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Aerospace & Defence Review

V/2022

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Indian Air Force Hawk Mk.132
(Photo: Angad Singh)

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

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Air Marshal Brijesh Jayal says....

Terming MiG-21 a 'flying coffin' is deeply insensitive

It was with great sadness that one learnt the other night, that a MiG-21 trainer aircraft had crashed in Rajasthan with loss of both pilots. A personal reaction was one of profound sorrow and sympathy not just for the lost ones and their bereaved families, but for every member of the fraternity of the squadron and base from where these young pilots had set off on a routine training mission, as such losses profoundly hurt the entire team of the air and support crew. Since this is an occupational hazard of the profession, whose mission is far nobler than one's own comfort and safety, one is confident that those left behind will face the tragedy and move on towards the larger mission of securing national air space.

One cannot, however, say the same for the rest of the governance system that must bear the ultimate responsibility for denying the IAF a timely replacement for the MiG-21. If today one sees reference to the aircraft in the public domain as a 'widow maker' and worse still a 'flying coffin', one is left wondering if any of these arm chair commentators have paused to reflect on the adverse impact of such casual talk on the morale of those who must continue to operate these machines, their near and dear ones and indeed on the fighting capability of the entire force?

Had indeed our representatives been alive to their responsibility towards the security of the nation, they would perhaps have spent more time deliberating on issues that impact national security. Looking back, based on the LaFontaine committee recommendations, the government had accepted the need for an Advanced Jet Trainer as far back as 1986 and the IAF had evaluated various options, but to no avail. The Kalam committee in 1997 repeated this recommendation. Not surprisingly, the fourth report of the Standing Committee on Defence (1998-99) of the 12th Lok Sabha on the AJT squarely blamed the government for indulging in a procrastinative technique of committing the matter ad nauseum to various committees and deplored that such methodology was being adopted for inventing alibis despite its admission that non-availability of an AJT continued to take a heavy toll in terms of training-

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related accidents. In spite of this strong condemnation, none of the 45 committee members drawn from both houses and across the political spectrum, thought it worth their while to pursue this serious security matter on the floor of Parliament.

In its 29th report on 'Aircraft Accidents in the Indian Air Force', the Public Accounts Committee had called for phasing out of the MiG-21 aircraft from the IAF's inventory. Pointing out that of the 221 aircraft destroyed in flying accidents between 1991 and 2000 with a loss of 100 pilots' lives, 100 were MiG-21 fighters, the PAC had concluded that 'the IAF is saddled with a sad compromise between what the nation can afford and what ought to be discarded'. Indeed, amongst these statistics were also trainee pilots, because delayed acquisition of the AJT had compelled the IAF to use the MiG-21 in lieu.

These examples have been quoted merely to highlight that there appears little concern or indeed sympathy amongst our lawmakers for dire needs of the armed forces- merely lip service! How ironic that whilst both Houses of Parliament continue to be disrupted for one reason or the other, as reported in the media, one MP should take to social media to tweet: "The whole country is shocked and saddened by the incident in Barmer. For a few years now, the MiG-21 jets were involved in frequent accidents. This alone has claimed the lives of about 200 pilots".

Having been intimately involved with the MiG-21 from its induction in 1963 and through thirty years of service thereafter and having logged well over a couple of thousand flights on various variants of the MiG-21 both in operational roles as well as a test pilot in the Nasik factory, personally one finds reference to the MiG-21 as a flying coffin by an Honorable MP insensitive and deeply humiliating to all those professionals who have had the privilege to operate this aircraft, of which some 5000 were built worldwide and served some 33 Air Forces.

That the aircraft is long overdue for replacement does not make those flying in service unsafe. It merely reflects on the aircraft type's operational and technological irrelevance in the current air warfare environment. As an ex -IAF Chief said on a news channel after this accident, every MiG-21 that takes to the air is fully airworthy thanks to the technical and engineering support teams that work hard to make it so. That the aircraft continues in service long after the fleet should have been retired, is not a reflection on the airworthiness of the machine, but its relevance in the technological and operational domain of modern warfare and against modern forces of neighbours. A casual statement made by an elected representative may grab headlines, but is ill -conceived and shows no concern for how this will impact the morale of the men and women who must continue to operate these aircraft well into the future, in no small measure due to the indifference to national security displayed by our elected representatives.

If this tragedy touches the conscience of the nation's lawmakers and stirs them into debating issues relating to large gaps in IAF's re- equipment plan and arriving at decisions with a time bound follow-on plan, the sacrifice made by Late Wing Commander Rana and Flight Lieutenant Bal may not have been entirely in vain.

(Photos: Simon Watson)

Admiral Arun Prakash says....

Step back from water's edge

Reports about the impending visit of a Chinese "spy ship", Yuan Wang-5, to the Sri Lankan port of Hambantota, created a major flutter in the Indian media. Citing the ship's "lethal capabilities" and "aerial reach of more than 750 km", fears have been expressed that "atomic research centres within Indian borders could be snooped upon". Reflecting concerns at the "highest levels" in New Delhi, social media fired unkind comments about India's emergency economic assistance to an "ungrateful Sri Lanka".

Reports that Sri Lanka has asked for a delay in the Chinese ship's arrival may temporarily calm the waters and provide respite for a dispassionate examination of the issue through legal, military and diplomatic lenses. But before that a quick look at the ship's provenance is in order. Yuan Wang is the generic name given to a flotilla of seven to eight ships belonging to the Chinese PLA's Strategic Support Force. These large "survey/research" vessels carry optical, laser, passive-radio and radar devices whose large dish-antennae enable tracking of ballistic-missile trajectories, monitoring of satellite and space vehicle launches, and gathering of technical intelligence.

From the legal perspective, the 1982 UN Convention for Law of the Seas permits unfettered freedom of navigation on the high seas and a foreign warship has as much right to be in the Indian Ocean as a similar Indian vessel would in the South China Sea. Even in the 200-mile exclusive economic zone, there exists the conditional right of "innocent passage" for all vessels, including warships. Entry into foreign ports, especially for warships, has to be with prior consent. But even in wartime, the 1907 Hague Convention permits entry for warships of belligerents into neutral ports for limited durations. Given its cordial diplomatic relations, and its economic dependence on China, there could be no plausible reason for Sri Lanka to deny entry for Yuan Wang 5, especially into Hambantota on which China has a 99-year lease.

Viewed from the security angle, the presence of a research ship like the Yuan Wang 5, bristling with multi-spectral surveillance and eavesdropping devices, in India's vicinity, certainly calls for vigilance and caution. However, in this age of transparency, regular electronic "snooping" by ships, aircraft and satellites —both friendly and hostile — happens all the time. Our armed forces and other agencies are aware of this, and precautionary policies and procedures relating to electronic emissions and missile-firing trials are in place. One can also be sure that the position and movements of Yuan Wang 5, as long as she is in our waters, will be closely followed by the Indian Navy's maritime domain awareness matrix.

Coming to the diplomatic aspect, observers have harked back to the September 2014 visit of a PIA Navy's (PLAN) Type-039, a diesel submarine which had docked in Colombo, to be followed a few weeks later by a port-call by a Type-091 nuclear-powered attack submarine. The Sri Lankan government had then brushed aside India's concerns describing the ship-visits as "usual practice", while a Chinese communiqué had (with unintended flippancy) stated that the submarines were en route to the Gulf of Aden "for antipiracy duty".

Some in India have viewed the forthcoming visit of the Chinese "spy ship" to Hambantota as an infringement of the 1987 Indo-Sri Lankan Accord, which calls upon the two countries not to allow their respective territories to be used for "activities prejudicial to each other's unity, integrity and security". However, Colombo has often acknowledged that the security and economic interests of both India and Sri Lanka are inextricably interlinked and any deliberate actions that harm Indian interests will eventually rebound on it.

As we await further developments, there is a need to reflect on Sri Lanka's current political meltdown and dire economic crisis. Given its geographic proximity and ethnic connection, India cannot allow Sri Lanka to sink. New Delhi has already rendered substantial help, but with the best of intentions, India has neither the economic wherewithal nor political capital to pull Sri Lanka out of the abyss. Therefore, apart from the IMF, China will have to lend a hand for Sri Lanka's economic recovery. For this to happen, Colombo will need to kowtow to Beijing, and India must show diplomatic forbearance. Some other issues, germane to this discussion, need to be noted by India's decision-makers.

First, India must face the reality that with its 350-warship strong (and growing) battle force having overtaken the US Navy, China has achieved its ambition of becoming a "maritime Great Power". China's 2019 Defence White Paper charges the Chinese navy with the responsibility of safeguarding Xi Jinping's prized Maritime Silk Road that spans the Indo-Pacific and includes the China-Pakistan economic corridor. The string of ports, created by China, in India's neighbourhood, are meant to undergird this endeavour.

Thus, until India can bolster its economic and maritime power and, perhaps, enforce its version of a "Monroe Doctrine," it will have to live with frequent PLAN presence in the Indian Ocean. We must also prepare for the day when the Taiwan situation permits China to station an aircraft-carrier battle-group in our waters.

The second issue that deserves our attention is the intense activity of China's space programme, which has planned 50 space-launches for 2022. In mid-April, three Chinese astronauts returned to earth, after spending six months aboard their 11-year-old space-station. In early June 2022, another spacecraft took a team of three astronauts to dock with the under-construction Tiangong-3 space station. During such space activity, survey/research ships need to be positioned for control and tracking as well as rescue tasks in dispersed oceanic locations ranging from mid-Pacific and south Indian Ocean to the coast of Africa. While the actual mission of Yuan Wang 5 is not known, it is just possible that she may be on such a legitimate space-related assignment.

Finally, let us remember that ISRO also has an ambitious manned space programme underway and DRDO is, or will be, undertaking test flights of its Agni series of inter-continental ballistic missiles over distant oceanic stretches. India, too, will seek to deploy "research" vessels in distant waters/ports in days ahead.

