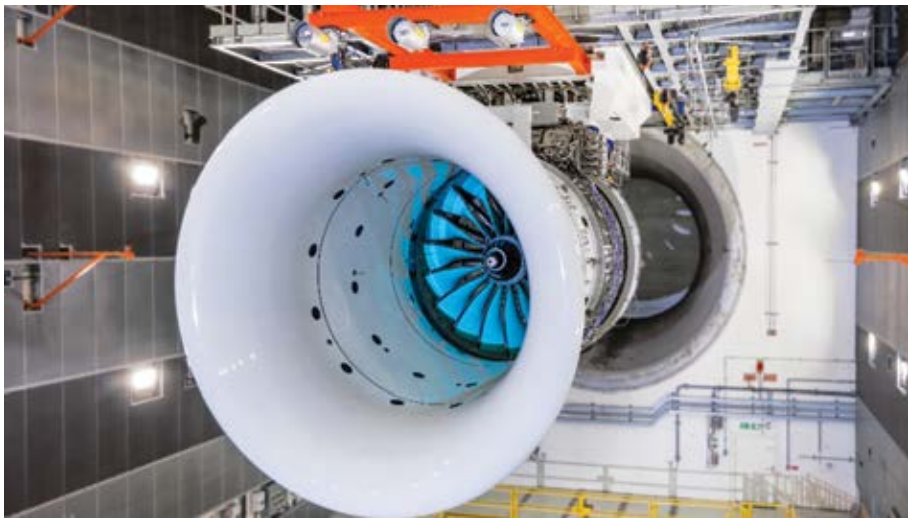
Elbit Systems UK has been awarded a contract from the UK Ministry of Defence (MoD) to provide a series of Ground–Based Surveillance Radar (GBSR) systems, manufactured and developed in the UK and Europe, to the British Armed Forces to support front line threat detection for a range of end–users. Elbit Systems UK will deliver 90 GBSR systems throughout 2023 and 2024, with a follow–on option of an additional 40 systems.

Elbit Systems to supply PULS

Elbit Systemsannounced that it has been awarded a $150 million contract to supply PULS (Precise and Universal Launching Systems) rocket launchers and a package of precision-guided long-range rockets to an international customer.

Elbit Systems' PULS provides a "comprehensive and cost effective solution"that can launch unguided rockets, precision guided munitions and missiles with an effective range of up to 300km. The PULS can also support future growth capabilities such as the ability to launch loitering munitions, including the canister launched configuration of Elbit Systems SkyStriker loitering munition.The PULS launcher is fully adaptable to existing wheeled and tracked platforms.

Rolls–Royce tests of UltraFan technology demonstrator



Rolls–Royce has successfully completed the first tests of its UltraFan technology demonstrator at its facility in Derby, UK. The first tests were conducted using 100% Sustainable Aviation Fuel (SAF). This is a historic moment for Rolls–Royce – it's the first time in 54 years the aero–engine manufacturer has tested a brand–new engine architecture and is proof of what can be achieved when industry and governments work together. Confirming the capability of the suite of technologies incorporated in the demonstrator is a big step towards improving the efficiency of current and future aero–engines. UltraFan delivers a 10% efficiency improvement over the Trent XWB, which is already the world's most efficient large aero engine in service. In the nearer term, there are options to transfer technologies from the UltraFan development programme to current Trent engines, providing our customers with even greater availability, reliability and efficiency.

In the longer term, UltraFan's scalable technology from 25,000–110,000lb thrust offers the potential to power new narrowbody and widebody aircraft anticipated in the 2030s.

Tufan Erginbilgic, CEO, Rolls–Royce plc, stated, "The UltraFan demonstrator is a game changer – the technologies we are testing as part of this programme have the capability to improve the engines of today as well as the engines of tomorrow. That is why this announcement is so important – we are witnessing history in the making; a step–change in engine efficiency improvement. When combined with Sustainable Aviation Fuels, more efficient gas turbine engines will be key to hitting the industry's target of Net Zero flight by 2050. Today we are closer to achieving this ambition. Collaboration is key in driving the decarbonisation of air travel and the UltraFan programme is a great example of what can be achieved when government and industry come together with a common purpose."

The tests took place in the world's largest and smartest indoor aero–engine testing facility – Testbed 80. The 100% SAF, derived primarily from waste–based sustainable feedstocks such as used cooking oils, was provided by Air bp. Testing the demonstrator is the culmination of many years work, which has been supported by the UK Government through the Aerospace Technology Institute (ATI), Innovate UK; the EU's Clean Sky programmes plus LuFo and the State of Brandenburg in Germany.

Gary Elliott, Chief Executive Officer, Aerospace Technology Institute, stated, "Rolls–Royce's UltraFan programme has achieved a huge step forward in terms of the fuel efficiency of aircraft engines. The technology developed within the programme has greatly improved our understanding of how to increase engine performance while reducing environmental impact. It is a programme that puts the UK at the forefront of the global market, and is absolutely critical for the future of the UK aircraft engine industry. Our congratulations to the Rolls–Royce team for the successful tests of this exciting technology demonstrator."

UltraFan has been a decade in the making, with the concept unveiled publicly in 2014. It is a fundamentally different design architecture to that within the approximately 4,200 Rolls–Royce civil large engines currently in service, as it incorporates a geared design that no other industry player has produced at this size before. Demonstrating at this scale gives us the flexibility to scale down as required by our customers.

It will also put us in the unique position of being able to offer a portfolio of two–shaft, three–shaft, direct drive and geared propulsion solutions to power future aircraft.

Text and photos: R–R

Gripen E: Dominating the Electronic Fight

In battle, your enemy is constantly trying to find new ways to challenge your capabilities and find any weak points. This is particularly true when considering Electronic Warfare (EW) systems – an area where Gripen E truly excels.

The Gripen EW system, combined with the highly integrated situational awareness provided by fusing intelligence from all sensors in the tactical unit and co–operating units, allows Gripen to enter what is known as contested battle–space, win the fight and exit safely. Today all aircraft have some form of EW, but none has the power or the ability to be enhanced constantly, like the Gripen EW system. This is a result of several new technological breakthroughs, and it ensures that Gripen can deliver both defensive electronic measures and offensive electronic disruption. This fundamentally eliminates enemy sensors operating on various bandwidths : sensors that in today's environment can locate platforms, even those with stealth features, if they do not have an EW system as capable as the one equipping the Gripen.

So let's put this into perspective. During peacetime, the enemy hides their most potent capabilities, refraining to use them to full operational effect. This can include various key systems such as Electronic Warfare and radar capabilities. In reality, this means that during peacetime, advanced systems including operational transmissions, emitter modes, frequencies and jamming techniques are kept secret and held in reserve for the war. Once the necessity arises and tensions rise, new hostile system capabilities are engaged. In times of an escalating conflict, day–by–day new threat emissions are introduced into the battlespace in order to confuse and threaten your defences.

For this reason, it has never been more important than now to have the ability to rapidly change, instantly adapt and quickly implement features that counter the enemy, to develop operationally.

It is not possible to change the platform design – but the sensor must be capable of being tweaked and improved to adapt to the threat and defeat it. With Gripen E, all this comes as a "built–in feature," thanks to its one–of–a–kind avionics system, that continuously enables upgrades with even more advanced AI software and increased computational power. Adaptability therefore, of key sensors like the EW, ensures Gripen can provide lethality, while also excelling in survivability. In the scenario presented, Gripen fights, learns and adapts, so that its multitude of sensors, such as the EW are better than the adversary the next day. It's survival of the fittest.

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

News from Lockheed Martin

Romania for modernisation of TPT F–16s

Romania has requested to buy equipment and services to modernise thirty–two (32) F–16 Mid–Life Update Block 10/15 aircraft to be procured through third–party transfer from Norway.

LM's PAC–3 MSE launched from German Patriot Launcher

A German–modified M903 launcher successfully launched a Lockheed Martin PAC–3 Missile Segment Enhancement (MSE) interceptor in a flight test. The Germany Tactical Test/Operational Test 3 flight test was conducted by the German Air Force against a virtual tactical ballistic missile target to prove compatibility between PAC–3 MSE and the German–modified Patriot M903 launching station. The test was a critical final step before Lockheed Martin delivers the first shipment of PAC–3 MSEs to Germany.

Poland for IAMD/IBCS

Poland has requested to buy phase two of a two–phase programme for an Integrated Air and Missile Defence (IAMD) Battle Command System (IBCS) enabled Patriot Configuration–3+ with modernised sensors and components, including forty–eight (48) Patriot M903 Launch Stations; up to six hundred forty–four (644) Patriot Advanced Capability (PAC) 3 Missile Segment Enhanced (MSE) missiles; forty–eight (48) Launcher Interface Network Kits (LINKs), etc.

Czech Republic for 24 F–35s

Czech Republic has requested to buy twenty–four (24) F–35 Joint Strike Fighter Conventional Take Off and Landing (CTOL) Aircraft; twenty–five (25) Pratt & Whitney F135–PW–100 Engines (24 installed, 1 spare); seventy (70) AIM–120C–8 Advanced Medium Range Air–to–Air Missiles (AMRAAM); three (3) AIM–120C–8 AMRAAM Guidance Sections; eighty–six (86) GBU–53/B Small Diameter Bombs – Increment II (SDB–II) StormBreaker All–Up–Rounds (AUR); two (2) GBU–53 SDB–II Guided Test Vehicles (GTV); three (3) GBU–53 SDB–II Captive Carry Reliability Trainers (CCRT); twelve (12) Mk–84 General Purpose 2,000–lb Bombs or BLU–109 2,000–lb Penetrator Bombs for the GBU–31; twelve (12) KMU–556/KMU–557 Joint Direct Attack Munition (JDAM) Tail Kits for the GBU–31; fifty (50) AIM–9X Block II/II+ Tactical Sidewinder Missiles; ten (10) AIM–9X Block II Tactical Sidewinder Guidance Units; eighteen (18) AIM–9X Block II Tactical Sidewinder Captive Air Training Missiles (CATM); and four (4) AIM–9X Block II CATM Guidance Units, etc.

Boeing Updates

Boeing Completes T–7A 1st flight with USAF

Boeing and the US Air Force completed the inaugural flight of the service's first T–7A Red Hawk, marking the start of the engineering and manufacturing development (EMD) phase of the programme. During the 1 hour and 3 minute flight, US Air Force Maj. Bryce Turner, 416th Test Squadron and Steve Schmidt, Boeing T–7 chief test pilot, validated key aspects of the aircraft and demonstrated the power and agility of the Air Force's first advanced trainer to be digitally designed, built and tested. The aircraft is one of five EMD aircraft that will be delivered to the Air Force Air Education and Training Command for further testing. The T–7A moved from firm concept to flight testing in 36 months. A combination of model–based engineering, 3D design and advanced manufacturing increased first–time quality by 75% and reduced assembly hours by 80%.

In 2018, the Air Force awarded Boeing a $9.2 billion contract for 351 T–7A advanced trainers, 46 simulators and support. The T–7A will replace the Air Force's aging T–38 aircraft.

Germany for 60 CH–47F Chinooks

Germany has requested to buy sixty (60) CH–47F Block II Cargo Helicopters with customer–unique modifications; one hundred forty (140) T–55–GA–714A engines (120 installed, 20 spares); seventy–two (72) AN/AAR–57 Common Missile Warning Systems (CMWS) (60 installed, 12 spares); and two hundred eighty–four (284) AN/ARC–231A Communications Security (COMSEC) radios (240 installed, 44 spares), etc.

Canada for 16 P–8A's

Canada has requested to buy up to sixteen (16) P–8A Patrol Aircraft; up to twenty–six (26) Multifunctional Information Distribution System Joint Tactical Radio System 5 (MIDS JTRS 5); up to thirty–eight (38) Embedded Global Positioning Systems (GPS)/Inertial Navigation Systems (EGIs) for the LN–251; up to twenty–five (25) System Processor Replacements for AN/AAQ–24(V)N Large Aircraft Infrared Countermeasures (LAIRCM) System Processor Replacement (LSPR) with Exelis Embedded GPS Receiver (EGR) integrated with SAASM, etc.

News from Russia's Rosoboronexport

Rosoboronexport showcases military helicopters

Rosoboronexport (part of the Rostec State Corporation) showcased Russian military helicopters at the 16th International Helicopter Industry Exhibition (Heli Russia 2023), which was held 18–20 May at the Crocus Expo International Exhibition Centre in Moscow. "Since its establishment in 2001, Rosoboronexport has delivered over 1,200 helicopters to partners from

more than 45 countries. This is an excellent indicator of the reliability and high competitiveness of Russian equipment in the market," stated Alexander Mikheev, Director General of Rosoboronexport. "Today, Russian helicopter developers and manufacturers confidently meet the needs of domestic customers and foreign partners, including through military–technical cooperation. Well–proven helicopters undergo upgrades, based on their extensive operating experience. New models are being introduced to the market and will be on display at HeliRussia 2023."

Rosoboronexport took part in HeliRussia 2023 within a joint exhibit of Rostec subsidiaries. At its booth, the company showcased the Ka–52 scout/attack helicopter, the Mi–17V–5 military transport helicopter and the Mi–35M transport/attack helicopter. In addition, the exhibition guests were presented with upgraded versions of the Mi–28NE attack helicopter, Mi–171Sh military transport helicopter, Ka–226T light utility helicopter, as well as the Mi–26T2V heavy–lift military transport helicopter.

"Most of the Russian helicopters promoted today by Rosoboronexport are well known in the global market and occupy top positions in their respective segments. At the same time, the Russian helicopter industry works unceasingly, upgrading them based on the experience of their operation, including in combat conditions," Alexander Mikheev added. "Many helicopters have received new Russian–made powerplants, state–of–the–art air weapons, communication systems and defensive aids systems, which have shown high performance and reliability."

Rosoboronexport exhibits Klavesin–1RE UUV

Rosoboronexport JSC (part of Rostec State Corporation) exhibited the Klavesin–1RE, its cutting–edge autonomous unmanned underwater vehicle (UUV), during this year's International Maritime Defence Show in St. Petersburg.

"Rosoboronexport is closely watching trends in the global arms market," stated Alexander Mikheev, Director General of Rosoboronexport. "The main focus now is on unmanned military equipment, robotic systems. Unmanned vehicles and systems are expected to be used in all environments – on land, in the air, on and under the water. Among those advanced high–tech systems developed by the Russian defense industry is Klavesin–1RE ("Harpsichord"), the latest autonomous UUV. This is an

entirely indigenous Russian development, which has a number of unique characteristics, enabling it to occupy top positions in its segment. This product will be in demand both in this country and among international customers."

The Klavesin–1RE is designed to perform surveillance and search operations, inspect bottom objects at depths ranging from 5 to 6000m when operating in autonomous mode and also in correction mode via a hydroacoustic communication channel from the carrier vessel. The UUV makes it possible to conduct bottom topography survey using a sonar and identify objects worthy of detailed examination on board the carrier vessel. It is capable of inspecting underwater objects in detail using a sonar, TV and electromagnetic sensors, as well as of automatically identifying and tracking extended objects using TV and electromagnetic locators. In addition, the drone can perform acoustic profiling of the seabed and measure

environmental parameters across the entire range of operational depths and motion speeds.

The UUV system can be operated in any possible hydrological conditions, in Sea State 3 and at water temperatures from –4°C to +35°C. Launch and recovery operations involving the UUV can be carried out at a wind velocity of up to 15m/s, and the system can be stored and transported at ambient temperatures from –50°C to +70°C.

VAYU Interview with

Rosoboronexport Director General Alexander Mikheev

VAYU: What competitive advantages of Russian defence products are most valued by Rosoboronexport's partners?

Thanks to a great deal of attention on the part of the state leadership as well as the glorious long–standing traditions, today Russia's weapons have reached a qualitatively new stage in their development. Hightech complexes and weapon systems have been created that set the standard for armourers around the world. The financial, material and human resources invested in R&D efforts at defence industry enterprises have made it possible to develop the most cutting–edge production technologies. All products offered by Rosoboronexport are capable of operating reliably and efficiently in a wide range of climatic conditions. The experience of combat use of Russian weapons in military conflicts and major anti–terrorist operations by various countries around the world has demonstrated their effectiveness and compliance with the declared capabilities.

Today Rosoboronexport in cooperation with the Rostec State Corporation and other major Russian industrial companies is actively engaged in industrial cooperation involving joint projects to design and manufacture the high–tech weaponry and military equipment on the customer's premises. We have positive experience in implementing more than a hundred such contracts around the world.

Our efforts in India is the poster child for a comprehensive industrial partnership within the framework of which we manage to settle down joint projects for all branches of the armed forces with cooperation level between companies in the two countries being unique on the global market.

We have a long–term project with Hindustan Aeronautics Limited (HAL) to license production of the Indian Air Force's most popular aircraft that is the Sukhoi Su–30MKI and we are standing by to get the green light to produce the Kamov Ka–226T light multipurpose helicopters on the basis of a joint venture. India produces T–90 and T–72 main battle tanks, BMP–2 infantry fighting vehicles, 'Mango' and 'Invar' projectiles. Production of Kalashnikov AK–203 assault rifles has been launched at Korwa Ordnance Factory and it will eventually reach a 100 percent localisation level. There are joint projects on behalf of the Indian Navy and we are expecting cooperation on air defence missile systems.

VAYU: The list of Rosoboronexport's successes and achievements over the years is extensive but, for yourself which successes would you highlight in the first place?

If we talk about the entire period of Rosoboronexport's history, I would first of all mention that we hold one of the top rating in the global arms market, the high credibility of a reliable and strong partner among customers and the timely implementation of the tasks assigned by the President of the Russian Federation, who is at the top of the military–technical cooperation vertical. As for the period since 2017 when I was appointed as the Director General of Rosoboronexport, the main achievement was its successful adaptation to the harshest manifestations of unfair trade competition from the USA and other Western countries – imposed sanctions – and stable work under this condition.