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Lt Gen Kamal Davar (retd) says...

Indian armed forces @75: The challenges ahead

India overall, since 1947, has done reasonably well in keeping at bay the many diverse security challenges which came its way. However, the strategic and military lessons from our confrontations, since 1947, must never be forgotten.

As India completes 75 years of its independence from 200 years of British yoke, there is much to celebrate about and equally much to introspect. Revisiting the functioning with stark honesty of all its institutions and governance structures will produce realistic mid-course corrections and suggest better paths for the nation to traverse. The Indian Armed Forces, unquestionably, one of the few institutions of the nation, which has lived up to its assigned responsibilities with elan and the desired results has much to be proud of. Nevertheless, many emerging aspects, nuances of the nation's security and well-being have to be factored in and pursued earnestly with vision and resolve. For the nation's honour, its Armed Forces can never be found wanting.

By any standards, India is located in one of the most geo-politically troubled regions of the world. That it is surrounded by two consistently anti-India neighbours, China and Pakistan, both individually and collusively posing threats, only aggravates the formidable challenges it has to confront for its security. Both these nations being nuclear powers, synergistically anti-India, also adept at asymmetric warfare makes India's strategic challenges mind-boggling.

For the record, India overall, since 1947, has done reasonably well in keeping at bay the many diverse security challenges which came its way. However, the strategic and military lessons from our confrontations, since 1947, must never be forgotten.

Soon after attaining independence and the accession of J&K to India, the Indian Army successfully thwarted the Pakistani tribal invasion in J&K which had threatened to wrest the state from the Indian Union–that if the Army was not halted prematurely, the Army would have ensured that portions of J&K and Gilgit-Baltistan would have also not been in Pakistan's possession. Subsequently, the Chinese perfidy led to our debacle in 1962. The 1965 War, again triggered by Pakistan to foment unrest in J&K led to India having a clear upper edge at the termination of operations. In 1971, India's Armed Forces brought to the nation its finest hour, ever in its long history, by dismembering Pakistan and a new nation, Bangladesh, being born. Pakistan, after a lapse of nearly 30 years, once again committed a folly by capturing some border posts in Kargil and subsequently was inflicted a telling defeat by the Indian Army and Indian Air Force. As recently as in May 2020, the serious Chinese border transgressions in our Eastern Ladakh sector also brought out some deficiencies in our security preparedness.

In addition, the Army has also to keep its counter-insurgency expertise in fine fettle for some parts of the nation, notably insurgencies in J&K and North East too have a tendency to flare-up. In addition, Pakistan's efforts to trigger secessionist winds in Punjab can never be taken lightly by the Indian Army in concert with the para-military and state police forces.

As the Indian Armed Forces continually prepare to combat and defeat the enemies of the state, its top military and political leadership has to bear in mind certain imperatives which are sine-qua-non in ensuring the nation's territorial integrity and well-being. Defence reforms, where required, must be conceived by institutionalising review committees and on a time-bound basis and not as knee jerk reactions once any cataclysmic events befall the nation. Secondly, the government must allocate atleast 2.5 to 3 percent of the GDP for defence as recommended by many Inter-Parliamentary Standing Committees for Defence in the past–the current allocation of 1.5 percent or lower is woefully inadequate for modernisation.

Among Indian Armed Forces myriad critical accretions, the Indian Air Force fleet has to be speedily augmented to a minimum 42 fighter squadron strength while the Indian Navy's submarine force also needs substantial accretions. Our indigenous defence production remains well below expectations and the government has to come up with innovative and encouraging measures to give a fillip to the 'Atam Nibharta' schemes. We need substantial augmentation to our R&D budgets and induction of drones for a variety of roles. Genuine public sector and private enterprise cooperation is warranted, beyond lip service, to attain self-sufficiency in our defence needs is the need of the hour.

Importantly, what is indeed beyond comprehension is that even after seven months of Gen Bipin Rawat's tragic demise, no CDS has yet been appointed. Once the new CDS is appointed, among his first priorities will be to go into the much debated and essential theatrisation conundrum. Meanwhile, the Indian military will do well by studying the current Russian-Ukrainian conflict and drawing early lessons from it as we have similar equipment fielded by both the warring nations. Additionally, the Indian military must study emerging aspects of future warfare, newer technologies, nuclear, cyber and space warfare where China has taken a leap.

Many dispassionate observers feel that in many facets of Indian society there is a marked increase in politicisation of institutions and undue infusion of religion and regionalism. All these aspects are anathema to the ethos, upbringing and handling of the Armed Forces and it is thus imperative for the military's top hierarchy to ensure that such foul winds does not permeate into our traditional noble value systems.

The Indian Armed Forces have their work cut out to sustain the nation's honour and territorial integrity as it has done admirably in the past. We have the respect and love of our people to sustain us even if somewhere governments falter. As a Veteran, all I can state is that the Indian Armed Forces will remain ever-ready to do the nation's bidding and as true and resolute professionals, bring glory to the nation in all battlefields which they encounter.

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Air Marshal Brijesh Jayal says....

Protests over Agnipath: Time to look afresh at where India wishes to place its armed forces and expectations from them

(Photo: Angad Singh)

Judging by the debate preceding the formal announcement of the Agnipath scheme relating to recruitment of other ranks in the armed forces, it was quite apparent that not only was the issue somewhat emotive, because of its security implications, but also being driven by other than security considerations.

Notwithstanding this, none could have anticipated the inflammatory response on the streets that followed this announcement. With a fractured polity that appears to have become part of Indian democracy, it evokes little surprise that political parties are now vying to score political points over this sensitive national security issue with little concern for what impact this can have on the wider social contract of civil-military relations in our democracy.

It is not the purpose of this piece to delve into the merits or otherwise of the scheme that was announced by the RM and the service chiefs. Suffice it to say, that it is on their shoulders that our republic has vested the responsibility to defend the nation and we owe it to them to put our faith and trust in the choices they make towards fulfilling this mandate. After all, it is under their command that our soldiers, sailors and air-warriors commit themselves to a calling of unlimited liability — a commitment that is neither enacted by law nor indeed expected of any other profession.

In the midst of this din and debate, we have failed to value what lies behind the success of Indian democracy to have nurtured and maintained a tradition of sound civil-military relations without having fallen into a trap that many others have, where such relations have invariably fractured. This indeed is the subject of a book published in 2015 titled –'Army and Nation-The Military and Indian Democracy since Independence' by Yale University political scientist, Professor Steven Wilkinson in which he draws on comprehensive data to explore how and why India has succeeded in keeping the military out of politics, when so many other countries have failed.

Reviewing the book, Pratinav Anil of LSE makes the following observations in a blog. To quote: 'In his phenomenology of civil-military relations, Wilkinson argues that coup-proofing was no accident. Prime Minister Jawaharlal Nehru's calibrated thinking, coupled with a general distrust within the Indian National Congress leadership, who had often suffered at the hands of the armed forces in the run up to independence, were central to a number of decisions made by the cabinet and constituent assembly of the nascent republic.'

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He goes on to outline some of these:

- Removing the Commander-in-Chief from the governor-general's executive council and putting him under the Defence Minister. Later, abolishing the post and replacing it with that of Chief of Army Staff in equivalence to the chiefs of navy and air force, thus increasing the scope of inter-service rivalry.
- Prime Minister taking over the C-in-C's mansion as his official residence.
- Doing away with extensions to senior Generals
- Posting ex-Chiefs on extended and faraway diplomatic assignments.
- Transferring military's domestic functions to the IB which then kept track on retired military officers.
- The traditional recruiting streams, training academies, and mid-career training institutions being diversified to decrease cohesion.
- A policy of 'balancing outside the army' through induction of vast paramilitary forces totalling over 850,000 to serve as an indirect hedge against the army.
- Continuing with the policy of recruiting from so-called 'martial races' whilst appearing to publicly distance from doing so through token gestures like recruiting from 'military deficit' provinces in small numbers and in largely non-combat roles.
- Adopting a policy of 'balancing inside the army' — variegated companies within each battalion prevented soldiers from forming common ground on the basis of a shared identity. For example, a typical Punjab Regiment battalion was made to consist of two Sikh and two Dogra companies.

Having analysed through research the reasons for Indian democracy's successful civil-military relations, Professor Wilkinson however leaves a poser on 'whether, in a rapidly changing society, these structures will survive the current national conflicts over caste and regional representation in New Delhi, as well as India's external and strategic challenges.'

Ironically, one such challenge appears before us in the form of the current unrest and hence needs a closer look. That the entire national security edifice needs modernising to face challenges of today has generally been accepted by security analysts and successive governments over the years. The reasons why not much progress has been possible may be many, but Prof Wilkinson's work is a pointer to the complexities involved.

It is however to the credit of the present government that it has displayed the willingness to make a beginning to change the status-quo and towards this, first appointed a CDS along with its associated organisation and has now opted for the Agnipath scheme. But there is a major downside to this piecemeal approach that is evident from Prof Wilkinson's work as well. In the complex matrix of civil-military relations in our democracy, every such change, however desirable, will have ripple effects which then result in fire-fighting and adhocism of sorts. To quote two examples before us:

Following the untimely death of Late Gen Rawat, the first CDS, not only has there been undue delay in appointing a replacement, but reports indicate that one issue relates to the multiple hats (civil and military) that the post adorns. The other day, at the height of protests in the streets on the issue of Agnipath, the media was full of anticipation of an announced MOD press briefing. In the event, the MOD fielded only a uniformed team to convey a firm and apt message. Technically, the briefing was being held by the Ministry of Defence with the Additional Secretary DMA (a serving Lt Gen) in the chair. By the latter appearing in his military uniform, however, the impression conveyed to the general public (and to many of those serving in uniform) is that the MOD had passed the buck to the military!