As you know in April 2018 Rosoboronexport was put on the US list of sanctioned companies. Of course we realised right away that we would have to work for a long time under sanctions. We were prompt enough to implement the necessary measures and set up all the operational work so that Rosoboronexport could feel fine on the market. When it comes to specific projects one of the main achievements is the contract to supply India with S–400 'Triumph' long–range air defence missile systems, concluded during the Russian–Indian summit in New Delhi on 5 October 2018. It became the major project for the entire period of military–technical cooperation between Russia and India. The same systems were delivered to a NATO country despite strong opposition and political pressure from rivals. We returned to sub–Saharan Africa and are actively engaged in operations there.

Trooping the Colour 2023

Flypast over palace marks King Charles's birthday

On 17 June 2023, the King was treated to an extended military flypast following Trooping the Colour after his Coronation day display was scaled down due to bad weather. Around 70 aircraft from the Royal Navy, British Army and Royal Air Force, some of which date back to the Battle of Britain memorial flight, took part in His Majesty's first official birthday celebrations. The King, Queen and other members of the Royal family watched from the Buckingham Palace balcony as the aircraft flew over The Mall in a six–minute display. In one memorable moment, 18 Typhoons formed the shape of a "CR" – standing for "Charles Rex" – which drew applause from the family members on the balcony. The aircraft took off from 15 locations across the UK before meeting in the south–east of England to fly over the Palace.

Text: telegraph.co.uk
All Photos : RAF

Exercise INIOCHOS 2023 at Andravida AFB

Between 24 April and 5 May 2023, the blue skies of Hellas were shaken by the sounds of fighters participating in exercise INIOCHOS 2023. Three new members were welcomed to the ever expanding INIOCHOS family this year: India, Jordan and Saudi Arabia. Due to the current global geopolitical climate and the building of new alliances, INIOCHOS 2023 had enormous political and military importance beyond the narrow borders of Hellas. New friendships were made and existing ones refreshed and renewed. New technologies were tested and existing standards were raised for future exercises.

History of Exercise Iniochos

Exercise INIOCHOS was established in 1988 as a Hellenic Air Force exercise without participation of foreign Air Forces. In 2013, it was decided to upgrade the exercise into a INVITEX–exercise, meaning that invitations are being send to different Air Forces, asking if they want to participate, and to implement the so called "Single Base" concept, according to which all participating squadrons are operating from one single base. This was done for synergy effects and in order to create a realistic environment for the simulation of real combat operations with the opportunity of a better analysis of the results. Andravida AFB in the western Peloponnese was chosen as the host base. The two main reasons for this decision were the extended free airspace in western Hellas and over the Ionian Sea, which is something very rare today in most parts of Europe and the existence in Andravida AFB of the Hellenic Air Force Air Tactics Centre (KEAT). In 2014, this concept was put through test with the first INIOCHOS exercise run under the new rules, still only with Hellenic Air Force

squadrons participating. Since 2015, allied and other friendly Air Forces have been invited. The exercise scope expanded with time to provide a challenging and demanding high threat environment for the participating Air Forces, with the inclusion of simultaneous Hellenic and international Army and Navy exercises. The participants have the opportunity of using different kinds of target ranges (over land and sea) for realistic training conditions. The training area includes the whole of Athens Flight information Region (Athens FIR).

During the last years and with the ever–increasing experience gained from each previous edition, the exercise has become specially designed to simulate modern, complex and intensive air operations, day and night, in order to provide realistic training that resembles the early days of a conflict (simulating real warfare). Exercise INIOCHOS is now the frame where personnel and aircraft are tested to the limits of their mental, physical and technical endurance. This frame gives an unique opportunity to all participants: To exercise inside a layer of multiple, unexpected threats as members of combined strike packages against opponent forces consisting of some of the best pilots in the world and a multitude of different short, medium and long–range A/A–systems (for example, Crotale SRAD, MIM–104 Patriot, SA–15 Gauntlet, SA–20 Gargoyle, etc). Since this year's event, also a fully simulated combat environment is provided to all participants, with the introduction into service of the Hellenic Air Force Operational Synthetic Training Squadron.

As mentioned above, three newcomers were welcomed this year at Exercise INIOCHOS: India, Jordan and Saudi Arabia. Each of them brought their unique experience and capabilities with them in order to share it with the other participants and on the other hand to learn from them. The involvement of the Royal Jordanian Air Force was long overdue. The ties between the Royal Jordanian Air Force and the Hellenic Air Force have been very close for decades with many high–ranking former and current officers of the RJAF having graduated from the Hellenic Air

Force Academy in Tatoi. The Jordanians were quickly integrated into the exercise and mostly flew missions alongside the Hellenic F–16. The first participation of Saudi Arabia in an exercise INIOCHOS with the simultaneous cancellation at the last moment of their participation in the corresponding exercise of the Turkish Air Force "ANATOLIAN EAGLE 2023" is something that has been heavily discussed behind the scenes of INIOCHOS. It can be seen as a combination of the rapid development of bilateral political and military relations between Riyadh and Athens over the past decade and the simultaneous deteriorating of Saudi–Turkish relations. It was preceded by bilateral exercises in Souda AFB (Crete) and Saudi Arabia and the deployment of Hellenic Air Force long–range A/A MIM–104 Patriot systems in the Persian Gulf country. The participation of the Indian Air Force is the result of the continuous expansion and improvement of all aspects of the Indo–Hellenic relationship. It was speculated that the first IAF participation in INIOCHOS would be with Rafale as the Hellenic Air Force has recently become a Rafale user too, but the IAF managed to surprise everyone and sent the backbone of their fighter fleet to Andravida AFB, the mighty Su–30MKI!

For a detailed report about the Indian Air Force participation in INIOCHOS, we refer you to the next issue of Vayu Aerospace and Defence Review.

The Hellenic Air Force managed again to implement innovations and new scenarios in the already demanding and difficult course of the exercise. During INIOCHOS 2023, special emphasis was placed on the implementation of complex cross–operational scenarios with an escalation of the difficulties that pilots and technicians had to face in an electronic warfare and multiple threats environment. For this purpose, units of the Hellenic Army, the Hellenic Navy and the Hellenic Armed Forces Special Warfare Command also participated in INIOCHOS 2023, and the ORION 2023 Special Forces exercise took place at the same time with the participation of allied and friendly countries. A major step towards the cyber–centric conduct of complex missions was the primary involvement of the Operational Synthetic Training Squadron with its 11 simulators (10 Aircraft and 1 JTAC–simulator) at its disposal. In addition, the recently upgraded F–16CV/DV (with AN/APG–83 AESA radar) and the newly acquired Rafale fighters of the

Hellenic Air Force had their first official participation in an international exercise. As always, the overall exercise missions were planned by the Hellenic Air Force Tactical Weapons School (SOT) and covered the entire range of operations performed by modern Air Forces, such as Anti–Surface Operations, Battlefield Air Interdiction/Deep Air Support, Close Air Support, Combat Search & Rescue, Escort–Sweep, High Value Airborne & Ground Asset Attack Operations and Defensive Counter–Air Operations, Long–Range Escort, Maritime Strike Operations, Non Traditional Intelligence, Surveillance and Reconnaissance, Offensive Counter–Air Operations against Integrated Air Defence Systems, Support of "Slow Movers", Strike, Strike Coordination and Reconnaissance, Suppression of Enemy Air Defences / Destruction of Enemy Air Defences, Tactical Air Support for Maritime Operations, Time Sensitive / Dynamic Targeting and Traditional Reconnaissance Operations.

The Commander of the Hellenic Tactical Air Force assumed the tactical command of the participating Air Forces. This is exercised by a cell established at the Hellenic Air Force Air Tactics Centre (KEAT) specifically for the exercise.

According to Brigadier General Matthaios Kounoupakis, Commander of the KEAT, the overall scenario of INIOCHOS 2023 was "an escalating crisis over locale disputes that evolves through hybrid warfare to a full–scale international conflict. The so called – fog of war – was created through the input of false information into the planning and realistic attrition rates were taken into account".

In order to achieve the objectives of the exercise, the Hellenic Air Force Tactical Weapons School (SOT) oversees the missions from scenario planning to

debriefing and makes certain that they cover the current full spectrum of modern air warfare. This year there was no strict division into BLUE and RED Forces, but every participating contingent changed side depending on the individual mission or also during a mission as a further object of surprise for the other participants. Each mission/day, the overall command was given to another contingent. The aim was to emphasise the strengths and highlight the capabilities of each participating Air Force, learning common lessons and achieving maximum interoperability. Not only the flying personnel trained together but also the ground crews of all participating nations were cooperating to learn from each other's procedures.

It was tried to involve every participating Air Force in all aspects of the different missions planning and execution. In addition, each contingent could request specific missions they wanted to train together with all or some of the other participants. The Air Forces involved made active use of the most diverse training areas/ranges with particular emphasis this year on Maritime Air Support missions/Maritime Strike missions. Air refuelling support was provided by KC–135 air tankers of the USAF/USAFE, flying from Souda AFB (Crete). A large wave was flown mainly in the morning, one smaller around noon and again a bigger one during afternoon. Of course, there were also days with night operations. The number of air assets was 59, based in Andravida AFB, 22 flying from other airbases plus helicopters, in total over 100 air assets. These air assets completed more than 1.000 missions during the 8 days of the exercise. This means more than 125 sorties were generated every single day. A very impressive number by today's standards.

It is understood that all participants praised the realistic simulation of combat scenarios and the multitude of unexpected simulated threats that the Hellenic Air Force General Staff built into the exercise to keep the participants always on alert, such as for example the presence of A/A–units in expected "vacant" zones. As a foreign

At INIOCHOS 2023, the following countries participated with personnel and means, in addition to the Hellenic Armed Forces:

COUNTRY	NUMBER & TYPE(S)	UNIT(S)	REMARKS
Austrian Air Force	-	-	Only JTAC-Team
Cyprus Air Command	1x AW139	460 MED	+ JTAC-Team
French Air Force	2x Rafale C	RC 2/30	
Indian Air Force	4x Su-30MKI	222 Sq	
Italian Air Force	5x Tornado IDS 3x Tornado ECR	154° Gruppo CB 155° GruppoETS	
Royal Canadian Air Force	-	-	Only JTAC-Team
Royal Jordanian Air Force	2x F-16AM 2x F-16BM	2 Sq	
Royal Saudi Air Force	4x F-15S 2x F-15SA	92 Sq	
Slovenian Air Force	2x PC-9M	LeSo	+ JTAC-Team
Spanish Air Force	5x F/A-18A+	462 Esc	
USAFE	4x F-16C/D 1x MQ-9A	510th FS 31st EOG	Operating from their Homebase's; + JTAC-Team

Observers from Bahrain, Germany, Montenegro, Morocco, Slovakia, Tunisia and the United Arab Emirates were also present.

representative said, "This is the way exercises will be conducted in the future!" and another "The training is at an incredibly high level!" Finally, and most importantly, the geographical relief of Hellas was helpful, providing plenty of opportunities for a realistic training. Also of great value was the chance to increase cooperation, to share common values, to send a strong, common message of stability and protection of peace in the Eastern Mediterranean during these difficult times, the opportunity to strengthen the spirit of cooperation among the Air Forces involved, to support the productive exchange of ideas between them and to achieve synergy effects.

In his speech, the Chief of the Hellenic National Defence General Staff, General Konstantinos Floros, particularly drew attention to the importance of Air Power on the modern battlefield, emphasizing the strategic advantage it offers when conducting military operations, utilising its speed, range, flexibility and offensive capabilities of modern aircraft combined with the psychological pressure they exert on the enemy.

The Chief of the Hellenic Air Force General Staff, Lieutenant General Themistoklis Bourolias, mentioned the new elements that have been introduced this year in the exercise, which gave it a qualitative upgrade and the points to which it is given and will be given more emphasis in the future: "Our goal in exercise INIOCHOS is to develop challenging scenarios to include multiple modern threats and incidents in real time, so that our forces are trained to deal with air threats (Air to Air Defence/A2AD). In addition, INIOCHOS 2023 has been marked by the completion of an Information–Surveillance – Reconnaissance Fusion Centre (ISR Fusion Cell) in order to take advantage of the available capabilities to support Time Sensitive Target (TST) targeting procedures. Additionally, I am truly pleased that the newly formed Composite Training Squadron has been integrated into INIOCHOS 2023 and our fighter pilots, air combat coordinators and Joint Terminal Attack Controllers (JTAC) are able to fight in a sophisticated operational environment that includes training objectives that cannot be fulfilled in the real world. Underscoring this, I would like to share with you my vision to further improve INIOCHOS in the coming years, expanding composite training in an internally distributed and potentially externally constructive live virtual mode, with an emphasis on Electronic Warfare, in different operational environments, in customised complex scenarios and involving all tactical players; airmen, air defence and controllers of Surface Based Air Defence (SBAD), Joint Terminal Attack Controllers (JTAC), etc".

The INIOCHOS exercise achieves and stays up to date with international developments and trends in military aviation. The extensive experiences from more and more foreign participations flow into the planning of the next exercises and are shared with all participants. This brings tremendous benefits, increases confidence in conducting complex missions and creates a climate of trust between Air Forces with different mindsets, operational needs and capabilities. Through hard and persistent work, INIOCHOS has managed to rank among the best and most thorough international exercises, with the result that the desire to participate is greater than the available slots. There are already considerations of using a second airbase, most likely near Araxos AFB, in the future, if the development of the exercise proceeds so rapidly. The future of exercise INIOCHOS looks bright!

Article by Marcus Vallianos
Photos by Philipp Vallianos

"Dedicated to Lucky. Sadly gone for the eternal journey way too soon ..."

Anatolian Eagle 2023
Tactical Training Centre

A Pakistan Air Force F–16 departs the Eagle platform. Pakistan participated for the first time with their Block 52 aircraft in Anatolian Eagle

Every year the Turkish Air Force and allied nations gather at Konya air base in the middle of Turkey for the international exercise Anatolian Eagle. Anatolian Eagle is a high–level tactical training exercise providing realistic combat training opportunities. It is considered to be at the same level as the US Air Force's Red Flag exercises. Next to national versions during the year, there is always one iteration that includes significant numbers of allied nations. The training takes place in a high–threat environment in a dedicated airspace. The main training area is roughly 180 nautical miles (NM) by 215 nautical miles, with a ceiling of up to 50,000 feet, centred approximately 70 miles east of Konya. Additionally, there is a maritime operations area of 140 NM by 75 NM between the Turkish coast and the northwest coast of Cyprus. This amount of airspace allows for more than 60 aircraft to participate.

The objective of Anatolian Eagle is to prepare aircrew for combat operations as Lt Col Hakan Girgin, AETC Commander explains, "We are training to reduce the loss of inexperienced aircrews and aircraft in the early stages of a conflict. We provide air training to improve the skills of the pilots but we also encourage

161 Filo is a LANTIRN squadron specialising in night strike missions. They use the F–16 Block 50+

exchanges of experiences to improve interoperability. To achieve these aims, Anatolian Eagle seeks to provide the most realistic training domain to enable aircrews to execute their tactics, exchange ideas and maintain aircrew and Ground Control Interception controller combat readiness status so that they can survive in a combat environment".

Lt Col Girgin continues: "For the exercises, we divide the participants into three main components. The visiting squadrons make up the Blue Force and are the training audience. The Red Force is the training aid, whilst the White Force provides Command and Control (C2) for the whole exercise. The Red Force has three elements. It consists of a force of Lockheed Martin F–16C/D Fighting Falcons in the aggressor role provided by 132 Weapons and Tactics Squadron (132 Filo). They are controlled by Ground Controllers, operating under the callsign 'Redeye', and augmented by a range of ground–based air defence systems, operating under the call sign 'Hammer', which are mostly mobile radar and anti–aircraft missile and gun systems. The White Force is responsible for determining the level of training, developing scenarios, releasing the Air Tasking Order, monitoring the missions, and assessing and analysing the results. For the 2023 Anatolian Eagle edition, we started the exercise with a scenario where a pipeline was under attack by the Red Force. The Blue Force has been given targets to defend this pipeline and to secure the pipeline. The missions were flown using Composite Air Operations (COMAO), which are defended by the Red Force while all operations are monitored by the White Force using the Air Combat Manoeuvring Instrumentation (ACMI) system. After analysis, the Blue Force success rate can be determined by the time the debriefing is complete".

A 162 Filo F–16C takes off as part of the Blue Force pack operating in a large COMAO mission.

"The priorities for this exercise are to practice procedures and tactics for COMAO, Time Sensitive Targeting, Dynamic Targeting, High–Value Airborne Asset Protection and Anti Surface Forces Air Operations. The participating aircrew is responsible for tactical planning, briefings and mission execution. We designed the exercise to give maximum freedom to the aircrew to solve the problems presented by the tactical scenarios. Each day will see one main mission in the morning followed by local missions where the participants can train additional scenarios". He continues, "A total of 240 sorties have been planned for the exercise, against 110 ground targets. The exercise has been divided in such a way that 80% is

A Pakistan Air Force F–16D returns, using its brake chute for a precautionary landing.

A Qatar Emiri Air Force Typhoon takes off during one of the COMAO missions to defend the imaginary pipeline which was under attack by the Red Force.

Participants

A selection of participants from different nations participated in this year's edition. The United Arab Emirates Air Force participated with four of their F–16E/F Block 60 "Desert Falcon". These are considered by many as the most advanced F–16 built to date. Initially, the presence of Saudi Arabia had been announced, but at the last moment, the participation of the F–15s of the Royal Saudi Air Force was cancelled. The Qatar Emiri Air Force returned to Konya after a year of absence with five of its brand new Eurofighter Typhoons from 7 Squadron (1st Fighter Wing), Tamim Air Base. This marked the debut of the Qatari Typhoons in an international exercise abroad, just less

A Su–25 takes off with a pair of 1000 lb bombs fitted with Wing Assistance Guidance Kits produced by TUBITAK SAGE.

flown in an air–to–ground configuration and 20% in an air–to–air configuration. Anatolian Eagle has carved an important and unique place for itself, being able to offer unrivalled training facilities for both European, Asian and Middle Eastern customers".

Since its inception in June 2001, there have been 49 exercises, involving aircraft from 15 different countries, split between European nations and nations to the east of Turkey, plus the USA and NATO. Nearly 39,000 personnel using over 3,100 aircraft have flown more than 25,000 sorties, clocking up over 40,000 flying hours whilst benefiting from the training. Next to the 49 Anatolian Eagle exercises there have been a variety of other exercises flown from Konya, adding to these totals.

A Turkish E–7T "Wedgetail" Airborne Early Warning & Control (AEW&C) aircraft operated by the resident 131 Filo provided real–time battlefield overviews.

Eight 132 Filo F–16s flaunt a mini elephant walk. 132 Filo acted as 'Red Force' during the Anatolian Eagle exercise.

than a year after the first deliveries of the type (the first Typhoons arrived in Qatar on 27 August 2022). The Royal Air Force participated with four of their Eurofighter Typhoon FGR4s. Even though two were observed at Konya in the second week of the exercise, they were mainly operating from RAF Akrotiri in Cyprus. They were observed on various tracking sites heading to the training area, along with an RAF Airbus Voyager for inflight refuelling. Another interesting debut at Anatolian Eagle was made by the Pakistan Air Force which sent five F–16C/D Block 52's belonging to 5 (MR) Squadron "Falcons" based at Jacobabad/Shahbaz Air Base. The Azerbaijan Air Force is starting to become a regular addition to the exercise due to the tight connections between Azerbaijan and Turkey. This year, they again participated with a pair of Sukhoi Su–25s Frogfoots from Kurdamir Air Base. A single NATO E–3A AWACS along with a Turkish E–7T Wedgetail Airborne Early Warning and Control (AEW&C) aircraft operated by the resident 131 Filo provided real–time battlefield overview, relay vectors and target priority, enhancing situational awareness for the fighters involved in the operations. As always there were also several other nations providing observers, including Georgia, Libya, Morocco and Uzbekistan.

Turkish participation amounted to 24 F–16C/Ds from various squadrons (113, 131, 151, 152, 161, 181 and 191 Filo) and four McDonnell F–4E–2020 Phantom IIs, belonging to 111 Filo, which all deployed to Konya for the duration of the exercise.

Full afterburner take off by the UAEAF F–16E Block 60. One of the most modern F–16s flying around the world.

One of five QEAF Eurofighter Typhoons from 7 Squadron (1st Fighter Wing), Tamim Air Base.

One of four TuAF F–4E–2020 Phantom II, belonging to 111 Filo taking off. After a year of absence, they participated again at Anatolian Eagle.

A further ten F–16s from the Konya based 132 Filo provided Red Force participants. Additionally, one Boeing KC–135R Stratotanker was allocated to the exercise which operated from its home base at Incirlik. Also, a pair of Unmanned Aerial Vehicles from 302 Filo in the shape of a TAI Anka–S and a Bayraktar Akinci Unmanned Combat Aerial Vehicle, which also reportedly operated from their home bases. There was also participation from the Turkish Navy.

Testing

The cooperation between Azerbaijan and Turkey is developing more and more. Even the Turkish aviation industry is helping with the modernisation and testing of new systems. Two Su–25 aircraft of the Azerbaijani Air Force have been subjected to extensive avionic modernisation using the experience gained in the ÖZGUR Project. This includes the ability to carry air–air, air–to–space munitions, and data–link pods (such as ASELPOD, EHPOD and EDPOD) produced by Turkish defence and aviation industry companies. During Anatolian Eagle, an Azerbaijani Su–25 was noted flying with what appeared to be a pair of 1000 lb bombs fitted with Wing Assistance Guidance Kits. The KGK converts unguided 500lb and 1000lb bombs into smart munitions and significantly increases their range. It is reported that the Azerbaijan Air Force has ordered 1000 kits. The aircraft returned minus one bomb. The Su–25 was observed flying with a 132 Filo F–16C in a digital camouflage scheme. This aircraft arrived that morning and is believed to be the first Block 30 aircraft to receive upgrades as part of the Özgür (Liberty) Project. This upgrade replaces critical avionics with domestic components, in particular an Indigenous Mission Computer with locally produced software. Also being replaced is the Identification Friend or Foe (IFF) equipment and another significant upgrade will be the replacement of the original radar with the locally–produced MURAD Active Electronically Scanned Array (AESA) radar, developed by Aselsan. This will provide a significant improvement to the aircraft's capabilities compared to its current radar.

Text and Photos:
Erik Bruijns and Fred van Peursem

A Pakistan Air Force F–16C Block 52 takes off for a morning mission. Each mission is aimed at working toward a common goal of defending against the imaginary enemy.

Exercise Air Defender 2023

Peter ten Berg recounts the exercise and gives details on...

After years of extensive and thorough preparation, one of the largest exercises took off over Germany and surrounding countries early June, "Air Defender 2023". According the German organisers, the size of this international exercise had not be seen before and therefore unique according earlier NATO standards. Around 250 aircraft and 10,000 servicemen out of 25 countries, were only some of the key figures which underlined the enormous scale of the air drill of NATO members over North–West Europe.

X–large

International exercises often try to have the majority of participants gathered at one base, to leverage on logistic and support, but also benefit with multi force mission briefings for flight crew as well as mass de–briefs to gain insight and understanding for the overall missions. Exercise samples include the US "Red Flag", "Anatolian Eagle" in Turkey and "Iniochos" in Greece. For Air Defender (AD) this was no option due to the extra large size this exercise was aiming at. Throughout Germany, airfields were selected to base the aircraft which were all close to 3 defined airspace areas dedicated for the area. A central role was assigned for Northern Germany with Main Operating Bases (MOB) Schleswig–Jagel and only 15km further away located Hohn, where a majority of the international fighter aircraft were based. 200 kms south of the fighter MOB's, was Wunstorf, homebase of the Airbus A–400 transport fleet of the German 62nd Transport Wing and for Air Defender acting as the main logistic hub port. Other important airfields with based and or deployed exercise aircraft included Lechfeld, Neuburg, Laage, Spangdahlem and Geilenkirchen. Additionally some foreign countries had their aircraft operating out of their home base, like Dutch F–16's and F–35's, Belgian F–16's and Polish F–16's, or foreign airbases acted as temporary Forward Operating Base (FOB) like Lielvarde in Baltic state Latvia and Caslav in the Czech Republic.

2018

German Air Force Inspector General Ingo Gerhartz explained that the Air Defender exercise had nothing to do with the invasion of Russia into Ukraine of February last year and the subsequent war. General Gerhartz explained to media that the Air Defender exercise is of such a size that years of planning are essential and that

is why the original planning for this exercise started already in 2018. Sample element is to make additional agreements with Air Traffic Control when daily more than 100 of additional flights have to be safely separated from the civil aviation in the already extensive used German air space. However General Gerhartz addressed that the essence and importance of the Air Defender exercise was being born after the annexation of the Crimea peninsula of Ukraine by Russia in 2014. It is important that we as NATO regularly train and work together for mutual understanding on procedures and tactics. Moreover, General Gerhartz considers it as an important message when you can show that you can bring together large forces, not only from relatively nearby European members, but also assets out of the US which have to cross the Atlantic escorted by a considerable force of tanker aircraft for aerial refuelling. Also the high number of daily missions in multi–national settings and a variety of aircraft, is a clear sign that NATO members perfectly integrate and conduct together valuable missions, leaning on embedded standard NATO procedures. To maintain such a high level of integrated operations, General Gerhartz stresses the need to train together and the need to have exercises like Air Defender 2023. Last April, during a preparational press conference in the US, the German AF general mentioned that in the situation of an occurring crisis, the air forces will be of special importance thanks to their rapid reaction capability. Therefore it isessential to train and demonstrate this capability in the sense of credible NATO collective defence in the Air Defender 2023 exercise: "We must show everyone that we are capable of defending our shared values of freedom and democracy within this Alliance when it comes to the point", as General Gerhartz concluded.

MAGDAYS

The initial years of planning Air Defender were done by several groups of German military servicemen under NATO authority. Multinational Air Group Exercise (MAGEX) formats were developed and operationally ready large–scale flying units had to be established towards a required demonstration of initial operational capability in 2023 (being Air Defender). For preparational testing several smaller exercises were conducted under

the name of MAGDAYS and included up to 50 aircraft. A sample of a MAGDAYS exercise to test concepts was in 2020 when Israel deployed several aircraft including F–16's at Noervenich AB, Germany, for a joined training.

The decision to have the exercise centre at MOB's Jagel and Hohn, impacted Jagelless than Hohn. Schleswig–Jagel is home base of 51st Tactical Air Wing flying the Tornado and therefore in basic used to daily fighter aircraft operations. The base has also experienced increases of flight operations during regular temporary aircraft detachments, even up to hosting a large international aircraft community during earlier Tiger Meets. Hohn AB had seen its last major military activity until 2013, when the 63 Transport Wing terminated their activities. Over the last years, Hohn was in use by civilian operator GFD Aviation flying Learjets mainly contracted the German air force for simulation flights for Tornado and Eurofighter crews. In 2019 the German AF re–activated Hohn again as a diversion base, but with the decision to act as a MOB for Air Defender, the base received construction work to ramps and taxi ways. The months before the exercise, both Jagel and Hohn received temporary housing, catering and social facilities to host the detached units. Additionally fire–fighting units, including crash tender trucks, were deployed to Hohn to assure safety during flight ops.

Participants

Roughly 2 years before the exercise, nations were informed about the event with its possibilities and opportunities, so air forces were able to assess and determine if these goals would match their own objectives and planning. The impressive list of Air Defender 2023 representing 25 different nations, may give a sign that the exercise approach and objectives were of interest for many defence forces to participate. Next to the firm number of aircraft of host nation Germany, the USA was the largest contributor, mainly with Air National Guard fighter units next to a considerable force of transport and tanker aircraft. ANG fighter aircraft included F–15C's from Massachusetts and Louisiana, F–16's from Colorado and South Dakota and A–10's from Michigan, Idaho and Maryland. Vermont ANG came to AD with the 5th generation fighter platform, the F–35 "Lightning II". Next to the ANG, the US contributed furthermore with 8 F/A–18 Hornets from the US Navy. These navy assets arrived almost 1.5 week before the exercise start and came from the latest commissioned US aircraft carrier, CVN–78, the USS Gerald R. Ford. The Ford with embarked Carrier Air Wing (CVW) 8 launched 2 "Growlers", 4 F/A–18E's and 2 F/A–18F's for Hohn AB while sailing at the North Sea, before the carrier and its accompanying vessels continued their way up north to the Arctic circle, to participate in exercise Arctic Challenge 2023. Next to numerous C–17's, responsible for the transatlantic unit transport support flights, a logistic hub with approximately 10 ANG C–130's was installed at Wunstorf AB. From here flights were conducted to the US units deployed throughout Germany to be followed later on by missions for specific

Air Defender operations. Furthermore KC–135 and KC–46 tanker aircraft were deployed to European airbases, including Spangdahlem, Ramsteinand Geilenkirchen, all in Germany. The exercise was finally supported by Remotely Piloted Aircraft Systems (RPAS), being US ANG RQ–9's operating out of the Czech Republic. Other nations aircraft deployed to Germany included Hungarian Gripens and Turkish F–16's at Schleswig–Jagel, British Typhoons and Finnish F/A–18's at Hohn, Spanish Eurofighters at Neuburg and Greek F–16's at Lechfeld. The remainder of the German or foreign participants flew their operations for Air Defender out of their home bases.

Missions

For Air Defender, 3 main exercise airspaces were appointed. The largest was west of Hohn and Jagel air bases, over the North Sea. Another was over Eastern Germany, ranging from the Baltic Sea in the North to the city of Leipzig, more south. The 3rd and final exercise area was mainly over southern Germany, towards the northeastern direction of Ramstein. Three daily time slots were available for missions of which the first from 10.00 until 14.00 had a focus on the eastern exercise area. The slot from 13.00 until 17.00 concentrated on the south while the area over the North Sea had the slot from 16.00 to 20.00. In the general, the exercise flight levels ranged between 2,500 and 15,000 meters, where aerial refueling were executed at levels between 3,000 and 10,000 meters. Low level flights for fighter and transport aircraft, was reserved to some specific areas in the eastern exercise domain. One of the exercise scenarios was around the German city of Rostock, located at the East Sea, where enemy forces had overtaken the port of Rostock. The scenario worked around to re–gain control over the port and other critical infrastructure elements. At a certain moment, up to around 60 aircraft were active in the Rostock area. The planned scenario developments, evolved during the day and continued with focus to the other 2 areas. Next to the on–going

operations in the 3 appointed exercise areas, there were also regularly return flights planned of several fighter or transport aircraft to FOB's in the Baltic states and Black Sea area to have the regions at NATO's eastern flank connected with the exercise. Also for this reason, a detachment of 6 A–10 "Warthogs" of Maryland ANG was deployed during the first week of Air Defender at Amari AB, Estonia.

Planning and execution

For the 2 weeks of Air Defender 2023, about 2,000 missions were planned for all fighter, transport and tanker aircraft together, which indicates more than 200 missions a day. In order to plan and prepare a mission, all assigned flight crews receive an Air Tasking Order (ATO), which describes them in detail their individual tasks and responsibilities. An ATO includes elements like exact timings, coordinates, flight levels, codes, radio frequencies, aerial refueling details and possible info of hostile threats. The crews now have to make a tactical plan for the execution of the mission and will do this together with other flight crews assigned to the same mission. At Schleswig–Jagel AB, 3 planning rooms and 3 briefing rooms were installed, one room for each of the 3 exercise areas. In this Fighter OPS area, also the combat information centre, the tactical preparations are done in order that every crew knows exactly his role and actions in the mission. Prior to the mission, a briefing takes place where all elements are addressed and added with actual information, such as the weather situation enroute and on target. Once airborne, the flight crews are in contact with the specific assigned Control and Reporting Centre (CRC) and follow the ATO specified flight routes. When getting close to the target area, the flight crews get in contact with an E–3A AWACS radar aircraft of the NATO Airborne Early Warning & Control (NAEW&C) force, acting as on scene mission commander, providing actual information on air borne or ground based hostile forces. Depending on the mission, the AWACS can direct aircraft to other friendly aircraft in case of joined or combined attack or to provide protection like in Combat Air Patrols (CAP) or slow mover escort. Furthermore the AWACS can establish or direct contact of flight crews with ground based Joint Terminal Attack Controllers (JTAC), to receive target information. When the flight crews have returned to their bases after the mission, a de–brief takes place to analyse the mission, hear the overall and individual results and do further evaluation.

General Gerhartz concluded that the Air Defender mission scenarios were intense but of enormous value in the training of flight crews in large and multi–national operations.

After a drill of 2 weeks, Air Defender 2023 ended on 22 June and was summarised by General Ingo Gerhartz a day later while units started to re–deploy from the German air bases. Gerhartz mentioned that the exercise proved that NATO can rely on the defence and readiness capabilities of the joined air forces. The general addressed a special thank to the US ANG units who came with 100 aircraft, 3000 servicemen to Germany and were able to transfer about 1500 tons of equipment over the Atlantic in a matter of days. During the 10 days of the exercise, 808 missions were realised within 1800 flights, indicating that 90% of the planned missions were executed. General Gerhartz mentioned that some of the planned mission were cancelled mainly due to less favorable weather conditions. The exercise operations included 24 Composite Air Operations (COMAO), with an average of 52 aircraft.

Text and photos by Peter ten Berg

Air Defender 2023 in Germany foreign deployed assets

WUNSTORF (ETNW):
10 x C–130 Hercules US ANG
1 x C–27 Spartan Romanian AF

NEUBURG (ETSN):
3 x Eurofighter Spanish AF

HOHN (ETNH):
2 x EA–18 Growler US Navy (USS Ford)
6 x F/A–18 Super Hornet US Navy (USS Ford)
8 x F–15C Eagle US ANG (Maryland)
8 x F–15C Eagle US ANG (Louisiana)
4 x F/A–18 Hornet Finnish AF
4 x Typhoon RAF

SCHLESWIG (ETNS):
7 x F–16C Fighting Falcon US ANG (Colorado)
7 x F–16C Fighting Falcon US ANG (South Dakota)
6 x A–10C Thunderbolt II US ANG (Michigan)
6 x A–10C Thunderbolt II US ANG (Maryland) 1st week at Amari, Estonia
5 x JAS–39C Gripen Hungarian AF
3 x F–16 Fighting Falcon Turkish AF

SPANGDAHLEM (ETAD):
6 x F–35A Lightning II US ANG (Vermont)

RAMSTEIN (ETAR):
4 x KC–135 Stratotanker US ANG

LAAGE (ETNL):
2 x Eurofighter Italian AF

GEILENKIRCHEN (ETNG):
2 x KC–46A Pegasus US ANG
1 x KC–135 Stratotanker US ANG

LECHFELD (ETSL) :
6 x A–10C Thunderbolt II US ANG (Idaho)
3 x F–16 Fighting Falcon Greek AF


JZ

Baltic Debut for the Carpathian Vipers

This year was the first time in history, that the Romanian Air Force joined the NATO Baltic Air Policing mission with their Vipers. The introduction of the F–16AM Fighting Falcon on the scene in the Baltic's is a milestone for the Romanians after a period of hard work. The Romanian Air Force is partnering up with the Portuguese Air Force during the debut of its Vipers. It is not a coincidence that these countries collaborate at the Baltic, since Romania bought its current F–16 fleet from the Portuguese Air Force. Let's dive deeper in this achievement co–operation between these two NATO forces.