This writer has long argued that, much like what the US did prior to undertaking major reforms in its national security architecture, India, too, needs to set up the equivalent of a Blue Ribbon Commission tasked to look afresh at the entire issues of where India wishes to place its armed forces and the roles and missions expected of them in keeping with the nation's aspirations. The commission's findings must be debated in Parliament culminating in a National Security Act. This approach will also be in keeping with the Prime Minister's exhortations for out-of-the-box thinking towards transformation.

(Image IANS/DNA)


(Photo: Army PRO)

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Droupadi Murmu is India's new President and Supreme Commander of Armed Forces

Droupadi Murmu took oath on 25 July 2022 as the 15th President of India at a ceremony in Parliament's Central Hall in New Delhi. The President, who is the first tribal and second woman to hold the country's highest constitutional office, was administered oath of office by Chief Justice of India NV Ramanna. She succeeds Ram Nath Kovind, whose five-year-term ended on 24 July 2022. After the swearing in ceremony, President Droupadi Murmu received a ceremonial salute at the forecourt of the Rashtrapati Bhavan.

Ordnance Factories: an update

Total 41 numbers of Ordnance Factories have been set up by the Government in the country so far. There is presently no such proposal of setting up of new Ordnance Factories. Further, seven new Defence Public Sector Undertakings have been set up with effect from 1 October 2021 by subsuming the 41 Ordnance Factories.

DRDO and IN test VL-SRSAM

Defence Research & Development Organisation (DRDO) and Indian Navy successfully flight tested Vertical Launch Short Range Surface-to-Air Missile (VL-SRSAM) from the Integrated Test Range (ITR), Chandipur off the coast of Odisha on 23 August 2022. The flight test was carried out from an Indian naval ship against a high-speed unmanned aerial target for demonstration of vertical launch capability. The missiles, equipped with indigenous Radio Frequency (RF) seeker, intercepted the target with high accuracy. The VL-SRSAM system has been indigenously designed and developed by DRDO.

DRDO tests laser-guided ATGMs

Indigenously developed Laser-Guided Anti-Tank Guided Missiles (ATGM) were successfully test-fired from Main Battle Tank (MBT) Arjun by Defence Research and Development Organisation (DRDO) and Indian Army at KK Ranges with support of Armoured Corps Centre & School (ACC&S) Ahmednagar in Maharashtra on 4 August 2022. The missiles hit with precision and successfully destroyed the targets at two different ranges. The all-indigenous Laser Guided ATGM employs a tandem High Explosive Anti-Tank (HEAT) warhead to defeat Explosive Reactive Armour (ERA) protected armoured vehicles.

DRDO & Indian Army conduct 6 QR-SAM tests

Defence Research and Development Organisation (DRDO) and Indian Army successfully completed six flight-tests of Quick Reaction Surface to Air Missile (QRSAM) system from Integrated Test Range (ITR) Chandipur off the Odisha coast on 8 September 2022. The flight-tests were carried out against high-speed aerial targets mimicking various types of threats to evaluate the capability of the weapon systems under different scenarios, including long range medium altitude, short range, high altitude manoeuvring target, low radar signature with receding and crossing target and salvo launch with two missiles fired in quick succession. The system performance was also evaluated under day and night operation scenarios.

Tejas fighter aircraft: an update

Hindustan Aeronautics Limited (HAL) under the Ministry of Defence responded to a Request for Information (RFI) received from Royal Malaysian Air Force (RMAF), Malaysia in February 2019 for an LCA class aircraft. Subsequently, Hindustan Aeronautics Limited responded in October 2021 to Request for Proposal (RFP) issued against tender released by Royal Malaysian Air Force, Malaysia for 18 Fighter Lead In Trainers – Light Combat Aircraft (FLIT – LCA) and HAL offered LCA Tejas twin seater variant. Other countries which have evinced interest in LCA aircraft are Argentina, Australia, Egypt, USA, Indonesia and Philippines.

HAL to open office in Malaysia

HAL on 18 August 2022 signed an MoU for establishing an office in Kuala Lumpur (Malaysia). The office in Malaysia will help HAL in tapping the new business opportunities for Fighter Lead-in Trainer (FLIT) LCA and other requirements of Royal Malaysian Air Force (RMAF) like Su-30 MKM and Hawk upgrades. It will reinforce commitment of India in supporting the Malaysian Defence Forces and industry for sustainable aerospace and defence landscape in Malaysia.

Saab IDAS on 200 Dhruv ALHs

Since 2005, Saab's Integrated Defence Aids Suite (*IDAS)* systems have been integrated in over 200 ALH Dhruvs. "As India celebrates its 75 years of Independence, Saab is committed to sharing technology to overcome new aerial and ground based threats", stated company officials. IDAS is a multi-spectral EW self-protection suite for rotary and fixed-wing platforms. Saab is now in final stages with HAL for IDAS production transfer of technology to India. Saab will, together with HAL, work on the full production of the IDAS, including the future version of IDAS-3 in India.

Indian Navy's all woman aircrew creates history

On 3 August 2022, five officers of the Indian Navy's INAS 314 based at Naval Air Enclave, Porbandar, created history by completing the first all-women independent maritime reconnaissance and surveillance mission in the North Arabian Sea onboard a Dornier 228 aircraft. The aircraft was captained by the Mission Commander, Lt Cdr Aanchal Sharma, who had pilots, Lt Shivangi and Lt Apurva Gite, and Tactical and Sensor Officers, Lt Pooja Panda and Lt Pooja Shekhawat in her team. INAS 314 is a frontline Naval Air Squadron based at Porbandar, Gujarat and operates the Dornier 228 maritime reconnaissance aircraft. The squadron is commanded by Cdr SK Goyal, a Qualified Navigation Instructor.

CAS at Hasimara

Air Chief Marshal VR Chaudhari visited IAF's Eastern AOR and during the visit, CAS flew a sortie on the Rafale as part of three aircraft combat training mission at Air Force Station Hasimara with his son, Sqn Ldr Mihir V Chaudhari. The sortie flown by CAS and his son is a "continuation of the finest traditions of the IAF and underlines the importance accorded to grooming and preparing our young leaders for the challenges of the future".

Air Works delivers sixth P-8I to IN

On 4 August 2022, India's largest independent MRO and aviation services and solutions major - Air Works - handed over the last of the six P-8I maritime patrol aircraft after completing Phase 32 maintenance checks to Boeing and the Indian Navy. The heavy maintenance of these aircraft was successfully completed at the Air Works facility at Hosur, Tamil Nadu. Air Works and Boeing signed a strategic collaboration last year for the MRO of two critical Boeing defence platforms in India - the P-8I operated by the Indian Navy (IN) and the VIP transport fleet (BBJ) operated by the Indian Air Force (IAF).

Indigenisation of SDRs

Ministry of Defence (MoD) has fast-tracked the indigenisation of Software Defined Radios (SDRs) with country's premier R&D institutions viz. Defence Research and Development Organisation (DRDO) and Indian Institute of Technology (IIT) Kanpur to fulfill the increasing demand by the Armed Forces across a broad spectrum of operations. The complete product life cycle management framework is necessary for security sensitive SDR technology and products. It involves indigenous self-sustainable design, development, manufacturing, testing/certification and maintenance ecosystem.

BEL's SDR for representational purposes only

Tata ATAGS at India's ID@75

TATA Advanced Systems (TATA Aerospace & Defence) or TASL "is proud that the Artillery Gun System (ATAGS), which is manufactured and co-developed by TASL, participated in the 75th Independence Day celebrations at the Red Fort in Delhi". The 155/52 mm ATAGS jointly developed by DRDO (ARDE) and TASL successfully completed PSQR firing trials in May 2022. "This is a true example of Public-Private Partnership leading to a world class weapon system fully designed and developed in India. Such a weapon system is highly strategic for India", stated company officials.

Launch of Y- 3023 (Dunagiri)

Dunagiri, a Project 17A frigate, was launched into the Hooghly river at Garden Reach Shipbuilders and Engineers Limited, Kolkata on 15 July 2022. Christened after a mountain range in the state of Uttarakhand, 'Dunagiri' is the fourth ship of P17A frigates. These are follow-on of the P17 frigates (Shivalik Class) with improved stealth features, advanced weapons and sensors and platform management systems. P17A ships have been designed in-house by Indian Navy's Directorate of Naval Design (DND), which has successfully spear-headed design of numerous class of indigenous warships in the past.

Keel laying of third Diving Support Craft

Keel laying for the third ship of Diving Support Craft (DSC) project was held on 12 August 2022 at Titagarh Wagons Ltd., Kolkata. The contract for procurement of Five Diving Support Craft (Yards 325 to 329) for the Indian Navy was signed on 12 February 2021 with Titagarh Wagons Ltd., at a total project cost of Rs 174.77 Cr. The ships will be commissioned in the Indian Navy to provide diving assistance for ships inside and close to harbour, for underwater repairs, maintenance and salvage.

Launch of YD 12653 (Taragiri)

The fifth stealth frigate of P17A, being built at MDL was launched on 11 September 2022. Vice Admiral Ajendra Bahadur Singh, Flag Officer Commanding-in-Chief, Western Naval Command was the Chief Guest, VAdm Kiran Deshmukh Controller Warship Production and Acquisition other senior officers from the Indian Navy and MoD were amongst the dignitaries who witnessed the launch ceremony. Seven P17A frigates are under various stages of construction at MDL and GRSE.

IN Do-228 for SL

As part of the bilateral defence cooperation, an Indian Navy Dornier Do-228 Maritime Patrol Aircraft was handed over to Sri Lanka. The induction of this new asset would significantly augment the capability of Sri Lanka and is "aligned with India's vision of Security And Growth for All in the Region (SAGAR)".