The Lithuanian Šiauliai Air Base has been, for more than 20 years, a symbol of NATO's determination for the collective defence of the European skies in the Baltic region. The Baltic Air Policing (BAP) mission is a NATO air defence Quick Reaction Alert (QRA) in order to guard the airspace above the three Baltic countries of Estonia, Latvia and Lithuania and also, the north of Poland. The BAP started in 2004 at Siauliai air base in Lithuania. Since May of 2014, the mission has been expanded to other airfields as they were ready to house NATO BAP deployments. These include Ämari in Estonia and Malbork in Northern Poland. Every single NATO country has participated in these missions from one of these locations. This fact alone portrays how NATO is prepared and willing to defend its own territory against intruders. In recent

times, NATO has been involved in one of the most dangerous military conflicts in Europe since the Second World War. The Baltic Sea region is a sensitive region on the Eastern flank of Europe where, on a weekly basis, aircraft from NATO intercept Russian fighters close to its borders. The tensions between the West and Russia have been on a high since the outbreak of the Ukrainian War. In the past, the defence of Europe was never in NATO's hands, although, the situation has changed in current times. It requires flexibility and commitment on the part of NATO and its partners, to employ their assets and ensure collective control of their airspace and territory.

The Portuguese and Romanian F–16 Fighting Falcon detachments are handling this important mission until the end of July this year. Since early December 2022, the Polish and French detachments secured the skies above, operating from the Šiauliai Air Base, conducting around 50 alert scrambles. The Portuguese and Romanians took over the mission from the French and Polish detachments during March of this year. The detachments maintained a readiness of 24/7, vigilance and

responsiveness. At the same time, they flew combined and joint missions with regional allies and partners. The Portuguese F–16 unit holds the distinction of this being their fifth deployment as a lead nation for the Baltic Air Policing missions. Portugal has been involved in these missions on countless occasions, such as: 2007, 2014, 2016 and 2018. They even joined the mission as supplemental nation in 2019, 2020 and 2021. Besides supporting NATO missions in the Northern Baltic region, Portugal regularly contributes towards assurance measures and enhanced Air Policing in the Southern Baltic region, underlining its commitment to collective defence and solidarity. The F–16s of the Portuguese Air Force belong to the 301 Squadron which is based out of the Monte–Real

Air Base in Portugal. The Portuguese detachment consists of four F–16AM Fighting Falcons.

For Romania, the present BAP deployment is their second one, post joining the Baltic Air Policing in 2007 as the 12th ally. During their first deployment, the Romanian MiG–21 LanceR jets patrolled the skies from August to November of 2007. The present Romanian detachment is led by Colonel Cosmin Vlad (NATO OF–5) and is the first Romanian BAP team operating with the F–16AM Fighting Falcon. Romania bought these upgraded aircraft from Portugal. The combined mission of both nations under the NATO flag is a proof of their consistent co–operation. Colonel Vlad has a long history in the Romanian Air Force. His first assignment in the air force was in the year 2000. Vlad has completed more than 1000 flight hours and is currently serving as the Detachment Commander (Detco) of the Romanian Detachment in Šiauliai. As Detco, Vlad is not flying actively himself. His role is to lead the detachment and guide the personnel of the Viper Wing. The current Romanian detachment consists of almost 100 personnel. The participating contingent arrived on 25 March 2023 and the mission started on 1 April 2023. According to Vlad, the Romanian mission will end on 1 August 2023. The contingent is drawn from the 53rd Fighter Squadron (Escadrila 53 Vanatoare or 53 FS) of the Romanian Air Force stationed at its 86th Airbase, located in Borcea. The unit is also known as the "Warhawks." Currently the 53 FS is the only unit in Romania operating the F–16AM/BM Fighting Falcon. The Romanian detachment consists of four F–16's. The detachment of the designated personnel has had the privilege of wearing the honorary name of "Carpathian Vipers." Vlad explains that they currently have 10 pilots who are serving on a rotatory basis during the BAP mission. "Currently we are halfway through the mission, and about half of the pilots here in Lithuania will soon be replaced by a new group of pilots from Romania for the second half of the mission."

The Romanians have a varied level of experience among the pilots involved. According to Vlad the ratio of experienced pilots to younger pilot stands at 50:50. All pilots are fully qualified for the job as this is not

training, but real deal deployment where the skies of Europe are guarded. The young pilots are mission ready, both in the role of flight lead and wingman. In Romania, the pilots have performed same kind of missions. "We are using the same procedures and TTPs (Tactics, Techniques & Procedures), the only difference is that in Romania, the Air Policing mission is under the control of the CAOC (Combined Air Operations Centre) in Torrejon while here we are under control of the CAOC in Uedem, Germany." Colonel Vlad explains how a mission like the BAP starts for the Romanian Air Force. "First, it began as a voluntary deployment. Normally, in Romania, the services send a proposal to the Joint Force Command followed by the Ministry of Defence for approval. The proposal is then submitted to the National Security Council. In the end, it is a political–military decision." After approval for the BAP missions, the Romanians have to work up a plan for the same. "We had a complex work–up plan that included months of preparation, intense training and tough evaluations. At the end of this period, the "Carpathian Vipers" Detachment was certified to participate in the NATO Air Policing Mission in the Baltic's. Overcoming maintenance and operational challenges, the detachment managed through hard work and dedication to deploy in due time, complete the handing and taking over from our French partners and declare the Full Operational Capability in accordance with the NATO AIRCOM

(NATO Allied Air Command) timeline and intentions."

Six days after taking over the Baltic Air Policing mission at Šiauliai Air Base, two Romanian F–16 fighter jets were scrambled by the Combined Air Operations Center in Uedem, Germany. The aircraft were, for the first time, able to respond to an air incident in international airspace over the Baltic Sea. A formation of two unidentified aircraft was detected flying over international waters within the NATO area of responsibility. The aircraft involved did not communicate their identity and were not in contact with civilian Air Traffic Control agencies. In line with the Alliance's standard procedure, the Romanian F–16s were scrambled and subsequently identified two Russian Sukhoi Su–27 "Flanker" fighter jets. After conducting the intercept and the identification maneuver in a professional manner, the NATO jets safely escorted the Russian aircraft and returned to Šiauliai Air Base. "The successful completion of the first scramble task within the enhanced Air Policing mission in the Baltic states confirms the high level of readiness of the "Carpathian Vipers" detachment to secure the skies and the ability of the Romanian Air Force to deploy and use

our F–16 aircraft in NATO missions" stated the commander of the F–16 detachment. Since the beginning of the mission in the Baltics, the Romanians have flown over 100 sorties halfway through their mission period. According to Vlad, approximately 10 aircraft, like the incident involving Su–27 were intercepted by the Romanian and Portuguese Air Forces. Regarding the deployment in the Baltics, until now, Vlad was clear in his answers, "We have collected some of the lessons identified, and have implemented them in our deployment check–list or in the SOPs (Standard Operating Procedures). For sure, all of them are going to make our life easier in future deployments." He is very satisfied with the result, while working together with the Portuguese Air Force. On the question if the Romanians will come back for a future BAP, Vlad was clear, "As I stated at the beginning, this is more a

political–military decision, but most likely we will be here again in the near future."

Colonel Mihaita Marin "Mitza", is currently the Deputy Detachment Commander for the flying ops at Šiauliai. Mitza is a very experienced pilot in the Romanian Air Force. He gained his wings 19 years ago in 2004. Currently he has 1800 flight hours on his name of which about 1100 on the Viper. Mitza was the lead pilot who joined the Lithuanian C–27J Spartan for the formation shoot. The Romanian jets flew under the callsign Warhawk 01 to 04 which is typical as this is the name of the 53 Fighter Squadron. Mitza explained, "We had a common briefing with the media in the morning, followed by our regular mission briefing. In total, I would say the entire morning of the first day was preparing for the flight in the afternoon." The media shoot was performed along the western coast of Lithuania and above Siauliai AB, where the BAP mission is located. "Escorting a slow mover like the Spartan is a challenge," stated Mitza. A plane like a Spartan is flying much slower than the Viper does which makes it difficult to form a formation for an escort. Escorting a Spartan like in today's mission is an important training for the Viper pilots.

Also under operational circumstances the pilots intercept slow moving aircraft high above the Baltic Sea. Mitza is already involved in the BAP mission since the start in March. Also Mitza learned a lot and gained mainly a lot of experiences during the Romanian BAP mission. Mitza explains, "The best is the huge number of opportunities to train together with almost all the platforms and troops that could be imagined. The very best is that on every training or real mission we have proved, mainly to ourselves, but to the others also, that we are fully inter operable and trustworthy," Mitza end his story about the deployment with his experiences, "Probably the most important aspect is that this is for our squadron the first deployment abroad with the Viper. It was not planned like this, but the Ukrainian War cancelled all our practice deployments in 2022, therefore we had to go straight to operational flights. Half way through the mission, all the feedback shows that we are doing the job, and more important, all the airmen see that their training pays off and there's nothing better than the 'feel good about my job' sentiment." The Air Force of Romania is next to the BAP mission on its way to become future proof. Currently the fighter fleet exists of seventeen F–16AM/BM Fighting Falcon aircraft which were bought from the Portuguese Air Force. Halfway during the Romanian BAP mission the country said goodbye to the aging MiG–21 LanceR fleet in Romania. On 15 May 2023, the last MiG–21 LanceR took off from the 71st Air Base "General Emanoil Ionescu" located in Câmpia Turzii after more than 60 years of service in the Romanian Air Force. This fighter and interceptor jet entered service with the Romanian Air Force in 1962. For over six decades it was the fighter aircraft that watched over Romania's skies when the country was a non–aligned State. With the membership of NATO in 2004, the upgraded MiG–21 LanceR contributed to the NATO Air Policing in Romania for over a quarter of a century. From August to November 2007, Romania deployed four of their MiG–21 LanceR aircraft to lead NATO's Baltic Air Policing mission in Lithuania, Estonia and Latvia which was at that moment an incredible achievement for the country. The 'Carpathian Vipers' joined the national air policing missions for the first time in 2019. Now the MiG–21 is retired from duty, the Viper took fully over this task. Romania has joined NATO's F–16 user community which has already a long history in Europe and America. At the end of 2022 the government of Romania announced that the country would purchase another batch of 32 F–16AM/BM fighters. The planes in this batch will be bought from Norway. The Norwegian Air Force is currently already operational with the F–35A Lightning II. The usage of the F–16s during the BAP mission showed already what the capabilities are of the Romanian Air Force and its staff. This will only grow with the purchase of more aircraft. About his period until now about the BAP, Vlad was very clear, "The level of interoperability and integration between NATO allies and partners is incredible! Quite a few large air engagements (with 10 or more aircraft) are planned and executed in a very short time frame (sometimes in just one day). Formations have a diverse composition of mostly four or more types of aircraft from different nations. This definitely increases our confidence in the alliance and demonstrates that “stronger together" is not just a concept on a paper." With this words Vlad is pointing out that he is very proud to be part of the NATO alliance with Romania and Portugal. Especially in this period where Europe is on the move it is important to work together and defend the common goods within the alliance. Vlad ended his story with some words about the Lithuanian host, "I have a special thought and consideration for our Lithuanian partners who have constantly supported our mission here from the very beginning.

None of this would have been possible without their dedication and hard work, thank you!”

Text: Alex van Noije and Joris van Boven
Photos: NATO AIRCOM – Arnaud Chamberlin

Melsbroek (Belgium) and 15th Wing

An Open Day was organised on the Pentacost weekend on 27 and 28 May 2023 at the Belgian airbase Melsbroek (ICAO code: EBMB) on the occasion of the 75th anniversary of the 15th Wing, the transport unit of the Belgian Air Force. The Melsbroek military airbase is located on the northern side of Brussels Airport.

Since 2021, the 15th Wing has exchanged the Lockheed C–130 Hercules for the Airbus A400M.

The static show displayed a Luxembourg A400M, a Dutch C–130 Hercules, an MMU A330 MRTT tanker and a C–47 Dakota / Skytrain. More A400Ms were seen in the hangars, while other A400Ms were used for maiden flights and for an 'assault' demonstration. During this 'assault' demonstration, soldiers and two vehicles emerged from the A400M to carry out a ground attack in front of the public.

At the same time, the flight service of the Belgian federal police (DAFA) also had an Open Day because of its 30th anniversary; this helicopter unit is also based at the military airbase of Melsbroek. Various helicopter demonstrations were shown, such as firefighting, Search and Rescue from a boat on a trailer, 'fastroping' in which police units leave the helicopter by rope and a dog demonstration in which the dog is put on the ground from the helicopter to catch a suspect. On this sunny day, thousands of visitors visited Melsbroek Air Base to see the aircraft and helicopters in action.

Photos and text: Joris van Boven

All photos by Joris van Boven

Romania withdraws the MiG–21

Final break before final landing

The clock displayed 13:04 on 15 May 2023, when Cpt Cdr (Wing Commander) Bogdan Madalin of the Romanian Air Force (RoAF) flying MiG–21 LanceR–C number 6607 touched down on the runway of Bacau airbase, in the country's north east. His landing will go in to the history books as the final landing of a MiG–21 of the RoAF.

The Romanian Air Force received its first MiG–21 in February of 1962. Deliveries continued until 1990, with the RoAF acquiring more than 320 examples.

After the MiG–21F–13, the Romanians received the MiG–21PF, MiG–21PFM as well as the reconnaissance variant of the Fishbed, the MiG–21R. Starting in the early seventies, more than 130 MiG–21M/MF aircraft were received. For training purposes the MiG–21U/US/UM two seat variants were in use, with a couple of second hand MiG–21UM aircraft arriving in 1990 being the last MiG–21s delivered to Romania. Over the years, more than 75 aircraft were lost in crashes claiming an unknown number of pilot's lives. Exact statistics are hard to come by as the Socialist Republic of Romania, as the country was known between 1947 and 1989, tried very hard to keep every detail regarding their military a secret.

Cpt Cdr Bogdan Madalin after MiG–21 final flight

Following the political changes in Eastern Europe during the late eighties and early nineties, Romania became more Western oriented and its government started working towards both North Atlantic Treaty Organisation (NATO) and European Union (EU) membership which it eventually achieved in 2004 and 2007 respectively.

While on a limited budget but in dire need of modernisation and alignment with NATO, the RoAF opted to upgrade part of its MiG–21 fleet to LanceR standard. The upgrade was developed by Elbit Systems of Israel with most work undertaken at the Aerostar facility in Bacau. A total of 112 MiG–21M/MF/UM aircraft were converted between 1995 and 2003. The introduction of the LanceR allowed to RoAF to withdraw its remaining MiG–21PF and MiG–21PFM aircraft, as well as the fleet of 35 MiG–23MFs and a handful of MiG–29s (out of 21 examples delivered) still in use. Earlier, during the late nineties, the RoAF had already grounded its fleet of IAR–93 Vulturs, a locally developed Jaguar–like aircraft in use for the air–to–ground mission after this type proved to

Last pilot Cpt Cdr Bogdan Madalin preparing for final engine shutdown

Cpt Cdr Adrian Trifa after final flight

Line up of Romanian Lancers after final flight

MiG–21 LanceR C cockpit

difficult and expensive to maintain.

The LanceR–A dedicated air–to–ground variant is equipped with the Elta EL/M–2001B radar. This is a small, dual–mode pulse–Doppler radar used for ranging only. Elta claims it displays excellent performance in heavy ground clutter (air–to–ground missions) as well as remaining clutter–free in very low altitude air–to–air missions. A total of 73 MiG–21M and MiG–21MF aircraft were converted to the air–to–ground LanceR–A version and the type was already grounded by the year 2011.

The LanceR–C air–to–air version carries the Elta EL/M–2032 radar. This is an advanced pulse Doppler, multimode planar array fire–control radar. It is suitable for both air–to–air and air–to–ground modes. The EL/M–2032 offers a broad range of operational modes, including high–resolution mapping in Synthetic Aperture Radar mode, detection, tracking, and imaging of aircraft, moving ground and sea targets.

This radar has also been integrated with Indian platforms, as part of modernisation programmes of the Sea Harrier. It was also selected for new fighters, including the Indian HAL Tejas Mark 1 Light Combat Aircraft. Furthermore, this radar can be found in the Korean T–50 family of aircraft.

The LanceR–C aircraft of the RoAF could be armed with Russian air–to–air missiles like the R–60 and R–73, but could also carry and fire the Israeli produced Python 3 as well as the French Matra R550 Magic II.

For target identification and weapon guidance the aircraft could be equipped with the Rafael Litening targeting pod on the centerline station. The LanceR family of aircraft could expend laser guided munitions thanks to the Litening pod.

The Israeli Elta EL/L–8222 ECM–pod was aquired to provide protection against all types of air–to–air and surface–to–air threats in a dense radar–guided weapons system environment.

The LanceRs are equipped with Multi–Function Displays in the cockpit (one each for the LanceR–A and –B, two for the LanceR–C) as well as a Head Up Display developed by Elbit Systems.

Then older Russian pilot helmets in use were replaced by the Elbit DASH (Display And Sight Helmet) which displays vital flight and targeting information on the pilot's visor.

Following a fatal LanceR–C crash on 2 March 2022 flight operations with the remaining tendual seat LanceR–B and 18air–to–air LanceR–C aircraft based at the 71st airbase (Campia Turzii) and 86th airbase (Borcea) were suspended.

After a thorough investigation, the grounding order was lifted on 23 May of the same year but at the same time it was announced the fleet would be permanently retired on 15 May 2023.

This date saw simultaneous retirement ceremonies taking place at both Campia Turzii and Borcea airbases. Each base then launced its final three LanceR aircraft for the flight to Bacau airbase with both formations overhead the latter base just before 13:00.

The six jets, piloted by Capitan (Flight Lieutenant) Tudor Dura, Locotenent Comandor (Squadron Leader) Romina Mirza, the Capitan

Comandors (Wing Commander) Adrian Trifa and Bogdan Madalin, and the Comandors (Group Captain) Silviu Marincas and Mihail Zamfirescu, landed one by one signalling the end of 61 years of Romanian Air Force MiG–21 operations.

The six LanceRs joined a total of four LanceR–Bs and nine Lance R–Cs from both bases which had already been flown to Bacau for storage in the weeks prior. Single examples of both LanceR types were also handed over to the RoAF Technical School at Boboc on 12 May 2023, where they will see continued use as instructional airframes.

The last MiG–21 LanceR to touch down, LanceR–C number 6607 produced in 1975, was also the first LanceR–C conversion to roll out of the Aerostar facility on 26 November 1996.

For the occassion, the airbase at Bacau had opened its gates to local citizens and invited guests, with a fly by of locally based Puma helicopters and IAR–99 Soim jet trainers to commemorate the withdrawal of an iconic aircraft type. Following speeches by the Romanian Air Force commander and several dignities from the municipality of Bacau the assembled public, including many former MiG–21 pilots and technicians, was allowed a closer look at the six jets that had just shut down for the very last time. Shortly after her flight to Bacau, Lt Cdr Romina Mirza stated, "The last flight appeared a normal one but we knew it was the last take off from Campia Turzii, the last fly over, and finally, the last landing at Bacau which filled us with a profound feeling of sadness." Lt Cdr Mirza, only the second female MiG–21 pilot in Romania, will convert to the F–16 Fighting Falcon. Some of her colleagues will also convert to the F–16 while other, mainly older pilots, will transfer to either helicopters or transport aircraft. While awaiting the arrival of the 32 former Norwegian F–16s bought under the Peace Carpathian III programme the stored LanceRs at Bacau will be kept in good condition. Rumours about the fleet ending up in Ukraine floated around for a while, but given the recent green light by US President Biden for F–16 deliveries to the Ukrainian Air Force this seems highly unlikely.

For now, the Romanians rely on their fleet of 17 former Portuguese F–16s, consisting of 14 F–16AM single seat and three F–16BM twin seat aircraft. The first fourteen of these were delivered under the Peace Carpathian programme during 2016. Three more, deliveries of these having approved by the US Government under the Peace Carpathian II programme, flew to Romania in August of 2020.


MiG–21 Litening targeting pod

The contract for the earlier mentioned Norwegian machines was signed on 4 November 2022, with the US Government approving the transfer on 30 June 2023. The first of these aircraft will be delivered before the end of 2023 with the final one arriving during 2024. This will bring the total number of F–16s in RoAF service to 49. Ultimately, the RoAF wants to transition to a fifth generation fighter force, with the Lockheed Martin F–35 as the aircraft of choice. "The process of the modernisation of the Air Force will continue with the purchase of the latest–generation F–35 aircraft", the Romanian Presidential Office said in a statement issued on 11 April 2023. "These aircraft will allow the Romanian Air Force to achieve and maintain air superiority, a mandatory condition for ensuring sovereignty in the national airspace and, if necessary, its defence."

The number of jets to be purchased as well as the planned aquisition value were not disclosed. It is anticipated more details of the possible deal between Lockheed Martin and the Romanian government will be announced during 2024. With the withdrawal of the Romanian MiG–21 fleet only a single European operator still flies the MiG–21. The Republic of Croatia still operates a handful of upgraded MiG–21bis and MiG–21UM aircraft to maintain the country's sovereignty. These aircraft will be replaced by the Dassault Rafale during 2024, marking the end of the MiG–21 in Europe.

Article and photos: Robin Polderman


MiG–21 LanceR C being put through its paces

INTO THE UNKNOWN

On 9 October 2022 the first KC–390 was presented to the Portuguese Air Force during a ceremony at Beja air base (Photo: Embraer)

In March 2023, the Portuguese Air Force (Força Aérea Portuguesa–FAP) made a big step forward in their pursuit to integrate their newly acquired transport plane. The first Embraer FAP KC–390 Millennium multi–mission transport landed at Beja air base on 5 March. The KC–390 will undergo a phase of integration of NATO equipment and certifications by the Portuguese National Aeronautical Authority (AAN). The integration phase and AAN certification–related activities in Portugal will be handled by Embraer's Portuguese subsidiary OGMA in collaboration with the FAP. Once equipment integration and certification work is complete, the first aircraft will be officially handed over to the FAP. This is scheduled to be formally received in 2023. The final of five aircraft is scheduled for delivery in 2027.

Esquadra 506 badge

In August of 2019, the Government of Portugal signed a EUR 827 million (USD 894 million) contract with Embraer for the acquisition of five KC–390 Millennium aircraft, as part of FAP's process to modernise capabilities and increase readiness for public interest missions. The contract includes a Rheinmetall full flight simulator, maintenance of the fleet, an Elbit systems electronic warfare suite and related support, ground support equipment, maintenance of the V2500–E5 engine, medical evacuation (medevac) kits, the construction of new

Portugal FAPC–390 (Photo: Embraer)

Soon the new KC–390 will operate within several air forces in Europe and will likely be a go to transport aircraft to replace some C–130's (Photo: FAP)

The first FAP Millennium touches down at the Gavião Peixoto facility in Sao Paulo region (Photo: Embraer)

infrastructure and refurbishing existing infrastructure. The KC–390 aircraft meets all FAP requirements capable of performing various civilian missions, including humanitarian support, medical evacuation, search and rescue, and wildfire fighting, adding superior transport and launch capabilities for cargo and troops and in–flight refueling. It also includes NATO standard equipment, such as the Link–16 datalink system, a Mode 4/5 identification friend or foe transponder and communications equipment.

Starting up

506 Squadron "Rinocerontes" ("Rhinos") at Beja Air Base No 11 was officially activated on May 20, 2023. This is the fourth transport squadron that will be operated by the FAP, next to 501 Squadron "Bisontes" ("Bisons") flying the Lockheed C–130H, 502 Squadron "Elefantes" ("Elephants") flying the CASAC–295 M/MPA and 504 Squadron "Linces" ("Lynxes") flying the Dassault Falcon 50/900. The KC–390 was initially acquired to replace the aging C–130H's. The latter is set to be replaced in 2028, but this is currently not written in stone. Collins Aerospace is currently working on the C–130H in a modernisation effort, which the first fully upgraded airframe to be ready at the end of 2023. Serving as a contractor to OGMA, Collins will provide its Flight 2 after market avionics solution, which delivers the most cost–effective and lowest–risk CNS/ATM upgrade solution. Flight 2 transforms a federated analog system into a modern digital glass cockpit that provides commonality to commercial aircraft. Included in the avionics upgrade is a full glass cockpit with new primary flight displays, Required Navigation Performance/Area Navigation flight management system with high altitude release point, and computed air release point precision airdrop software.

This upgrade would enable the C–130H to work together with the KC–390 and focus on specific missions. Major Pousa, 506 squadron commander, explains, "The KC–390 was initially acquired to be a replacement for the C–130H, but with the capabilities of the KC–390 it is more than that. With the current knowledge, the Hercules is planned to be phased out in 2028.

There is however currently an upgrade programme ongoing on the Hercules, which is looking at the cockpit and not the engines or airframe. When we take the KC–390 into operations, it can do what two C–130's are currently doing, so the FAP will gain a lot more capabilities. With an ever growing need to reduce cost this will be a great advantage for the transport fleet of the FAP. We are planning for Initial Operational Capability (IOC) in 2024 followed by the Full Operational

The first KC–390 is still wearing its civil Embraer registration PT–ZDK. Soon it will fly under its new serial number 29601 (Photo: FAP)

Capability (FOC) in 2026."

Major Pousa, goes into more details about the KC–390 programme, "Portugal has always had a close relationship with Brazil and Embraer. We have OGMA, which is a subsidiary of Embraer, so we have close cooperation with our aviation industries. We started the programme in 2017 with the procurement process, in which the FAP looked at the capabilities of the new transport plane to come to a final decision. In August 2019, the ministry of defence decided to buy the KC–390 to replace the C–130. To replace the C–130 is not easy, because it is a well proven aircraft which is operated by many other armed forces, over the world. This gives advantages to the FAP, not only from spare parts point of view, but also from pilot and crew experience point of view. Following the decision for the procurement, the FAP started the process of filling in the details. Next to the number of planes and a simulator this also included how the qualification of the crews and maintenance personnel would be done. The first crew, two pilots and two load masters, started their training at the end of 2021. We were integrated within the Brazilian Air Force (FAB) finishing the course and maintained the qualifications in 2022. After finishing the course, we flew missions within the FAB on basic missions from Anapolis, near Brasilia."

Major Pousa continues on the current status of the programme, "After the first production aircraft arrived at Beja in March of this year, we started a round of certifications. The aircraft is currently still owned by Embraer. On some flights, we go onboard to supervise and see the certification of specific equipment that needs to be verified and confirmed by the FAP. We have a team of our own engineers that are doing these certifications, to ensure all the tests are being done as per our standards. The Embraer team in the meantime is working on integrating the NATO equipment as this is a completely new integration. Together with the Embraer team each flight is debriefed to check the status and discuss anything that needs to be improved for the next flight. At the moment, we are in a crucial phase. We are trying to keep up with the planning which has been set at the beginning of the programme. So, our main goal is to prevent any delays in the test phase, in order for us to not get behind on the upcoming tests. Currently we are still aiming to have the first aircraft handed over around September/October of 2023. Pilot and crew training is currently ongoing. We have one course per year with currently pilots and load masters coming from 501 Squadron, previously flying on the C–130. This includes four pilots and six load masters as well as 12 mechanics who are currently in Brazil. The aim is to have all these new pilots and crew completely qualified to start the missions in November of 2023. For the upcoming course, in 2024, we will have six pilots and six loadmasters going to Embraer in Brazil. These upcoming courses will receive pilots that have just graduated from the academy as well as more experienced pilots that have flown on the other transport squadrons. So, we will see more and more a mix of pilots that will be joining 506 squadron. The training courses are providing a good learning curve to the new crew as well as Embraer. The FAP is providing the first crew of a foreign armed force, so the feedback we give back is valuable to make the course and training even better."

The new KC–390 arrives at Beja for further testing and certification (Photo: FAP)

With the presence of the Prime Minister of Portugal, António Costa, the first KC–390 Millennium was presented in October 2022 at Beja (Photo: Embraer)

A drawing of the proposed boom configuration. This will expand the air to air refueling possibilities for the KC–390 and open up for potential new customers (Photo: Embraer)

Future operations

With the KC–390 set to be handed over at the end of 2023, the FAP is looking ahead at expanding their transport capabilities. Major Pousa provides more details: "The KC–390 will be able to carry out the same missions as we have been tasked with for many years on the C–130. This will include carrying out strategical and tactical airlift, civil and military operations, from transporting troops, vehicles and cargo, dropping paratroopers and cargo, health evacuations, and search and rescue missions. Going forward we will be able to add onto this, with the possibility to perform air to air refueling missions as both tanker and receiver. In addition to this, we are even looking at adding firefighting activities to the mission envelope. At the moment, we see firefighting activities only as a possibility, but it will bring with it a whole different set of challenges. How we use an airplane during such missions will put a lot of additional stress on the airframe. It will be a difficult decision to take on whether we will use the KC–390 for this. We do however see that we will gain a lot from operating the KC–390. Yes, we will mainly be performing the same missions, but the biggest difference is the speed of the aircraft. This will enable us to gain a lot of time in two ways. First of all, we can get to our destination in a shorter timeframe. And secondly, we can deliver more payload, saving us a lot of time. As example, our detachment in Lithuania or Iceland for instance. With the C–130H, we would need two aircraft and two days. We would fly out, stay there overnight due to the flying time before we can return to base. With the KC–390, we can deliver the same payload and return within the day. This will give us way more possibilities and flexibilities in how we transport troops and material to places far away. On top of that, the technology is more advanced and the aircraft will give us more fuel efficiency which saves Portugal money."

Major Pousa elaborates further on the use of the KC–390 in the air to air refueling role: "The possibility to refuel a plane in mid–air will provide the FAP with new possibilities for reaching places that are out of reach for our planes with their normal fuel load. With the current setup of the refueling system, we will not be able to provide fuel to our F–16's. Initially the KC–390 will be configured with a drogue system, which limits the mid–air refueling capabilities to specific types of aircraft. This is being discussed with Embraer and the possibility of adding a boom operated system into the KC–390 is being explored. Our main goal with the new mid–air refueling capabilities will be to sell our service to other armed forces in Europe. Many aircraft in Europe, like the Eurofighter and Rafale, are flying with the probe system for refueling in mid–air, so this will allow us to work closer together with our allies."

As the FAP has been the first armed force after the Brazilian Air Force to acquire the KC–390, they are paving the way for other countries to see the advantages of the new plane and get onboard. Major Pousa explains: "We have been working closely together with different European armed forces in the last couple of months as there has been a lot of interest into capabilities of the KC–390. We have had a visit of representatives of the Royal Netherlands Air Force, who have a similar contract with Embraer as the FAP has. So, they visited Beja to have a look at the new facilities and to get an update on the current status of the programme and what we are focusing on

A FAP pilot flying the KC–390 over Brazil (Photo: Embraer)

C–390 Millennium Users group enabling future and potential users of the KC–390 to learn more about the new aircraft (Photo: FAP)

at the moment. In addition to this, we had a C–390 Millennium Users Group', which was held at the end of March 2023 for interested countries. During this users group, we had representatives from the Netherlands, Hungary, the Czech Republic and Austria looking at presentations from ourselves as well as the Brazilian Air Force. This forum was set up to show them the specifics of the aircraft as well as share experience gained on the KC–390 so far. The amount of work we have done so far on the programme has been a great achievement. We have been working hard on all the certifications and making sure the new aircraft can be integrated into the FAP and NATO standards. Other countries will benefit from our work as they can start using it with minor adjustments and improvements. When you start using a completely new aircraft it is normal to find some minor issues. These points will be resolved quickly and not be an issue for other operators at a later stage. Next to the benefits from our initial work, other countries will also get a benefit from our simulator as the FAP will sell this service and make 506 squadron the main hub for KC–390 users in Europe."

Text: Erik Bruijns
Photos: as stated

The new KC–390 approaches Beja during the recent airshow, held on the 18 June 2023 (Photo: FAP)

Cento Anni dell' Aeronautica Militare

100 years of the Italian Air Force

On 28 March 1923, the Regia Aeronautica (Royal Air Force) was founded and Minister President Benito Mussolini wanted that Italy to become a world power. The first military operations where the Regia Aeronautica was involved were conducted in Ethiopia in 1935 and Spain between 1936 and 1939. On 10 June 1940, Italy entered World War II alongside Germany and after the armistice of 8 September 1943, Italy and also the Regia Aeronautica divided itself into two. The hostilities ended on 8 May 1945 and a referendum resulted in the proclamation of Italy as a Republic on 18 June 1946. Also the Regia Aeronautica was called Aeronautica Militare (Air Force) since that day!

The Paris Peace Treaty of 1947 placed severe restrictions on the Italian armed forces, but becoming a NATO member in 1949, opened the way for modernisation of the Aeronautica Militare. Through the mutual defence assistance programme, the Aeronautica Militare received American military aid in the form of P–51 Mustang, P–47 Thunderbolt and later the F–84, F–86 and C–119s. The Aeronautica Militare was not content with foreign–designed aircraft and the Italian aviation industry was reborn and began to develop and produce its own aircraft like the Fiat G–91, Aermacchi MB–326, Piaggio P166 and multiple Agusta–Bell helicopters. The Lockheed F–104G Starfighter was manufactured under license by Fiat and during the seventies, the Lockheed–Aeritalia F–104S, a fighter–variant of the Star fighter, was developed to meet the requirements of the Italian defence system. To improve and expand the aircraft industry, Italy joined the programme of the Panavia Tornado and developed and introduced the AMX together with Embraer. Nowadays, the Aeronautice Militare is flying the Eurofighter and the Lockheed Martin F–35 Lightning II.

To celebrate the 100 years anniversary of the Regia Aeronautica/ Aeronautica Militare, a lot of symposiums and events were organised throughout whole Italy. It started with the historical symposium on 15 February at the Palazzo Vecchio, Firenze. At the Piazza del Popolo in Rome was an exhibition with aircraft and a helicopter. On 28 March, almost all the airbases of the Aeronautice Militare were open to the public. The highlight of all the events was a flyby of

A total of 81 helicopters and aircraft participated in the flyby in the following formations:

- Formation 1 : 6x F–35, 8x EF–2000 and 8x T–346
- Formation 2 : 2x HH–139B, 1x VH–139A, 1x UH–139A and 2x AB–212AM
- Formation 3 : 3x HH–101A and 3x HH–101A
- Formation 4 : 4x P–180AM
- Formation 5 : 2x C–130J, 4x C–27J and 1x P–72A
- Formation 6 : 1x Beech 350 and 1x E–550A
- Formation 7 : 1x A–319, 1x Falcon 50 and 1x Falcon 900
- Formation 8 : 2x Tornado ECR and 6x Tornado IDS
- Formation 9 : 4x EF–200 and 4x T–346
- Formation 10 : 1x KC–767A, 1x F–35B, 2x EF–2000 and 2x T–346
- Formation 11 : 9x MB–339 Frecce Tricolori

helicopters and aircraft over the city centre of Rome!