IAF assets to the rescue

Following the unfortunate cloudburst near the Amarnath shrine cave in July 2022, IAF helicopters and transport aircraft commenced operations to airlift NDRF personnel to the site and rescue the pilgrims. Also, in the same month, IAF continued its efforts to provide relief to flood affected populace of Assam and Meghalaya utilising various helicopter and transport aircraft.

BEL contract for supply of IAC MOD 'C'

Bharat Electronics Limited (BEL) signed a contract with the Ministry of Defence, Government of India, worth around Rs. 250 crores, towards supply of nine Integrated ASW Complex (IAC) MOD 'C' Systems on 23 July 2022. IAC MOD 'C' is an Integrated Anti-Submarine Warfare (ASW) system for all surface ships of the Indian Navy. IAC MOD 'C' computes Fire Control Solutions and facilitates firing of ASW weapons such as torpedoes and rockets.

BEL signs MoU with Smiths Detection India

Bharat Electronics Limited (BEL) on 30 August 2022, signed an MoU with Smiths Detection, a global leader in threat detection and security inspection technologies, for offering advanced, high-energy scanning systems to the Indian market. The MoU will leverage the high-end, technological capabilities of both the firms to meet India's domestic security needs.

Keel laid for 1st ASW SWC

Keel laying of the first warship (BY 523, Mahe) of Anti-Submarine Warfare Shallow Craft (ASW SWC) project under construction by CSL, Kochi, was undertaken on 30 August 2022 by VAdm Kiran Deshmukh, CWP&A in presence of Mr. Madhu S Nair, CMD, CSL, Commodore V Ganapathy, WPS (Koc), CSL, Directors and other senior officials of CSL and Indian Navy.

Steel Cutting of BY 528 and BY 529 for ASW SWC

Steel Cutting of 6th and 7th ships (BY 528 and BY 529) of Anti-Submarine Warfare Shallow Craft (ASW SWC) project under construction by Cochin Shipyard Limited (CSL), Kochi, was undertaken on 30 August 2022. The steel cutting event and commencement of fabrication of any warship signifies an important milestone, as this occasion is a culmination of preparatory process and kick starts the construction phase of the ships.

First ever repair of a US Navy ship in India

Adding a new dimension to the Indo-US strategic partnership, US Navy Ship (USNS) Charles Drew arrived at L&T's Shipyard at Kattupalli, Chennai on 7 August 2022 for undertaking repairs and allied services. This is the first ever repair of a US Navy

ship in India. The US Navy had awarded a contract to L&T's Shipyard at Kattupalli for undertaking maintenance of the ship. The event signifies the capabilities of Indian shipyards in the global ship repairing market.

INS Sindhudhvaj decommissioned

INS Sindhudhvaj bid adieu to Indian Navy on 16 July 2022 after serving for a period of 35 years. Vice Adm Biswajit Dasgupta Flag Officer Commanding -in-Chief, Eastern Naval Command was the Chief Guest for the ceremony. The Decommissioning event was attended by 15 of the former Commanding Officers including Cmde SP Singh (Retd), the Commissioning CO and 26 Commissioning crew veterans.

Update on the accidental missile firing

PRESS INFORMATION BUREAU (DEFENCE WING)
GOVERNMENT OF INDIA
****

'हर काम देश केनाम'

New Delhi, Phalguna 20, 1943
Friday, March 11, 2022

Statement on accidental firing of missile

On 9 March 2022, in the course of a routine maintenance, a technical malfunction led to the accidental firing of a missile.

The Government of India has taken a serious view and ordered a high-level Court of Enquiry.

It is learnt that the missile landed in an area of Pakistan. While the incident is deeply regrettable, it is also a matter of relief that there has been no loss of life due to the accident.

CLOSURE OF THE INCIDENT OF ACCIDENTAL BRAHMOS MISSILE FIRING ON 09 MARCH 2022

A BrahMos missile was accidentally fired on 09 March 2022. A Court of Inquiry (CoI), set up to establish the facts of the case, including fixing responsibility for the incident, found that deviation from the Standard Operating Procedures (SOP) by three officers led to the accidental firing of the missile. These three officers have primarily been held responsible for the incident. Their services have been terminated by the Central Govt with immediate effect. Termination orders have been served upon the officers on 23 Aug 22.

INS Ajay decommissioned

INS Ajay was decommissioned on 19 September 2022 after rendering 32 years of service to the nation. The ceremony was conducted at Naval Dockyard, Mumbai in the traditional manner, wherein the national flag, naval ensign and the decommissioning pennant of the ship were lowered for the last time at sunset, signifying the end of the ship's commissioned service. INS Ajay was commissioned on 24 January 1990 at Poti, Georgia in the erstwhile USSR and was part of the 23rd Patrol Vessel Squadron under the operational control of Flag Officer Commanding, Maharashtra Naval Area.

Thailand for 600 Tata trucks

(Representational image)

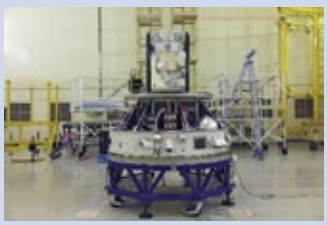
Royal Thai Army is set to complete the purchase of 600 Tata military trucks. Recently, Thailand had lauded India's Atmanirbhar Bharat initiative by announcing the purchase of 600 ATA LPTA military trucks. The LPTA 715 4X4 is used for carrying troops.

ISRO's new Inflatable Aerodynamic Decelerator (IAD)

An IAD, designed and developed by VSSC, has been successfully test flown in a Rohini sounding rocket from TERLS, Thumba. The IAD was initially folded and kept inside the payload bay of the rocket. At around 84 km altitude, the IAD was inflated and it descended through atmosphere with the payload part of sounding rocket. The pneumatic system for inflation was developed by LPSC. The IAD has systematically reduced the velocity of the payload through aerodynamic drag and followed the predicted trajectory. This is first time that an IAD is designed specifically for spent stage recovery.

ISRO's maiden flight of SSLV-D1/ EOS-02 Mission

ISRO's maiden flight of SSLV-D1/EOS-02 Mission took place on 7 August 2022: "SSLV-D1 placed the satellites into 356 km x 76 km elliptical orbit instead of 356 km circular orbit. Satellites are no longer usable. Issue is reasonably identified. Failure of a logic to identify a sensor failure and go for a salvage action caused the deviation. A committee would analyse and recommend. With the implementation of the recommendations, ISRO will come back soon with SSLV-D2".



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HAL-L&T in Rs 860 Crore Contract for PSLV

The HAL-L&T consortium has been contracted for Rs 860 crore contract for end-to-end realisation of five Polar Satellite Launch Vehicles (PSLV) over a period of four years from the NewsSpace India Limited (NSIL). As part of its mandate NSIL had invited Expression of Interest (EoI) on 16 August 2019, for realisation of five PSLV-XL Launch Vehicles by Indian industry. Based on competitive bidding HAL led consortium emerged as the successful bidder.

36th Tri-Services Commanders' Conference

36th Tri-Services Commanders' Conference (TSCC) - South was held at Port Blair on 12-13 September 2022 under the aegis of Andaman and Nicobar Command. The senior leadership deliberated upon aspects various pertaining to the geostrategic situation and infrastructure development in the Indian Ocean Region, coordinating the actions of Regional Command of the three services as well as avenues of augmenting tri-services training and readiness of all components.

RattanIndia launches its advanced drone 'Defender'

RattanIndia Enterprises Ltd has launched the 'Defender' by its company TAS (Throttle Aerospace Systems). The unveiling took place at the hands of Minister, Gen. V.K. Singh, MOS, Civil Aviation, Govt. of India at Air Force Auditorium, Subroto Park, New Delhi during the 'Unmanned Aerial Systems India 2022' event. Defender is an indigenously developed tracking and capturing system for rogue drones. Defender is loaded with 13 pre-programmed to neutralise the rogue drones. This solution will provide a first-of-a-kind capability to the Indian defence establishment to get rid of rogue drones flying over unauthorised airspace.

Garuda Aerospace maps 7000 villages using drones in 1 year

Garuda Aerospace has successfully mapped 7,000 villages in Uttar Pradesh under the Svamitva Scheme. The drone start-up had won the tender from the nodal agency, The Survey of India in September 2021. As per the tender, Garuda Aerospace was authorised to deploy drones for large scale mapping and digitisation of land records in rural areas thereby empowering land-owners and farmers with accurate digital land certificates and a unique ID that enables them to get a layout of their entire land with precise and all information. As the winner of the largest order, Garuda Aerospace deployed 15 fixed-wing drones for the purpose of mapping at the speed of 8 to 10 sq kms per hour.

Pratt & Whitney to open India Engineering Centre

Pratt & Whitney has announced the establishment of a state-of-the-art India Engineering Centre (IEC) in Bengaluru, India which is slated to commence operation in January 2023. The new center will focus on providing contract engineering services. The IEC is expected to employ 500 engineers and professionals when fully staffed. "Pratt & Whitney's growth in the country represents our strong ties and deep respect for the skills India offers, skills needed for the future of aviation," stated Ashmita Sethi, managing director of UTCIPL.

Aequs and Hindalco in strategic alliance

Aequs and Hindalco Industries Ltd. have entered into an strategic alliance for long- term collaboration and joint business development in the commercial aerospace sector. The partnership leverages the capabilities, market presence and industry knowledge of the respective parties for the development, manufacture and qualification of extrusions required for commercial aerospace OEMs and other Aequs customers.

ModAir leases Tecnam through GIFT CITY

ModAir an entity registered in GIFT City, Gandhi Nagar, Gujarat as an aircraft leasing company leased out its first aircraft which is an Italian trainer twin engine Aircraft (Tecnam) to a flight training academy in Jalgaon, Maharashtra through a lease of IFSC city, Ahmedabad. This is the first time a trainer aircraft is leased in India to an FTO.