The flyby began with not less than 22 aircraft that formed the numbers 100 to mark the 100 years anniversary of the Aeronautica Militare and it ended with the national Frecce Tricolore which made a few passes.

Guidonia Air Base

Guidonia air base is located 22 kilometers north–east of Rome and was founded in 1915 and intended to accommodate as a flying school where pilots were trained. After the newly formed Regia Aeronautica (Royal Air Force), the air base underwent a construction and the facilities of the Higher Directorate of Studies and Experiences, as well as the Experimental Flight Centre and the Aircraft Construction Plant for the development and construction of new aircraft were built at the air base.

Nowadays, these facilities are at Pratica di Mare air base and Guidonia is used again for training pilots. Guidonia is the home of 60° Stormo which consist of two Squadriglia; 422 Squadriglia and 423 Squadriglia. 422 Squadriglia is flying with Gliders like Grob G103, Lak17 and Nimbus 4D. The 423 Squadriglia is flying with S–208M.

In 1920, two SVA 9 biplanes flew from Rome to Tokyo, covering 18,000 kilometers in 106 days! This record flight was conducted with aircraft made in wood, with open cockpits and were not equipped with radios and navigation was done on watch and compass! To celebrate the 100th anniversary of this flight, two S–208s received special coloured tails. To celebrate the 100th anniversary of the Regia Aeronautica/ Aeronautice Militare, four S–208s received special colours.

Frosinone Air Base

Frosinone air base is located 74 kilometers south–east of Rome and was founded between 1936 and 1939 to train pilots. In the beginning, both fixed–wing and rotary–wing pilots were trained at Frosinone but in 1955, the training of fixed–wing pilots was transferred to nearby Latina air base. Latina air base is located 34 kilometers west of Frosinone and 52 kilometers south–east of Rome. Frosinone is the home of 72° Stormo–208° Gruppo and is flying the NH500E helicopter. The 72° Stormo is also responsible for the training of helicopter pilots for the Aviazione dell'Esercito, Carbineiri, Polizia di Stato, Vigilidel Fuoco and Guardia di Finanza. For this, the Aviazione dell'Esercito and Vigilidel Fuoco have their AB206s on temporary deployment at Frosinone.

Article and photos: Rene Sleegers
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All photos by Rene Sleegers


1923 - 2023


72-15


1923 - 2023


EI-639
ESERCITO


72-10

According to Turkish pilots, F–4 is still performing well in AG roles.

Anatolian Eagle 2023-2

Between 2–12 May 2023, the Türk Hava Kuvvetleri also known as the Turkish Air Force hosted the second International Anatolian Eagle multinational exercise (AE 2023–2) of the year at the 3rd Main Jet Base located in Konya, Central Turkey.

"We are happy to host allied and partner nations at the Anatolian Eagle Training Centre (AETC) command. Our airmen worked towards improving their skills and interoperability between the participating nations in training such as; Composite Air Operations, Time Sensitive Targeting, Dynamic Targeting, High–Value Airborne Asset Protection, and Anti–Surface Air Operations," stated Lieutenant Colonel Hakan Girgin, AETC commander.

The objective of the exercise is to prepare pilots and air defence personnel through working in an operational scenario that is as realistic as possible, developing joined and combined operational procedures, increasing mission effectiveness by giving the opportunity to the pilots for executing their planned tactics in large aerial packages and keeping attrition at a minimum. Finally, by training the participants as they fight, the exercise serves as a useful forum for the exchange of ideas and lessons learnt.

"AE 2023–2 Training stood out as an excellent opportunity to showcase the readiness of the systems, aircraft, and airmen of all participating nations," Lieutenant Colonel Girgin highlighted.

Since its establishment in 2001, more than 15 countries, 39,000 personnel and 2000 air assets have participated in 43 editions of the Anatolian Eagle for a total of around 26,000 sorties flown. The participants benefit off of large exercise areas over land and sea, a wide array of threat emitters and Air Combat Maneuvering Instrumentation System (ACMI). This provides them with an

Turkish F–16C taking off

opportunity to organize a full–scale exercise similar to Red Flag.

The exercise

The training scenario runs over a large surface area of 50,000 square miles and an airspace extending between 120NM and 216NM, and up to 50,000 feet from the ground. It consists of two imaginary nations: Blue (democratic, with a strong military power) opposed to Red (a poor country but with a good military power and a growing regional power). A pipeline passes through the Blue nation, near the border with the Red nation. The area adjacent to the pipeline is attacked by the Red forces and, the Blue forces are called to re–establish full sovereignty over the disputed territory and safeguard strategic infrastructure. Under the control of AETC operational command, the Blue forces conducted Combined Air Operations (COMAO), SEAD/DEAD, air superiority, CAP (Combat Air Patrol), CAS (Close Air Support) and other missions, against targets located within the Red country's borders, heavily defended by different types of weapons, from advanced SAM systems to 4 and 4.5 generation combat aircraft.

QEAF Eurofighter Typhoon

RAF Eurofighter Typhoon FGR4

Two missions were flown every day, with one in the morning (Eagle 1) and another in the afternoon (Eagle 2 NON COMAO), each with up to 40 aircraft involved. Success was only established when Air to Ground mission achieve at least 80% targets hit. While for air–to–air missions, the Blue forces were to suffer no more than 20% losses.

The participants

It is worth noting that, the participants in this edition of the AE reflect the latest geopolitical developments of Turkey towards Middle Eastern countries, portraying a gradual rapprochement with the latter after the diplomatic tensions in recent years.

In fact, besides the numerous aircraft from the host nation and the usual presence of NATO, Qatar, Azerbaijan and Pakistan, AE 2023–2 saw participation from the UAE, which sent to Konya four of their F–16E/F Block 60 "Desert Falcon" (considered by

F–16F Desert Falcon of the UAEAF

Pakistan Air Force F–16

Two Azeri Su–25

many the most advanced F–16 ever built). Furthermore, the presence of the Royal Saudi Air Force had been announced earlier, but at the last moment their participation was canceled due to unknown reasons.

The Qatar Emiri Air Force attended the exercise with five of its brand new Eurofighter Typhoons from the 7 Squadron (1st Fighter Wing), Tamim air base. This marked the debut of the Qatari Typhoons in an international exercise, just less than a year post the first deliveries of the same type (the first Typhoons arrived in Qatar on 27 August 2022). Four more Eurofighter Typhoons FGR4 were deployed by the Royal Air Force.

Another interesting debut at Anatolian Eagle was made by Pakistan Air Force, which sent five F–16C/D Block52, belonging to the 5 (MR) Squadron "Falcons", based out of Jacobabad/Shahbaz air base.

The Azerbaijan Air Force participated with a pair of Sukhoi Su–25 "Frogfoot" attack jets from Kurdamir air base. A single NATO E–3A AWACS (Konya is a Forward Operating Base for NATO's AEW&C Force) along with a Turkish E–737 "Wedgetail" Airborne Early Warning and Control (AEW&C) aircraft operated by the resident 131 Filo, provided real time battlefield overview, relay vectors and target priority, enhancing situational awareness for the fighters involved in the operations.

The large Turkish component making up the Blue force in the exercise consisted of one KC–135R tanker from the 101 Filo. One ANKA–S along with one AKINCI UAV of 302 Filo was tasked for recce missions. Four F–4E–2020 Phantom II belonging 111 Filo and F–16C/D from 113, 131, 151, 152, 161, 181 and 191 Filo and F–16C/Ds of 132 Filo, acted as a part of the Red force. A total of 34 Fighting Falcons were involved in AE 2023–2. The Turks also deployed SAM systems in order to expose aircrews to the threats that may occur in a real–time fighting environment.

Text and photos:
Fabrizio Capenti and
Simone Marcato

132 Filo's F–16C acted as an aggressor

A–10

Air Defender 2023: Air War in Europe

The Luftwaffe (German Air Force) organised NATO's largest air exercise since its inception in 1949. Air Defender 2023 (AD23) took place from 12 June until 22 June 2023.

According to official numbers 25 nations participated in the exercise involving 10,000 persons and 250 aircraft; around 100 of these belonging to United States Air Force and Air National Guard wings.

Almost all German Air Force bases were involved in the exercise which were augmented by the two reserve bases, Hohn in Northern Germany and Lechfeld in Southern Germany. Hohn lost its status as an air base after Lufttransportgeschwader 63 (LTG 63 – Air Transport Wing 63) was deactivated on 15 December 2021. Lechfeld air base lost its status when the resident Jagdbombergeschwader 32 (JBG 32 – Fighter/Bomber Wing) was deactivated on 31 March 2013. When needed the base is activated to support exercise or host visiting squadrons. It should be restored to an active air base in 2025 when several A400M's will be based here.

Except the German Air Force bases multiple bases in other NATO countries played an important part in AD23. The United Kingdom hosted several ANG aircraft flying their missions from Prestwick airport, Scotland while Czech, Danish, Dutch and Polish aircraft flew from their home bases with JAS–39, F–16 and F–35 fighters.

USAF Lead Wings and Agile Combat Employment

The United States Air Force is a process to transition to the service's new force generation model. The last twenty

A400M


EF–2000

years the USAF operated as a reactive force on permissive environments. With the role of China in Asia and Russia in Europe the service is changing its doctrine. Its mission changing to operate in contested environments and working together with coalition nations. At the same time the transition refines the Agile Combat Employment (ACE) and Multi–Capable Airmen concepts.

On 5 January 2022 commander of Air Combat Command Gen. Mark Kelly identified five lead wings. Another four fighter wings and one air base wings were identified as Lead Wings in Extremis, "A lead wing will act as the main group in charge of a team of aircraft from different bases and wings. Lead wings must be able to build a temporary airfield from scratch; organise command and control from there and provide air power".

Agile Combat Employment (ACE) saw squadrons operate from austere locations and with minimal support. Where at their home or other bases all material, vehicles etc are at hand, this was not the case at the deployed locations. A squadron must be able to conduct its mission from these locations. One of the examples used during ACE was the transfer of fuel by transport aircraft to fighter aircraft. This was done by C–130 Hercules transport aircraft refueling A–10's.

The ANG used the lead wing concept during AD23. Michigan's ANG 127th WG was designated the lead wing for the exercise. 30 members of the wing's air staff set up the command–and–control element.

Air National Guard

The largest participant was the Air National Guard. Each of the 50 United States and Puerto Rico have one or more wings based. In peacetime the ANG conducts its mission on behalf of the state governor. When needed to support deployments, exercises, humanitarian missions etc, the status of the ANG wings can be changed to active by the US DoD. These wings are then controlled by the USAF through its major commands.

26 states directly participated in AD23 with A–10C Thunderbolt II (Warthog), F–15C Eagle, F–16C Fighting Falcon (Viper), F–35A Lightning II, C–130H/J (Super) Hercules, KC–46A Pegasus and KC–135R Stratotanker operating from Germany. Several other ANG states supported their colleagues by transporting vehicles, equipment and personnel with the C–17A Globemaster III.

Fighter Wings

The three A–10 wings operated from Germany in the second week of the exercise. 175th WG flew its missions from Latvia during the first week. It then redeployed to Schleswig–Jagel joining its MI sisters. Lechfeld hosted the ID ANG.

Hohn air base was home for both F–15 squadrons. The Eagle community is in the middle of changes. In Japan, Pacific Air Forces 18th WG is saying goodbye to F–15 operations. Its Eagles flew to 173rd FW at Klamath Falls IAP (Kingsley Field), Oregon. After inspection the Eagles found their way to ANG squadrons or are sent to 309th AMARG for storage in the boneyard. The MA ANG took one former 18th WG Eagle with them, still coded ZZ as well as a former 53rd WG "OT" coded aircraft.

Schleswig–Jagel hosted the two original F–16 squadrons; South Dakota 114th FW and Colorado 140th WG. The later not only brought its special marked "first in the Air Guard" but also an F–16 received from the 100th FS, 187th FW, AL ANG. The wing is awaiting its first F–35A and had two of their F–16's painted with a red tail and AL tail code prior to distributing them to their colleagues.

As a surprise, at least for the aviation community, the MN ANG (148th FW, 179th FS, Duluth IAP) also arrived in Europe. Three F–16's of which two dual seaters arrived at Spangdahlem air base. A few days after their arrival, they started participating in AD23. The base already hosted six Vermont ANG F–35A's. It was the second deployment for the "Green Mountain Boys" assigned to the 158th FW, 134th FS. In 2022, the squadron relieved the 388th FW in support of NATO's enhanced Forward Presence (eFP).

Airlift Wings

Wunstorf, home to the Luftwaffe A400M fleet assigned to LTG 62 hosted the Hercules fleet. 10 different wings/states took up residence here a week prior to AD23. Most of the C–17

The Hercules detachment was led by the Illinois Air National Guard, 182nd AW.

ANG	Airlift Squadron	Airlift Wing	Aircraft	Base
AR	154th TRS	189th AW	C-130H	Little Rock AFB, AR
DE	142nd AS	166th AW	C-130H	Wilmington (New Castle County AP), DE
GA	158th AS	165th AW	C-130H	Savannah IAP, GA
IL	169th AS	182nd AW	C-130H	Greater Peoria Regional AP, IL
KY	165th AS	123rd AW	C-130J.30	Louisville (Standiford Field), KY
MN	109th AS	133rd AW	C-130H	Minneapolis St. Paul, MN
MO	180 thAS	139th AW	C-130H	St. Joseph (Rosecrans Memorial), MO
NV	192nd AS	152nd AW	C-130H	Reno - Tahoe IAP, NV
TX	181st AS	136th AW	C-130J.30	Fort Worth JRB, TX
WY	187th AS	153rd AW	C-130H	Cheyenne, WY


F/A–18

support flight arrived here with its cargo flown to all other bases by the C–130's. During AD23, the squadrons departing the base flew its missions throughout Europe the entire day. All left roughly a week after the exercise had ended and everything was flown back from all locations to Wunstorfand reloaded onto the Globemasters.


F–16s

Air Refueling Wings

At least eight Air Refueling Wings were supporting AD23. The Wisconsin ANG, 128th ARW, 126th ARS acted as the lead wing. The "normal" deployments will see tankers gather (for Europe) on the east coast with a KC–135R supporting a cell of max six aircraft on the first part of the leg, then returning to the USA. The Atlantic crossings were supported by the KC–10A,but this mission was transferred to the KC–46A. When needed a KC–135 flew towards the fighters to support the last part of the leg from the United Kingdom.

ANG	ARS	ARW	Aircraft	Base	Operating from
AK	168th ARS	168th ARW	KC-135R	Eielson AFB	Prestwick, UK
AL	106th ARS	117th ARW	KC-135R	Sumpter Smith	Ramstein, GER
				ANGB,	
IA	174th ARS	185th ARW	KC-135R	Sioux Gateway	Prestwick, UK
KS	117th ARS	190th ARW	KC-135R	Topeka-Forbes	Ramstein, GER
				Field	
MS	153rd ARS	186th ARW	KC-135R	Meridian / Key	Geilenkirchen,
				Field	GER
NE	173rd ARS	155th ARW	KC-135R	Lincoln Municipal	Ramstein, GER
				AP	
NH	133rd ARS	157th ARW	KC-46A	Pease ANGB	Geilenkirchen, GER
WI	126th ARS	128th ARW	KC-135R	Milwaukee	Ramstein, GER
					Prestwick, UK

AD23 saw a different approach. An air refueling element was set up at Keflavik air base, Iceland. KC–46A's were stationed here. Once a cell was airborne from the USA, the assigned Pegasus aircraft flew towards Canada for a rendezvous with the fighters accompanying them during the crossing. After reaching Europe, the KC–46's refueled their receivers one more time and then headed back to Iceland. During AD23, the air refuelers were operating from several locations.

United States Navy, Carrier Air Wing eight

USS Gerald R. Ford (CVN 78) is on its first deployment. The carrier visited Europe before but that was still during its work–up and test phase. Carrier Air Wing eight (CVW–8) is assigned and five of its squadrons participated in AD23.

Except the Bulls and Golden Warriors, one aircraft each, the squadrons participated with two Super

Squadron	Aircraft	Code	Base	Nickname
VFA-31	F/A-18E	AJ-3xx	NAS Oceana, VA	Tomcatters
VFA-37	F/A-18C	AJ-1xx	NAS Oceana, VA	Bulls
VFA-87	F/A-18E	AJ-4xx	NAS Oceana, VA	Golden Warriors
VFA-213	F/A-18F	AJ-2xx	NAS Oceana, VA	Black Lions
VAQ-142	EA-18G	AJ-5xx	NAS Whidbey Island, WA	The Gray Wolves

F–16

NATO members operating form their home, or deployed (Italy), bases:

Country	Aircraft	Air base	Comment
Czech Republic	JAS-39C/D	Caslav	
France	E-3F	Avord	
Italy	F-2000A	Constanta, Romania	eFP
NATO	A330MRTT (KC-30M)	Eindhoven and Cologne-Bonn	
Netherlands	F-16AM	Volkel	
Netherlands	F-35A	Volkel	313 and 322 sqn
Poland	F-16C/D	Poznan-Krzesiny	
United Kingdom	F-35B	RAF Marham	
United Kingdom	Voyager KC.2/3	RAF Brize Norton	
United States	B-1B	Ørland	BTF 23-3
United States	F-16C	Spangdahlem	

Hornets/Growlers. CVW–8 aircraft arrived at Hohn well ahead for the exercise on 31 May. The carriers supported the Artic Challenge Exercise off the Norwegian coast and also operated in the North Sea. During AD23 the USS Gerald R. Ford (CVN 78) relocated to the Mediterranean Sea.

German Air Force and other European NATO participants

The German Air Force took part with its EF–2000 and Tornado fighter aircraft. Its A400M flew both transport and air–to–air refueling missions. The aircraft can be fitted with refueling pods underneath its wings providing droqueand hose refueling capacity. Four H145M helicopters also participated. Due to major reconstruction work at their home bases TLG 33 operated from Norvenich and TLG 71 from Laage.