Airbus partners with GMR

Airbus has signed a contract with the GMR Group, a leading Indian aviation infrastructure developer, to provide aircraft maintenance training to young aviation engineers making a trending career choice. GMR will provide the fully integrated Aircraft Maintenance Engineer (AME) licensing programme at the GMR School of Aviation in Hyderabad. The four-year course will include two years of classroom training and a two-year training in maintenance, repair and overhaul (MRO) at GMR Aero Technic in Hyderabad followed by Aircraft Type Training.

Akasa Air enhances its network with its fifth aircraft

Akasa Air, India's newest airline, announced Delhi as the sixth destination on its network, adding to its existing network of

Ahmedabad, Bengaluru, Kochi, Chennai and Mumbai. Akasa Air has been aggressively scaling up its operations and will have crossed 250 flights per week by October 2022 along a total of nine routes.

Vistara inducts third Boeing 787-9 Dreamliner

Representational image courtesy @PlanesAtPaine

Vistara announced more than a 100% increase in frequencies to/from Frankfurt and Paris as it gears up to receive its third Boeing 787-9 Dreamliner aircraft which has been leased recently. Starting 30 October 2022, Vistara will operate 6x weekly flights between Delhi and Frankfurt, up from the current 3x weekly frequency; while connectivity between Delhi and Paris goes up from 2x to 5x weekly. The airline has a fleet of 54 aircraft including 41 Airbus A320, five Airbus A321neo, five Boeing 737-800NG and three Boeing 787-9 Dreamliner aircraft and has flown more than 35 million customers since starting operations.

Flybig connects Guwahati to Imphal via Tezu

Flybig is adding one more sector under the UDAN scheme: Guwahati – Tezu – Imphal – Tezu – Guwahati, all days except Mondays. Imphal, the cultural capital of Manipur is now getting directly connected to Tezu and Guwahati.

Redbird and Airbus to deliver A320 type-rating training

Redbird Flight Training Academy has joined hands with Airbus to provide type-rating training to its students who are aspiring to become commercial pilots for the A320 aircraft in the region. As per the contract, Airbus will deliver the Jet Orientation Course (JOC) and Multi-crew Cockpit Co-operation (MCC) - theory and

Full Flight Simulator (FFS) sessions to the students. The training will be provided by Airbus-approved instructors at the Airbus India Training Centre (AITC) in Gurugram.

APPOINTMENTS

HAL's Director Finance gets additional charge of CMD, HAL

Mr. C. B. Ananthakrishnan, Director (Finance) of HAL has taken over the additional charge of the post of Chairman and Managing Director on 1 August 2022 following the superannuation of R. Madhavan as CMD HAL on 31 July 2022. Ananthakrishnan will hold this post for a period of three months from 1 August or till the post of CMD, HAL is vacant, whichever is earlier.

New head at DRDO

Dr Samir V Kamat has assumed charge as Secretary, Department of Defence Research & Development and DRDO Chairman from Dr G Satheesh Reddy, who in turn will be the Scientific Advisor to the Raksha Mantri (defence minister).

Mr Dinesh Kumar Batra is new CMD, BEL

Mr Dinesh Kumar Batra, Director (Finance) & CFO, has taken additional charge as Chairman & Managing Director (CMD) of Bharat Electronics Limited (BEL) with effect from 1 September 2022. Mr Batra was instrumental in the company's move to foray into the Electro-Explosive segment. He is also credited with BEL entering into Li-on battery packs for automobiles to support the e-Mobility programme of the Government of India. He is a member of the Board of BEL subsidiaries, BEL-Thales Systems Limited (BTSL) and BEL Optronic Devices Limited (BELOP).

HAL signs contract with Honeywell for HTT-40 engines

On 27 July 2022, HAL signed a contract worth over US$100 million for supply and manufacture of 88 honeywell TPE331-12B engines/kits along with maintenance and support services to power the Hindustan Trainer Aircraft (HTT-40). The contract was exchanged by Mr. Eric Walters, Sr. Director OE Sales, Honeywell and Mr. B Krishna Kumar, Executive Director (E & IMGT) in the presence of Mr. R Madhavan, CMD, HAL.

"HAL has successfully developed Basic Trainer Aircraft (HTT-40) to address the basic training requirements of the IAF. There is potential requirement of 70 aircraft. The contract for the same with IAF is under advanced stage of approval", stated Mr. Madhavan.

"We are proud of our four decade long partnership with HAL and happy to extend our relationship with this new order," stated Mr. Eric Walters, Senior Director OE Sales, Honeywell Defense & Space. "The TPE331-12 family of engines has proven itself in operations all over the world, and we have committed to support and deliver engines as well as kits within the stipulated schedule to meet the requirements of the IAF. Honeywell is committed to support export of HTT-40 aircraft in coming years along with other engine programmes which are currently on radar. This contract would pave the way for future collaboration between HAL and Honeywell".

The TPE331-12B engine is a single shaft turboprop engine with integral inlet and gearbox, two stage centrifugal compressor, power turbine, gearbox, three stage axial turbine and turbine exhaust diffuser as well as EEC for reliable power and outstanding operational characteristics.

The HTT-40 prototypes are powered by TPE331-12B engines and has been serving well since 2014. Entering into this 'Manufacturing & Repair license agreement for Honeywell TPE331-12B Turboprop engine' marks a major milestone in the execution of 70 HTT-40 aircraft contract with IAF. HAL is working closely with Honeywell for its support for export potential of HTT-40. HAL and Honeywell are exploring other areas such as 1MW Turbo Generators, manufacturing, Repair & Overhaul of TPE 331-10GP/12JR engines for variants of Dornier.

HAL and Safran to develop new helicopter engines in JV

Hindustan Aeronautics Limited (HAL) and Safran Helicopter Engines signed an agreement on 8 July 2022 to create a new joint venture intended to develop helicopter engines. Through a Memorandum of Understanding (MoU), signed by Mr. R. Madhavan, CMD, HAL and Mr. Franck Saudo, CEO Safran Helicopter Engines in the presence of Mr. Olivier Andriès, Safran CEO, both partners will extend their long-lasting partnership by establishing a new aero-engine company in India. It will be dedicated to the development, production, sales and support of helicopter engines and one of its main objectives will be to meet the requirements of HAL and Ministry of Defence's future helicopters, including the 13-ton IMRH (Indian Multi-Role Helicopter).

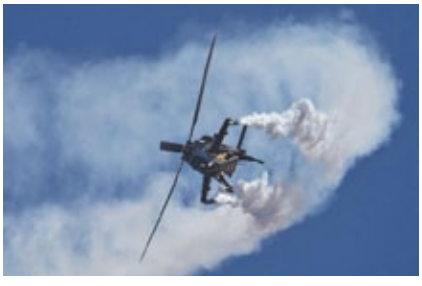
This MoU demonstrates once again the commitment of both Safran Helicopter Engines and HAL to the Indian Government's vision of "Aatmanirbhar Bharat" or achieving self-reliance – particularly in defence technologies.

Mr. Madhavan stated, "Safran Helicopter Engines has been our valued partner for several decades. We now look forward to utilise this opportunity to leverage HAL's experience in manufacturing of more than 15 types of aircraft and helicopter engines to jointly co-develop and manufacture engine with immediate focus on IMRH and its naval variant the Deck Based Multi Role Helicopter (DBMRH). This partnership will involve and utilise the Indian defence manufacturing ecosystem within India".

Mr. Franck Saudo stated, "The creation of this new joint venture marks a turning point in our relationship with HAL and the Indian MoD with the development and production of a new generation of helicopter engine. We are proud to further expand our structuring partnership with HAL, which began more than 50 years ago, and which was recently illustrated with the development and production of the Shakti engine and the inauguration of our joint venture Helicopter Engines MRO Pvt Limited (HE-MRO). With a fleet of over 1,000 engines, India's Armed Forces are one of the largest operators of Safran-designed helicopter engines".

HAL and Safran Helicopter Engines have already multiple partnerships, including the Shakti engine, which powers HAL-produced helicopters, including the Dhruv, Rudra and the Light Combat Helicopter (LCH). The Ardiden 1U variant also powers the new Light Utility Helicopter (LUH). More than 500 Shakti engines have already been produced.

Through HE-MRO joint venture in Goa, HAL and Safran Helicopter Engines will also provide MRO (Maintenance, Repair and Overhaul) services for TM333 and Shakti engines in service with Indian Armed Forces. It will be operational by the end of 2023.



Delivery of MH-60R's to the Indian Navy

A Letter of Offer and Acceptance (LoA) for procurement of 24 MH-60R multi-role helicopters was concluded with the US Government in February 2020 at a cost of more than Rupees Fourteen Thousand Crores. The first three MH-60Rs delivered in US in 2021 are being utilised for training to IN crew. The next three MH 60R helicopters were delivered at Kochi, two helicopters of which were received by the Indian Navy at Cochin International Airport on 28 July 2022 and the third helicopter was delivered in August 2022. The delivery of all 24 MH-60R helicopters will be completed by 2025.

DAC approves arms procurement proposals worth Rs 28,732 crore

The Defence Acquisition Council (DAC) meeting under the chairmanship of Raksha Mantri Rajnath Singh, was held on 26 July 2022. Acceptance of Necessity (AoN) for Capital Acquisition Proposals of the Armed Forces amounting to Rs 28,732 crore were accorded by the DAC in this meeting under Buy (Indian IDDM) and Buy (Indian) categories giving a further boost to 'Aatmanirbharta' in Defence.

Among the proposals approved by DAC in the meeting were three proposals of the Indian Army, viz. Guided Extended Range Rocket Ammunition, Area Denial Munition Type I and Infantry Combat Vehicle – Command have been designed and developed by DRDO. The total value of these three proposals is Rs 8,599 crore. Guided Extended Range Rocket Ammunition has the range of 75 kms with accuracy of 40 meters. The Aerial Denial Munition Type I Rocket Ammunition contains dual purpose sub munitions capable of neutralising both tanks and armoured personnel carriers as well as B vehicle entrenched troops. The Infantry Combat Vehicle – Command is equipped with technology to collect, disseminate, share and present real time information to commanders to facilitate quick decision making for execution of tasks.

Considering the demand of enhanced protection against the threat of enemy snipers to our troops deployed along the Line of Control and in close combat operations in counter terrorism scenario, DAC accorded AoN for Bullet Proof Jackets with Indian Standard BIS VI level of protection. To combat the current complex paradigm of conventional and hybrid warfare and counter terrorism at the borders, AoN for induction of approximately four lakh of Close Quarter Battle Carbines for the Services has also been accorded by the DAC. This is set to provide major impetus to the small arms manufacturing industry in India and enhancing 'Aatmanirbharta' in small arms.

Weaponry manufacturing units

In order to promote 'Make in India' in defence sector, the Government has issued 584 Defence Licenses to 358 private companies for setting up of manufacturing units, including 107 licenses for weapon manufacturing. In addition, there are 16 Defence Public Sector Companies manufacturing various platforms and equipment for the Armed Forces.

In the recent conflicts across the world, drone technology proved to be a force multiplier in military operations. Accordingly, to augment Indian Army's capability in modern warfare, AoN for procurement of Autonomous Surveillance and Armed Drone Swarms has been accorded by the DAC under Buy (Indian-IDDM) category.

The DAC also approved Navy's proposal to procure upgraded 1250KW capacity Marine Gas Turbine Generator for power generation application onboard Kolkata class of ships through Indian industry. This will give a major boost to indigenous manufacturing of gas turbine generators.

In order to enhance the security in the coastal region of the country, the DAC also approved the proposal of procurement of 14 Fast Patrol Vessels (FPVs) for Indian Coast Guard under the Buy (Indian-IDDM) with 60% IC.

Self reliance in defence manufacturing

The Government has taken several policy initiatives in the past few years and brought in reforms to encourage indigenous design, development and manufacture of defence equipment in the country, thereby expanding the production of indigenous defence equipment. These initiatives, inter-alia, include according priority to procurement of capital items from domestic sources under Defence Acquisition Procedure (DAP)-2020; Announcement of 18 major defence platforms for industry led design and development in March 2022; Notification of three 'Positive Indigenisation Lists' of total 310 items of Services and two 'Positive Indigenisation Lists' of total 2958 items of Defence Public Sector Undertakings (DPSUs) for which there would be an embargo on the import beyond the timelines indicated against them; Simplification of Industrial licensing process with longer validity period; Liberalization of Foreign Direct Investment (FDI) policy allowing 74% FDI under automatic route; Simplification of Make Procedure; Launch of Innovations for Defence Excellence (iDEX) scheme involving start-ups and Micro, Small and Medium Enterprises (MSMEs); Implementation of Public Procurement (Preference to Make in India) Order 2017; Launch of an indigenisation portal namely SRIJAN to facilitate indigenisation by Indian Industry including MSMEs; Reforms in Offset policy with thrust on attracting investment and Transfer of Technology for Defence Manufacturing by assigning higher multipliers; and Establishment of two Defence Industrial Corridors, one each in Uttar Pradesh and Tamil Nadu; Opening up of Defence Research and Development (R&D) for industry, start-ups and academia with 25% of defence R&D budget earmarked to promote development of defence technology in the country; Progressive increase in allocation of Defence Budget of military modernisation for procurement from domestic sources, etc.

With these actions of the Government, the expenditure on defence procurement from foreign sources which used to be 46% of the overall expenditure has reduced to 36% in the last four years i.e. 2018-19 to 2021-22.

Chief of the Air Staff flies 3 indigenous platforms

Air Chief Marshal VR Chaudhari, Chief of the Air Staff (CAS) was on a two day visit to Bangalore on 5 and 6 August 2022 where he flew three indigenous platforms, Light Combat Aircraft (LCA) Tejas, Light Combat Helicopter (LCH) and Hindustan Turbo Trainer-40 (HTT-40), which are being inducted into IAF as part of its drive towards Atmanirbharta. CAS was demonstrated the capabilities of the LCH and HTT-40 as well as updates on the Tejas. He also interacted with the designers and test crew to understand the current status and future plans.

On 6 August 2022, CAS delivered the Air Chief Marshal LM Katre Memorial Lecture which was attended by serving and retired officers of IAF, HAL and other stakeholders from the aerospace industry. The CAS spoke on 'Capability and Force Development Plans of IAF' towards making it a future ready combat force.

Boeing F/A-18 Super Hornet successfully completes operational demonstrations in India

Boeing's F/A-18 Super Hornet successfully completed operational demonstration tests at Indian Naval Station Hansa in Goa, India, and reinforced the Super Hornet's ability to "effectively and safely operate off Indian Navy carriers". Two US Navy F/A-18E Super Hornets completed multiple ski-jumps, roll-in and fly-in arrestments, as well as performance flights, in a variety of weights in the air-to-air, air-to-ground, and air-to-surface configurations, meeting the Indian Navy test requirements. "The Boeing team was privileged to showcase the F/A-18 Super Hornet's compatibility with Indian carriers in Goa," stated Alain Garcia, vice president, India business development Boeing Defense, Space & Security and Global Services. "As the premier frontline multi-role naval fighter, the F/A-18 Super Hornet is one of the world's most proven and affordable multi-role fighters and continues to evolve with the development of the next-generation Block III capability which will be game-changing for India. With the Super Hornet Block III, the Indian Navy would not only get the most advanced platform but would also benefit from tactics, upgrades and knowledge related to the naval aviation ecosystem that the US Navy offers," he added.

The tests followed eight ski-jumps in various weights and configurations during previous tests held at Naval Air Station (NAS) Patuxent River in Maryland in late 2020 that demonstrated the Super Hornet's ability to operate from a short takeoff but arrested recovery (STOBAR) aircraft carrier.

As the US Navy's frontline fighter, with over 800 aircraft delivered around the world and over 2.5 million flight hours flown, the Super Hornet Block III offers opportunities for cooperation and interoperability between the United States and India navies. The Super Hornet Block III will come with advanced networking and open architecture design that will allow Super Hornet to be interoperable with the Indian Navy's P-8I and other US-origin assets and rapidly accept new technology to stay ahead of emerging threats.

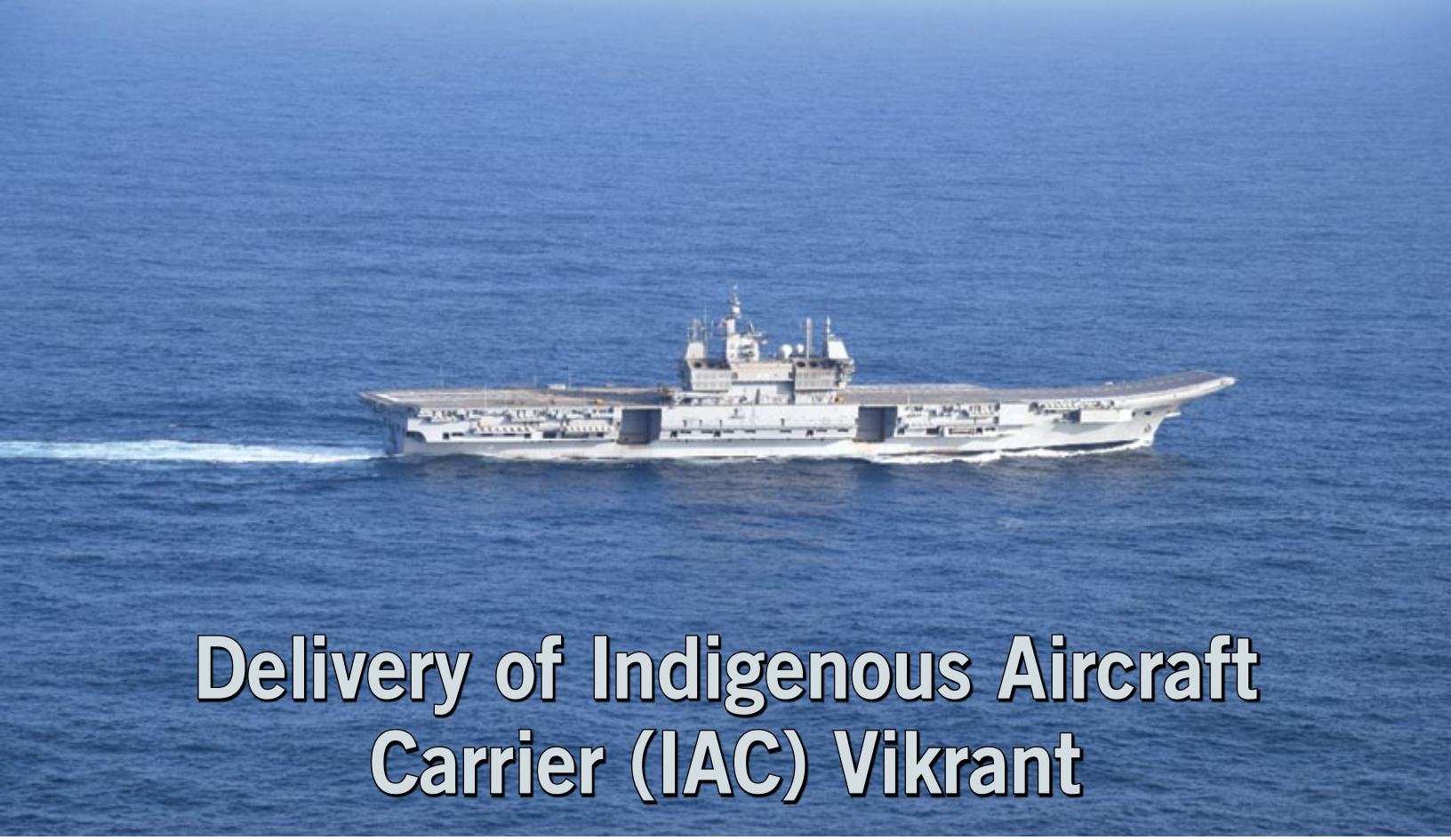
Boeing and the US Navy made multi-billion-dollar investments in infusing new technologies in the Super Hornet Block III, including increasing the life of the airframe to 10,000 hours from 6,000 hours of Block II, radar cross-section improvements, and advanced crew station which includes a large area display. The F/A-18 Super Hornet has been designed and built for carrier operations, and is fully compliant with INS Vikramaditya and INS Vikrant aircraft carriers. F/A-18 will be able to operate on the deck, in the hangar and on the lifts of the Indian Navy's aircraft carriers. The F/A-18 can carry four anti-ship missiles (Harpoon).