The Royal Air Force drew its participants from aircraft deployed to Estonia in support of the Baltic Air Policing Mission and Cyprus operation Shader. It's reported that 1(F) Squadron and 6 Squadron both based at RAF Lossiemouth are currently deployed to Estonia and Cyprus. The later also used its presence in Cyprus to participate at Anatolian Eagle in Konya, Turkey. Unfortunately, almost all RAF Typhoons do not carry their squadron batch which makes it difficult to assign an individual aircraft to a squadron.

Italy has its EF–2000 deployed to Romania in support of NATO eFP/Air Policing Mission. RAF Fairford hosted Bomber Task Force Europe 23–3 with the 9th Expeditionary Bomb Squadron deployed with its B–1B Lancer. When not deployed the 9th BS is based at Dyess AFB, Texas and subordinate to the 7th Bomb Wing.

With an exercise of this magnitude, it is not possible to keep track of all aircraft movements. Especially for aircraft operating from their home bases which conducted their regular training programmes as well. From the first day on aircrews conducted ACE missions which saw aircraft departing during the morning wave, only to return during the evening.

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

Eight NATO members deployed their aircraft to Germany:

Country	Aircraft	Number	Operating from
Hungary	JAS-39C/D	4 / 1	Schleswig-Jagel
Italy	F-2000A	2	Laage
Finland	F/A-18C	4	Hohn
Greece	F-16C	3	Lechfeld
Romania	C-27J	1	Wunstorf
Spain	EF-2000	3	Neuburg
Turkey	F-16C	3	Schleswig-Jagel
United Kingdom	Typhoon FGR.4	4	Hohn

C–130

EF–2000

F–15 and F–18s

F–35

F–16

F/A–18

JAS–39

Tornado

Air Marshal (R) Harish Masand says…

I learnt more than flying from them: GSN Prasad

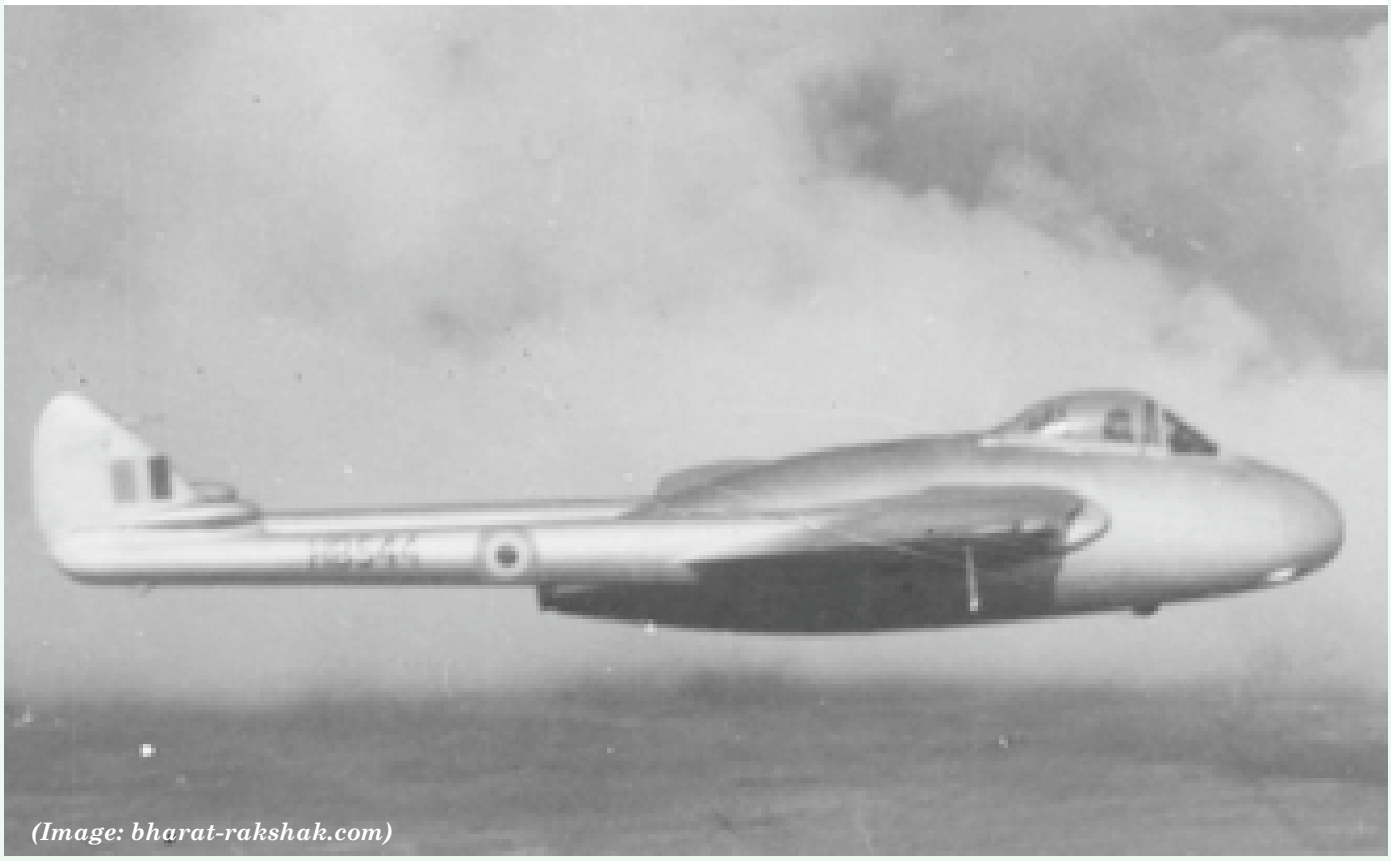
In mid–June 1967, I landed up in Jet Training Wing at Hakimpet (Secunderabad) to train as a fighter pilot on the Vampire after about 6 weeks of summer holidays at home. While the break was fun and I got to meet my family and friends including a lot of my classmates who were still going through their engineering course, I was somewhat on tenterhooks and eager to get back to flying and regain my confidence which had been dented a bit in the last stages of my training on the Harvard/Texan in Air Force Flying College, Jodhpur. That, however, is part of another story on my days in Jodhpur which I would narrate, perhaps in the next episode. So, please forgive me if I am not quite in sequence for the story of Hakimpet and what I learnt from my Instructor on the Vampire, then Flight Lieutenant GSN (Gudiseva Sri Nagendra) Prasad. Briefly though, I had been shaken after the firing I got after my first night flying sole in Jodhpur, all due to my own fault, and hadn't been able to perform in flying after that at the level I expected of myself. Due to this, after giving it a lot of thought during the break, I was eager to get back and prove to myself, if none else, that I was capable of making a good fighter pilot. The

added attraction, incentive or motivating factor, whatever one may call it, was that I was going to fly a jet finally which was a dream come true for me personally.

After about 20 days of ground subjects and training which included technical aspects of the Vampire aircraft and its systems as also a mock ejection drill with a jump from about 8–10 feet for a simulated descent on a parachute, we finally came to the flight complex and were introduced to our future instructors. Initially, I was assigned to Flight Lieutenant Suman Gupta who went through the cockpit procedures and drills with me, including emergency drills, and took me up for the first sortie of air experience on the Vampire Mk 55, BY 998–the bird cage trainer aircraft, on the 4th of July 1967. For some in the US, this was Independence Day but for me it was a red–letter day as my first baby step towards fulfilling my childhood dream of flying fighter aircraft. Flt Lt Gupta was a gentle and friendly instructor and I truly enjoyed the sortie with him with all the thrills of speeds and heights along with the gentle hum of the Goblin jet engine behind on the Vampire. For some strange reason that I never figured out even later, after this single sortie with Flt Lt Gupta, I was kept on the ground for almost six days and then assigned to Flt Lt GSN Prasad for regular flying from July 10, 1967.

Flt Lt Prasad turned out to be even

(Image: bharat-rakshak.com)



(Image: bharat-rakshak.com)

more gentle and patient than Flt Lt Gupta. He never raised his voice even once on me and demonstrated everything once with a soft patter telling me what he was doing and suggesting minor corrections whenever I attempted the same manoeuvre. Engine start in the Vampire was a very tricky operation, at least in our time with those old refurbished engines since these had a centrifugal compressor instead of the multi–stage axial compressors in the more modern jets I flew later. Flt Lt Prasad showed me how to gently and smoothly open the HP Cock as the engine wound up during the starting cycle timing the movement of the HP Cock with the sound of the engine by feel so as not to make it rumble, exceed the JPT or lead to a wet start. Even in flying, he made very gentle and smooth movements of the controls to get the aircraft to do the required manoeuvre. I guess, he was quite happy with the way I performed the manoeuvres, having learnt the art of gentle handling before from Flt Lt VP Kala and Wg Cdr Babla Senapati in the earlier Harvard/Texan days in Jodhpur. Flt Lt Prasad also started telling me that instead of chasing accuracy in flying in terms of speeds or heights with a lot of attention on instruments, it was more important to just have the aircraft trimmed in the estimated required attitude and let the desired height or speed come slowly so that you found the time for tactical tasks like checking the area around for other aircraft thus simulating tail clearance for formation members, glancing at ground features to know your ground position at all times even after a series of manoeuvres and paying attention to the radio and general situational awareness. With all this in my mind from his teachings, it was here in Hakimpet on Vampires that, under his guidance, I formulated my principle of gentle and smooth movements of the control which stipulated that the lesser the movement of the controls, the lesser would be the counter correction to stop the initiated movement of the aircraft and thus less time and attention devoted to flying the aircraft and more time looking out and doing the other tasks required in fighter flying. Slowly, this principle evolved into spending just 5% or even less of your time and attention in flying the aircraft and the remaining 95% or more on the tactical tasks required of a single–seat fighter pilot. I also found that accuracy in flying came almost on its own after a few sorties of care–free handling of the aircraft in this manner. After a few sorties of watching me fly, Flt Lt Prasad started encouraging me to try different combination of manoeuvres on my own thus building up my confidence in handling the aircraft gradually. Being soft–spoken as he was, since he never said much in the aircraft or even in the debriefs on the ground after the sorties, I got the feeling that he was satisfied with the way I was progressing in my training syllabus. It was almost like he read my mind because that was exactly what I needed at that stage to regain my confidence in flying. He also started making me fly with different instructors once in a while so that I could pick up some more tricks or tips from them. Amongst these were Sqn Ldr Jal Mistry, Flt Lt Jagbir Singh and Sqn Ldr ID Bhalla, the latter known to be a tough but good instructor whose pupils generally went for the trophy check. I always wanted to fly a sortie with Flt Lt Tripathi who was famous in JTW in our time for doing a triple roll of the top on the Vampire. Unfortunately, I could not directly ask for such a sortie nor did the opportunity ever come through so I had to try this manoeuvre on my own in my solo sorties but somehow never

succeeding in having enough speed after the second roll of the top to attempt a third. One time when I did try to push my luck, I almost entered a spin for which the Vampire 52 was notorious but, fortunately, came out just a bit shaken due to the smooth handling of the aircraft that had been taught to me and ingrained in me by then. Later, I tried to analyse why I couldn't do it and after an indirect discussion with Flt Lt Prasad, I figured out that I couldn't commence the manoeuvre at lower levels as Flt Lt Tripathi did, as an instructor, because we pupils were restricted to a minimum height of 6000 feet for any aerobatics. Not that we had any Flight Data Recorder which would have recorded the initial violation in height if I had attempted the manoeuvre in the local flying area on my own but I did not want to violate the rules and break the trust placed in me by all my instructors and felt that caution and discretion was the better part of valour at that stage, leaving such attempts to my later days in operational squadrons.

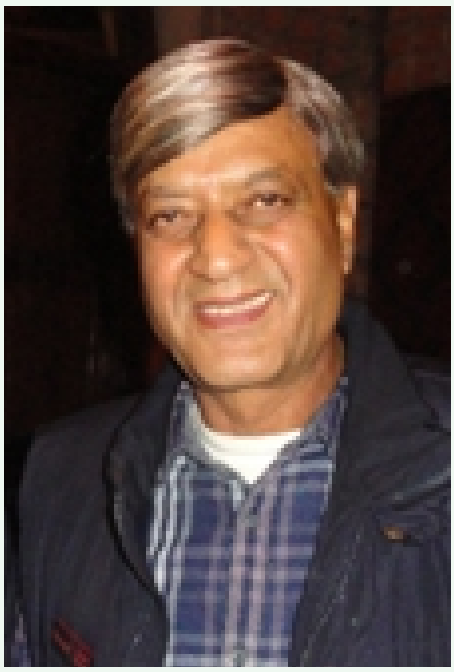
Flt Lt Prasad always encouraged me to push myself to higher standards in the air while he also monitored that I was doing well in ground subjects. I still recall one day in September 1967 when I was out on a solo sortie and low clouds drifted in over the entire area blanketing the airfield as well the nearest diversion of Begumpet. That day, I was, perhaps, the farthest out in the local flying area and though all others had been recalled and recovered before I arrived over the base on mental DR and as established by the homer. The airfield was completely covered with these clouds and without a radar/GCA or even an NDB, there was no way of getting below the clouds safely to sight the runway and carry out a landing. The only option was to bale out of the aircraft when the fuel ran out. I could hear both Sqn Ldr Jal Mistry, the Flight Commander, and Flt Lt Prasad on the radio who calmly tried to comfort me and hold on. Somehow, with the help of my changing homings, I was fortunate enough to manage a descent in a safe area to about 100 feet above ground and just below the clouds so that I could see the ground and find my way back to the airfield culminating in a sort of a timed circuit and a safe landing. I would never forget the gentle pat on the back I got from both my instructor, Flt Lt Prasad, and Sqn Ldr Jal Mistry when I got out of the aircraft. Time flew in Hakimpet and

with almost 15–20 hours of flying a month, soon it was November 1967 and I was nearing the end of my syllabus. About this time, Flt Lt Prasad, perhaps, felt that I had a shot at the flying trophy and started talking about things to watch out for in such a trophy check. After Wg Cdr PD Dogra, the then Chief instructor, finished my Final Test on 2 December, I was given one refresher sortie with Sqn Ldr Bhalla after a break of two weeks on 16 December, and then taken up by Wg Cdr Dogra again the same day for a trophy check. Again, the firm handshake and a shy hug from Flt Lt Prasad after this sortie is still etched vividly in my mind.

So much for the professional aspects, on the social side the pupils were generally not entertained by the instructors in our time. However, Flt Lt Prasad used to gently enquire about our Sundays and hint that we should go out on the weekend and have a good time in the twin cities of Hyderabad/ Secunderabad which were very cosmopolitan those days and also had some good restaurants serving a great change from the Cadets' Mess food that we were living on through the week. Surprisingly, those days, the meals in such restaurants were not very expensive and highly affordable in the monthly pocket allowance we were allowed to receive. I still recall that a good Chinese meal with a bottle of beer in Nanking's cost just about Rupees 12–15 per head, requiring at least three persons to share the dishes. This included the cost of bussing there and back. Sometimes, when we felt rich, we even took a cab back to the Cadets' Mess on the far side of the airfield since the bus stop was some walk. The famous Biryani of Hyderabad was even cheaper so we could afford to go out at least on two weekends every month on the Rupees 40 that we were then allowed to receive per month from our parents. On 14 September 1967, as per my log book, Flt Lt Prasad took me to Bangalore for a High Level Navigation sortie culminating with a radar controlled approach and landing at the HAL airfield in Bangalore. This was my first ever visit to Bangalore though it meant little because we were supposed to just refuel and return to Hakimpet at low–level. As it happened, Flt Lt Gupta also brought one of his pupils to Bangalore for the same navigation sortie within a few minutes of our arrival. During the turn–around, the HAL crew refuelling our aircraft noticed a fuel leak and told us it would take some time to repair and make the aircraft airworthy. Since Flt Lt Prasad had to get back to Hakimpet that day itself, Flt Lt Gupta and he did a deal trading aircraft, and in the bargain the pupil in it, letting me stay back for the night in Bangalore. I was quite happy to spend the night in Bangalore since I had never been there before and had heard so much about its salubrious climate as the Garden City as also its night life. We spent the night in the Trinity officers' Mess and Flt Lt Gupta treated me that evening to a sumptuous dinner at the famous joint just off MG Road called Blue Fox with a live band and some

De Havilland Vampire at Indian Air Force Museum Palam (Image: commons.wikimedia.org/aeroprints.com)

great music as also some mild mocktails so that I didn't lose my head that evening. Once again, an initiation and part of growing up that I haven't forgotten. Towards the end of our stay in Hakimpet we got commissioned on 31 December, I spent many afternoons/ evenings enjoying the hospitality of our instructors and their spouses which included by then Sqn Ldrs Prasad, Gupta and Flt Lt Jagbir Singh and even the tough Flt Cdr, Sqn Ldr ID Bhalla. Through such interaction, I learnt some more about the social graces and the camaraderie in the Air Force as also the generosity of all these instructors and their graceful spouses who groomed young chickens like us into being officers and gentlemen, apart from just fighter pilots. To them, we owe most of everything of what we are today. GSN Sir left the Air Force due to some personal commitments soon after commanding 22 Squadron in Hasimara and Bagdogra in 1980 while I was in Iraq and we met rarely due to our different paths in the Air Force. However, later whenever I passed by Secunderabad, we did talk if not meet. I have also been fortunate to meet Air Commodore ID Bhalla when he was commanding Palam, when we operated from there for the Air Force day, and later both his fighter pilot sons, Rajnish and Navneet, who were in MiG–29s and with me in my time in Poona. I also called on and met Wg Cdr and Mrs GSN Prasad in Hyderabad while organising the Golden Jubilee of our course, the 98 GD(P) and 37 GD(N) in June 2017 and had the pleasure of hosting him to our reunion dinner in January 2018. I am also blessed to keep meeting Air Commodore and Mrs Jagbir Singh whenever we visit Wellington/Conoor. Jagbir Sir also commanded 28 Squadron, the First Supersonics, many moons before me and I had the pleasure of meeting them recently during the Diamond Jubilee celebrations of the Squadron in Adampur. Every time I meet any of these illustrious instructors, what comes foremost to my mind is how much I owe them for nurturing us the way they did and to count my blessings.