The two-seater carrier compatible variant of the Super Hornet offers several unique advantages to the Indian Navy including flexibility, higher utilisation of the fleet, and the ability to embark on certain

missions from the carrier that benefit from having a second crew member. Additionally, two-seater F/A-18 Super Hornets can be used as trainers (ashore and on the carrier) and as fully capable fighters, operational from the carrier and from land bases. Designed as a carrier-based fighter for high- loading, high stress operations, the F/A-18E/F Super Hornet Block III requires minimal support equipment and has the lowest cost per flight hour to operate with high mission readiness rates.

Depending on the Indian Navy's requirements, Boeing's "By India–For India Sustainment Programme" that is built on other successful sustainment programs that Boeing is executing for the Indian Air Force and the Indian Navy today will allow for capabilities development in India to sustain the F/A-18 Super Hornet. Powered by the GE F-414 engine that has clocked more than 5 million hours, the F/A-18 Super Hornet Block III uses the same family of engines that is powering India's indigenous Light Combat Aircraft (LCA); that has already been inducted by the Indian Air Force. The commonality in engines will create scale efficiencies for potential sustainment opportunities in the future.

Courtesy: Boeing



Delivery of Indigenous Aircraft Carrier (IAC) Vikrant

Indian Navy created maritime history on 28 July 2022 by taking delivery of the prestigious Indigenous Aircraft Carrier (IAC) Vikrant from her builder Cochin Shipyard Limited (CSL), Kochi. Designed by Indian Navy's inhouse Directorate of Naval Design (DND) and built by CSL, a Public Sector Shipyard under Ministry of Shipping (MoS), the carrier is christened after her illustrious predecessor, India's first aircraft carrier which played a vital role in the 1971 war. Coinciding with the celebrations to commemorate 75th anniversary of India's independence 'Azadi Ka Amrit Mahotsav', the reincarnation of "Vikrant is a true testimony to the country's zeal and fervor in pursuing capability build up towards enhanced maritime security".

The 262 meter long carrier has a full displacement of close to 45,000 tonnes which is much larger and advanced than her predecessor. The ship is powered by four gas turbines totaling 88 MW power and has a maximum speed of 28 knots. Built at an overall cost of close to Rs. 20,000 Crs, the project has been progressed in three phases of contract between MoD and CSL, concluded in May 2007, Dec 2014 and Oct 2019 respectively. The ship's keel was laid in Feb 2009, followed by launching in Aug 2013. With an overall indigenous content of 76%, IAC is a perfect example of the nation's quest for Aatma Nirbhar Bharat and provides thrust to Government's Make in India initiative. With the delivery of Vikrant, India has joined a select group of nations having the niche capability to indigenously design and build an aircraft carrier.

Vikrant has been built with high degree of automation for machinery operation, ship navigation and survivability, and has been designed to accommodate an assortment of fixed wing and rotary aircraft. The ship would be capable of operating air wing consisting of 30 aircraft comprising of MiG-29K fighter jets, Kamov-31 AEW, MH-60R multi-role helicopters, in addition to indigenously manufactured Advanced

TASL

India's indigenous Aircraft Carrier Vikrant that was handed over to the Navy by Cochin Shipyard, has its Combat Management System (CMS) developed by TATA Advanced Systems (TATA Aerospace & Defence) TASL along with Navy's WESEE. TASL system combines the sensors and weapons for real-time combat decision-making on the ship.

Several design iterations, including use of 3D Virtual Reality models and advanced engineering software were used by the Directorate of Naval Design in shaping the design of the carrier. CSL had also upgraded their shipbuilding infrastructure as well as enhanced productivity skills during the building of the ship. Delivery of Vikrant was marked by signing of acceptance documents on behalf of Indian Navy by the Commanding Officer Designate of Vikrant, representatives of Naval Headquarters and Warship Overseeing Team (Kochi) and by the Chairman and Managing Director on behalf of Cochin Shipyard Ltd., in the presence of senior officers of Indian Navy and Cochin Shipyard.

Light Helicopters (ALH) and Light Combat Aircraft (LCA) (Navy). Using a novel aircraft-operation mode known as STOBAR (Short Take- Off but Arrested Landing), the IAC is equipped with a ski- jump for launching aircraft, and a set of 'arrester wires' for their recovery onboard.

The ship has large number of indigenous equipment and machinery, involving major industrial houses in the country viz. BEL, BHEL, GRSE, Keltron, Kirloskar, Larsen & Toubro, Wartsila India etc. as well as over 100 MSMEs. The indigenisation efforts has also led to development of ancillary industries, besides generation of employment opportunities and bolstering plough back effect on economy, both locally as well as pan-India. A major spin-off of this is the development and production of indigenous warship grade steel for the ship through a partnership between Navy, DRDO and Steel Authority of India (SAIL), which has enabled the country to become self-sufficient with respect to warship steel. Today all the warships being built in the country are being manufactured using indigenous steel.

Vikrant has been delivered to the Indian Navy by CSL following extensive user acceptance trials conducted between August 2021 and July 2022, during which ship's performance, including hull, main propulsion, PGD, auxiliary equipment, aviation facilities, weapon and sensors

as well as sea keeping and manoeuvring capabilities were proved satisfactory in accordance with trial protocols and system parameters. The delivery of Vikrant is the culmination of a long design, build and trials phase, during which both Indian Navy and CSL had to overcome multitude of unprecedented technical and logistic challenges including Covid-19 pandemic and changed geo-political scenario. The successful delivery of the indigenous carrier, a major milestone activity and historical event, is testimony to the dedicated efforts of large number of stakeholders within Indian Navy, shipyard, industry, OEMs & MSMEs for over two decades.

The Indigenous Aircraft Carrier would soon be commissioned into the Indian Navy as Indian Naval Ship (INS) Vikrant which would bolster India's position in the Indian Ocean Region (IOR) and its quest for a blue water Navy.

GE's LM2500 engines power IAC

The Indian Navy's newest carrier, the Vikrant, has been commissioned with four LM2500 engines powering the ship with 88 MW giving it a maximum speed of 28 knots. With the commissioning of the Vikrant, the Indian Navy has 18 GE Marine engines in service, with additional engines in production to support the ongoing Project 17A ship construction. The IAC project started in 2007, and when selected, GE Marine announced the LM2500 marine gas turbines would power the ship and be built by Indian partner Hindustan Aeronautics Limited (HAL).

For more than 30 years, GE has worked with HAL, which assembles, inspects, and tests all LM2500 gas turbines built for the Indian Navy. The LM2500 gas turbine kits were manufactured at GE's Evendale, Ohio, facility and assembled and tested by HAL's Industrial & Marine Gas Turbine Division in Bangalore, India.

Stop Press

IAC commissioned

Showcasing the country's growing prowess of indigenous manufacturing and a major milestone in the path towards 'Aatmanirbhar Bharat', Prime Minister Mr. Narendra Modi commissioned the country's first indigenous aircraft carrier Indian Naval Ship (INS) Vikrant at Cochin Shipyard Limited (CSL) on 2 September 2022. During the event, the Prime Minister also unveiled the new Naval Ensign (Nishaan), doing away with the colonial past and befitting the rich Indian maritime heritage. He dedicated the new ensign to Chhatrapati Shivaji. *(Full story in the next issue)*

Saab awarded Indian contract for AT4 support weapon

Saab's AT4 weapon has been selected by the Indian Armed Forces through a competitive programme for a single-shot weapon. AT4 will be used by the Indian Army and the Indian Air Force.

The Indian Armed Forces are a new customer for AT4. This order includes the AT4CS AST, which can be fired from confined spaces such as from inside buildings, bunkers and other urban environments. The AT4CS AST offers a tandem warhead with a breach or blast mode, which is optimised to defeat enemies within buildings and to destroy structures, which can create a point of access into them.

The contract was signed by FFV Ordnance AB, responsible for Saab's Ground Combat offer in India.

"We are honoured that the Indian Armed Forces, which are already users of our Carl-Gustaf system, have also selected Saab for their single-shot weapon need. The Indian Army and Indian Air Force can be confident in the knowledge that they have the necessary firepower to give them the advantage," stated Görgen Johansson, Head of Saab's business area Dynamics.

AT4 is one of the most popular and successful support weapon families on the market. Operated by a single soldier, this single-shot system has proven efficacy against structures, landing craft, helicopters, armoured vehicles and personnel. Its 84 mm calibre warhead offers enhanced power and performance.

French Air Force contingent stops over in India during Indo-Pacific deployment

(Images courtesy IAF)

A French Air and Space Force contingent, including three Rafale jets, was hosted for a technical stopover at Air Force Station Sulur, India, on 10-11 August 2022 during a long-distance deployment from metropolitan France to the Pacific Ocean.