The author of this series, Air Marshal (Retd.) Harish Masand

(Photos of Vampire for representational purposes only)

Air Marshal (Retd) Shashi Ramdas recounts.... ....Nostalgic Memories of Days Gone By

Though I had received my posting orders for the 79th Pilots' Course in December 1959, I was not permitted to leave Ambala, where I was then posted as EO 27 Sqn (Hunters), till after the Republic Day Flypast in January 1960. I was scared stiff my course would be cancelled, but I was assured that a slot would be kept open for me.

I arrived at the Air Force Flying College, Jodhpur in late January 1960, to find the Course had commenced more than four weeks earlier. I was told to immediately report to "A" Flight where the Flt Cdr (Flt Lt M S Rane) was irritably awaiting my arrival. He brusquely ordered me to report to Flt Lt N N Ubgade who had been assigned only two pupils till then, Sub/Lt Ashok Sinha and Flt Cdt Ashok Oza. "Ubee" Ubgade and I had been squadronmates and friends in 27 Sqn and I was apprehensive about how our new student/pupil relationship would work out. But "Ubee", in his inimitable style, soon sorted that out and we had a wonderful professional relationship right from the beginning. I called him "Sir" and he called me Shashi. He treated me just like his other pupils.

I used to get terribly airsick, initially, but "Ubee" soon made sure I was cured of that. He was always so patient and never raised his voice at any of his pupils. He was meticulous in his briefings, in–flight instruction and post–flight debriefing. I am eternally grateful to him for everything he taught me. It stood me in good stead throughout my subsequent years in the Air Force. "Ubee" took us three pupils through all three terms; Basic, Intermediate and Advanced, till we got our "wings" on 31 May 1961. Soon after that, he was posted out to FIS, as an instructor, and never taught an ab initio pupil ever again! He was polite enough not to blame his three pupils at AFFC for this.

During the 1½ years, we were in Jodhpur, the Naval and Air Force pupil officers were neither fish nor fowl. As commissioned officers, we dined in the Officers' Mess but lived in a separate block, near the Cadets' Mess, at a considerable and safe distance from the instructors' living in accommodation. During working hours, there was absolutely no differentiation between pupil officers and flight cadets. We shared the same trepidation and exchanged the same confidences as any new entrants to the wonderful world of flying.

During our initial ground training we had to attend classes, on airframes, engines and other such technical subjects, taught by our instructor Plt Offr K S Bhalla (Tech Eng). It used to gall me that an officer of my own branch, five years junior to me, should try and teach me the basics of my own profession. To add insult to injury, he would deliberately point to me, sitting at the back of the class, and ask me questions to make sure I had understood.

Our meteorology instructor was Warrant Officer Abraham. He was the most enthusiastic instructor I have ever met. He used to start talking as he came through the doorway, well before he stepped onto the platform and continue with unabated fervour right till the end of the period. I will never forget his drawings on the blackboard and the way he used to prance around the platform.

Finally, one by one, we did our Final Flying Tests on Vampires and the lucky ones were found fit to move on to the Applied terms; Fighter Training Wing,

The poor girl (she was only 18 years old then) had just completed her Domestic Science from Lady Irwin College, New Delhi. She was the daughter of a retired Lt Col from the Corps of Engineers.
When I was first introduced to her, during the summer break of 1960, she had called me "Uncle", just as any young girl would have addressed an officer who had come to call on her parents! I was told, later, that her mother told her the bitter truth after I left and she soon began calling me by my name.
We got married in Dehra Dun, where her parents had settled down after retirement. It was blazing hot there but she insisted that I wore my winter mess kit! We finally compromised on a "6B".
Gulab Israni had very kindly taken the trouble to come for our wedding.

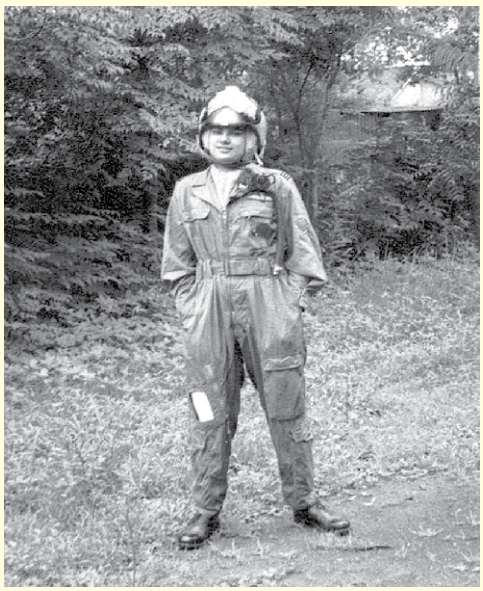
At one such dinner, Suresh Ratnaparkhi so enjoyed the chicken that he went to Puttu with the empty dish and told her, "This is bloody good stuff, get some more". I had to discreetly pull him aside and tell him that was all there was! In spite of all her culinary expertise, Puttu had just not been taught how to estimate the quantities that a bunch of hungry young lads could put away!
Happily, she soon got used to the quantities of food that Air Force officers could devour. Especially after an evening of knocking back some liquid refreshments.

Hakimpet (for fighters) and Transport Training Wing, Begumpet (for transports). The Chief of the Air Staff, Air Chief Marshal A M Engineer commissioned the flight cadets and awarded all of us our much coveted and cherished "wings" on 31 May 1961.

Exactly one week later, on 7 June 1961, my wings were clipped! I got married!

I had asked for special permission to get married during the course and it was granted on condition that I would not get any married accommodation or ask for any special privileges during the Applied phase of our training. My newly wed bride, Renuka (better known as Puttu) and I arrived in Secunderabad, a week before the course was scheduled to start, and desperately started looking for a place to live in. Luckily, we found one half of an old dilapidated bungalow in Bolarum, the other half being occupied by an EME major and his family. That was our first home.

Since we were located just off the main road linking Hakimpet to Secunderabad, we were regularly "bounced" by my fellow pupils on their way to/from town. Many were the cups of coffee that Puttu happily used to make for those thirsty young men, panting to get into town and thirsty after their exploits there. Occasionally, she also cooked meals for these young lads and they all survived!!!



Before I go any further, I must mention a coursemate who joined us for the Applied phase. I owe a great debt of appreciation and gratitude to that individual for the unstinted help, support and encouragement I received during that last phase of our training, making sure I mugged up the pilots' notes, vital actions and check lists, and also that I stayed physically fit. Many of you may not remember that person, so here's a photograph to jog your memory.
I might also add that this person was great company for me after duty hours!

That last phase of our flying training was most exhilarating as we were able to, at long last, do the type of flying we had only dreamed of; instrument flying, tactical flying, live armament work, etc. We had no permanent instructors, during this phase, and it was as much an education flying with a wide variety of instructors, each of them with their own idiosyncrasies. December 1961 soon came round and, with much excitement, we waited for news of our postings.

To my great delight, I found I had been posted back to my old station, Ambala. This meant that I could hope for a Hunter conversion there? However, since I was posted in an appointment of my parent Tech Eng branch, I had to give that job top priority and then try and get an opportunity to fly whenever it was possible. Luckily, my old squadron (27 Sqn) was still based there, and the Sqn Cdr and Flt Cdrs made sure I converted on Hunters.

After that, it was a continuation of the old familiar hectic Air Force life. Frequent postings, sometimes at very short notice, from one end of the country

to the other. But this time, I had Puttu to help and support me. She made a wonderful home for us wherever we went. Improvising with whatever she could lay her hands on. Beds and diwans made with steel trunks, wooden packing cases and razais. Curtains made from whatever material she could lay hands on. You name it she made do with it. Our first "fridge" was a third–hand Coca Cola sheet metal box into which went a couple of bottles of water, a small bottle of milk, a few eggs and a pat of butter. We even acquired an oven, fabricated out of an old kerosene tin, in which Puttu baked the most delicious cakes. We were never the worse for it. It was great fun.

My postings and travels took us all over the country. I had the privilege of being posted as the EO/STO of three squadrons (27, 14 and 220 Sqns) and A&ATU, five postings as CTO/CEngO (9 Wing, 5 Wing, two tenures at 32 Wing and finally 7 Wing) and CO of an independent BRD. Fortunately I was able to fly during each of these postings. Inevitably, I had my share of staff postings, initially at Air HQ and later at HQ WAC and HQ MC.

Eventually, I took premature retirement, in November 1990, to join Indian Airlines where I saw another aspect of aviation, quite different from what I had been used to. But, all my previous hands on experience of 36 years in the Air Force, as an engineer and a pilot, helped to me to slip easily and comfortably into my new job. I soon realised that, in the Service, we unknowingly absorb so much valuable practical experience on administration, HR, security, and many such allied subjects that even the best B–schools cannot provide.

After leaving Indian Airlines, I continued in the corporate sector, mainly involved in civil aviation but also in various other interesting industries. I still do some consultancy work, though not as much as I used to till about three years ago.

On the domestic side, Puttu and I have two sons. Our elder son, Ashish, joined the NDA (69th Course, Echo Squadron) and was later commissioned in the Armoured Corps. Our younger son, Sharad, decided that two fools in the family were bad enough, swore he would never join the Services, and went into medicine. They both married lovely girls who became the daughters we had always wanted but never had. Both girls are from Air Force backgrounds and all four of them had studied together at The Air Force School, Subroto Park, though in different classes.

We try to meet our children and grandchildren as often as we can but, given the fact that the two families are located at opposite ends of the country, not as often as we would like to.

It is even more difficult getting all ten of us to assemble at one place at the same time, due to the problems in synchronising leaves and vacations.

The last time we could all manage to get together was for Christmas 2008 when we were able to visit Sharad, Anita and family in Adelaide, where Sharad was doing a Fellowship. This is what we looked like then.

Ashish eventually commanded The Central India Horse (CIH), ably supported by his wife, Nisha. He is now Commandant of the Army Software Development Centre in New Delhi. They have an 18 year old daughter, Inayat, who is doing her History Honours in St Stephen's College, Delhi and a 14 year old son, Yohaan, who is studying in Std VIII at Sherwood College, Nainital. Sharad is now the Professor and Head of the Dept of Plastic Surgery at the Pondicherry Institute of Medical Sciences where his wife, Anita, is Professor of Pathology. They have a 13 year old daughter, Nikhita, and a 12 year old son, Ishaan, both of who are in school in Puducherry.

Meanwhile, Puttu and I are leading a peaceful semi–retired life. She continues to look after me as lovingly as she has done these last 49½ years. And I try not to get on her nerves by keeping myself as busy as I can, without getting in her way. Puttu calls it a state of "marital blitz"!

Air Marshal (Retd) Shashi Ramdas

The article was written on 24 October 2010. The author of this piece was commissioned in the Technical branch of the IAF in 1955 but had enjoyed being with aircraft for the major part of his 36 years in service. Right now the Air Marshal is a few months short of 90.

25 Years Back

From Vayu Aerospace Review Issue IV/1998

Far Eastern Navy Command Planned

According to the Chief of Naval Staff, Admiral Vishnu Bhagwat, a Far Eastern Naval Command would be established in the Andaman and Nicobar Islands as part of India's efforts to increase its influence in South East Asia.

Hansa-3 Ready for Production

The Hansa 3, an indigenously designed two–seater, multi–purpose trainer aircraft is expected to go into commercial production "shortly", as part of an initiative from government laboratories and industrial groups to develop a civil aircraft industry in the country.

Indian Navy: Aircraft Carrier Options

According to sources in Moscow, Russia has outlined a new $700 million defence package to India for the sale of the "modernised" 44,500–tonne aircraft carrier Admiral Gorshkov equipped with 24 MiG–29K fighters. Details of the proposal have been released by Russia's Nevskoye project design bureau (PKB) and state arms exporter Rosvoordouzhenie.

US Blacklists Indian organisations, Expels Scientists

In a series of moves during the fourth week of July 1998, the US administration has listed as many as 63 Indian establishments to be put under US sanctions by the Department of Energy with the intent of denying any aid to India for nuclear or military–related programmes.

"Lack of AJT Affects IAF"

"Non–availability of an Advanced Jet Trainer (AJT), coupled with unsuitability of MiG–21 combat jets for transitional training role for Air Force pilots and paucity of simulators continue to take a heavy toll of training–related accidents," according to the recently tabled Report of the Comptroller and Auditor General.

N-Tests: "Armed Forces Kept In Dark"

Former Chief of Naval Staff Admiral L Ramdas has alleged that the Indian armed forces were kept in the dark on the Pokhran nuclear tests and claimed that, had they been taken into confidence, the Vajpayee Government might have been prevailed upon to exercise restaint.

Civil Aviation in Economic Survey 1997-98

Analysts have pointed out that the civil aviation sector has received a mere passing mention in the recent national economic survey. In fact, it appears that the government has chosen to give a rundown on the history of aviation to fill space, reflecting rather poorly on the performance of the ministry of civil aviation.

Auctioning of Air Routes

The Brahma Committee has recommended "auctioning of air routes" and regulation of the number of airlines flying in a particular sector as part of series of suggestions to revive ailing private airlines. The Committee headed by the financial controller in the aviation ministry, PK Brahma submitted its report recently.

Steep Decline in Domestic Air Travel

Observers of the aviation industry in India have concluded that there is a definite recession in the industry which is heading for a negative growth in the current year (1998-99). It appears that all major domestic airlines confront a negative 5% growth in passenger traffic vis–a–vis the 8% growth in passenger traffic which had been projected for the year.

IA-AI Merger Uncertainty

There is uncertainty surrounding the merger of Indian Airlines with Air India in the wake of the government's decision to disinvest its stake in the domestic carrier. AF Ferguson had recommended setting up of a holding company with an executive chairman and a board of directors with IA, Air India and Alliance Air operating as three independent units with their own chief executives.

New Cargo Centre at IGIA

A new Cargo Centre for Perishable items has been set up at New Delhi's International Airport, as part of the government's ambitious project to promote export of perishable items and create necessary infrastructure to maintain the requisite cold chain.

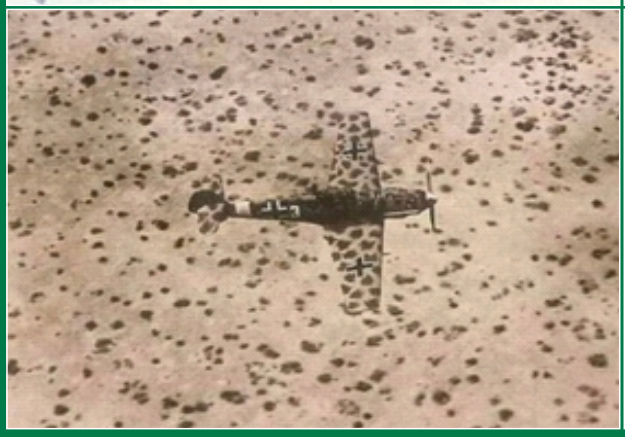
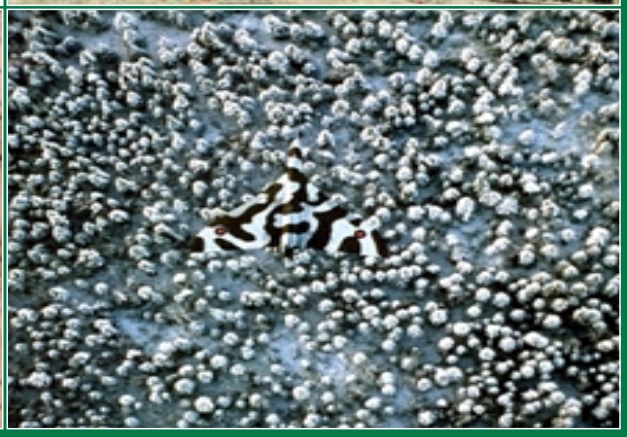
SWAC aircraft at Ahmedabad

The Defence Minister, George Fernandes thundered in anger against the tardiness of the civil aviation authorities in issuing passes to IAF personnel for Ahmedabad airport where the SWAC have based some aircraft and helicopters after the shift of headquarters to Gandhinagar from Jodhpur. "The status of IAF officers is much higher than that of the pen pushers who authorise these temporary passes".

The art of camouflage!

An assortment of photos of aircraft from WW–II and Cold War era. The good old days when deception mattered. Today with AESA and other radars plus sensors, camouflage and colours matching backgrounds is a thing of the past. (Photos: Twitter)



Boeing's history snapshot

After an 18,000 man hour rebuild by Pemberton and Sons Aviation in Spokane, Washington, a Boeing Model 40, the oldest airworthy Boeing, had a rendezvous with Boeing's new passenger aircraft, the Boeing 787 Dreamliner. (Image Twitter @ron_eisele)

Meals in space for $130,000

French company Zephalto wants to send travelers to the "edge of space" in a pressurised capsule, dubbed Celeste. The capsule will ascend to an altitude of 25 kms allowing guests to "marvel at the curvature of the Earth". In between gawping at views, travelers will be wined and dined in style with Michelin–star meals. (Courtesy CNN)
Can someone sponsor our trip please?

Red Bull Defence?

A new rocket launcher? Except this time the cluster bomblets held inside the main can are the energy drink Red Bull. Perhaps launching it into enemy territory just may give them "Wings"!!

Afterburner

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