From 10 August to 18 September, the French Air and Space Force carried out a major long-range mission in the Indo-Pacific, code-named Pégase 22. The first stage of this mission aimed to demonstrate France's capacity for long-distance air power projection by deploying an air force contingent from metropolitan France to the French territory of New Caledonia in the Pacific Ocean in less than 72 hours (10th-12th August). To achieve this unprecedented 16,600-km deployment, the French Air Force contingent made a technical stopover in India, at Air Force Station Sulur.

The contingent comprised three Rafale jets and support aircraft. Landing at Air Force Station Sulur on 10 August evening, it flew out in the early hours of 11 August after refuelling, enroute to New Caledonia. The operation demonstrated a high level of mutual trust and interoperability between the French and Indian Air Forces, which has been further boosted by the fact that both air forces now fly Rafale jets. It also illustrated the concrete implementation of the reciprocal logistics support agreement signed by France and India in 2018.

Lauding the IAF's role in this successful operation, the Ambassador of France to India, H.E. Mr Emmanuel Lenain, stated, "France is a resident power of the Indo-Pacific, and this ambitious long-distance air power projection demonstrates our commitment to the region and our partners. It is only natural that to carry out this mission, we rely on India, our foremost strategic partner in Asia. My heartfelt thanks to the Indian Air Force for welcoming the French contingent."

In the following stages of Mission Pégase 22, the French Air Force contingent took part in the "Pitch Black" air exercise in Australia from 17 August to 10 September. The Indian Air Force also participated in this multilateral drill, along with Australia, Japan, United States, Germany, Indonesia, Singapore, United Kingdom and South Korea.

Mission Pégase 22 is a powerful demonstration of France's capacity for quick deployment in the Indo-Pacific. The mission is also proof that the security situation in Europe has not diminished the French and European commitment in the Indo-Pacific. In this respect, it also aims to strengthen ties with key strategic partners, such as India, and underline France's support for security and stability in the region.


Representational images courtesy Dassault

Exercises and visits

IAF and EAF joint participation

The Indian Air Force contingent deployed to Egypt successfully completed the Tactical Leadership Programme (TLP) at Egyptian Air Force (EAF) Weapon School in Egypt (Cairo West Airbase) from 23 June-23 July 2022.

IAF participated with three Su-30MKIs and two C-17s aircraft were used for induction of the contingent. IAF Su-30 MKI aircraft undertook a non-stop ferry of six hours from Jamnagar airbase (India) to Cairo overflying four countries enroute. "The IAF deeply appreciates the in-flight refuelling provided by UAE Air Force MRTT aircraft which assisted the IAF Su-30MKI formation to seamlessly undertake nearly 6 hours non-stop ferry while proceeding to Egypt for the Tactical Leadership Programme" stated the IAF.

During the first two weeks of the exercise, IAF aircraft participated in missions by day and night, involving air to ground and air to air combat scenarios and Combat Search And Rescue (CSAR) activity alongside Egyptian F-16, Rafale and Mig 29 aircraft. The unique programme saw the participants from both nations sharing their knowledge of operational tactics and best practices.

This programme, involving synergistic air operations, has illustrated a high degree of professional trust that has developed between the two Air Forces. The bond between the two Air Forces dates back to the 1960s when Gp Capt Kapil Bhargava, an IAF Test Pilot, test flew the Egyptian prototype of the Helwan HA-300 with Test Pilots from the EAF. This was followed by Indian Qualified Flying Instructors training young Egyptian pilots - a programme that continued into the 1980s.

Indian Navy and Japan Maritime Self Defence Force

A Maritime Partnership Exercise (MPX) was conducted between Japan Maritime Self Defence Force and Indian Navy on 23 July 2022 in Andaman Sea. INS Sukanya, an offshore patrol vessel and JS Samidare, a Murasame class destroyer, undertook various exercises including seamanship activities, aircraft operations and tactical manoeuvres as part of the operational interaction. The two countries have been carrying out regular exercises in IOR towards reinforcing maritime association. The exercise were aimed at enhancing interoperability and streamlining seamanship and communication procedures. This exercise is part of the ongoing efforts between the two navies towards ensuring safe and secure international shipping and trade in Indian Ocean Region.

India-Vietnam Ex VINBAX 2022

The 3rd Edition of Vietnam India Bilateral Army Exercise "Ex VINBAX 2022" was conducted at Chandimandir from 1 to 20 August 2022. The exercise was a sequel to previously conducted bilateral exercise in Vietnam in 2019 and a major milestone in strengthening the bilateral relations between India and Vietnam. The theme of Ex VINBAX – 2022 was employment and deployment of an Engineer Company and a Medical Team as part of United Nations Contingent for Peace Keeping Operations. India has a rich legacy of deployment of troops in United Nations missions and has some of the best capacities to impart United Nations peace operations training incorporating best practices and hands on training to prospective United Nations peacekeepers at tactical, operational & strategic levels.

The conduct of Ex VINBAX – 2022 as a field training exercise with enhanced scope from previous editions of bilateral exercise has "strengthened mutual confidence, inter-operability and enabled sharing of best practices between the Indian Army and Vietnam People's Army". The joint exercise provided an opportunity to the troops of both the contingents to learn about the social and cultural heritage of each other. Indian Army was represented by troops from the 105 Engineer Regiment.

INS Satpura at RIMPAC 2022

INS Satpura entered Pearl Harbour in Hawaii, USA on 2 August 2022 on completion of the sea phase of RIMPAC-22, a multilateral exercise conducted over 22 days off Hawaii, USA. The ship participated in anti-submarine, anti-ship and anti-air warfare exercises with multi-national navies in the Pacific Ocean during the sea phase apart from undertaking cross-deck landings of Indian naval helicopter on foreign warships and replenishment at sea.

The sea phase of RIMPAC-22 was divided into three sub-phases wherein ships undertook basic and advanced level integration exercises during the first two sub-phases. The event culminated with a theatre level large force tactical exercise. The exercise witnessed the participation of an aircraft carrier battle group, submarines, maritime reconnaissance aircraft, unmanned aerial vehicles, remotely piloted surface ships and also an amphibious force landing operation including joint operations with Special Forces of multinational navies.

INS Satpura's participation in RIMPAC-22, 9000 nautical miles away from the Indian coast stands testimony to the Indian Navy's capability to operate in any part of the world. RIMPAC-22 is one of the largest multilateral naval exercises in which the Indian Navy participated and the exercise this year witnessed participation from 26 countries comprising 38 surface ships, 9 land forces, 31 unmanned systems, 170 aircraft and over 2,500 personnel.

INS Satpura is an indigenously designed and built 6000 tonnes guided missile stealth frigate. The ship is a part of the Eastern Fleet based at Visakhapatnam and has been tasked for a long-range operational deployment in the 75th year of India's Independence.

Indian and French Navies in the Atlantic

INS Tarkash, on her long range overseas deployment, conducted a Maritime Partnership Exercise (MPX) with French Naval Ships in the North Atlantic Ocean on 29 and 30 July 2022. Replenishment at sea was exercised between Tarkash and the French Fleet Tanker FNS Somme. This was followed by joint air operations with the maritime surveillance aircraft Falcon 50 participating in multiple simulated missile engagements and air defence drills.

INS Sumedha visits Bali, Indonesia

As part of the Indian Navy's Long Range Deployment in the South Eastern Indian Ocean, INS Sumedha, visited Tanjung Benoa, Bali, on 4 to 6 August 2022. The ship was en route to Perth, Australia, to coincide with India's Independence Day and celebrations of Azadi Ka Amrit Mahotsav. The visit to Bali was aimed at strengthening bilateral ties, enhancing military cooperation and improving interoperability with the Indonesian Navy. During her stay at Bali, the ship's crew engaged in professional interactions, cross-deck visits and sports fixtures with their Indonesian Navy counterparts.

Prior to entering Bali, the ship undertook a Maritime Partnership Exercise with KRI Sultan Hasanuddin, a Sigma class corvette of the Indonesian Navy on 2 August 2022. The exercise which included seamanship evolutions, tactical manoeuvres and communication procedures provided an opportunity for sharing professional experiences and strengthening maritime cooperation between the two navies. INS Sumedha is an indigenously built Naval Offshore Patrol Vessel and is deployed for multiple roles independently and in support of fleet operations. She is part of the Indian Navy's Eastern Fleet based at Visakhapatnam and functions under the operational command of the Flag Officer Commanding-in-Chief, Eastern Naval Command.

India, Malaysia conclude air exercise 'Udarashakti'

The four-day air exercise 'Udarashakti' between the Indian Air Force (IAF) and the Royal Malaysian Air Force (RMAF) concluded in Malaysia on 16 August 2022. The air exercise culminated with a traditional closing ceremony hosted by the Royal Malaysian Air Force and the ceremony was marked with a seven-aircraft formation flypast by both air forces and exchange of mementoes between the contingent leaders. "The successful execution of the first edition of the exercise is testimony to professional capabilities, mutual understanding and shared commitment of the two air forces. The Indian contingent took part in the air exercise with Su-30MKI and C-17 aircraft while the RMAF participated with Su-30MKM aircraft" stated IAF officials.

Post exercise, the IAF team flew to Darwin, Australia to participate in Ex Pitch Black-22.

Glimpses of IAF Su-30MKI aircraft receiving fuel from IL-78 MKI air-to-air refuelling aircraft. The Su-30s flew non-stop from India to Malaysia while inducting for the air excercise.

India-Oman joint Exercise Al-Najah

4th Edition of India/Oman joint military Exercise Al-Najah culminated on 13 August 2022 after an intense Validation Exercise. "This resulted in better understanding and enhancing inter-operability between both Armies. The exercise included key counter terrorism concepts and employment of new generation technology".

Indo-US Exercise Vajra Prahar

13th Edition of India-US joint Special Forces Exercise Vajra Prahar commenced on 8 August 2022 at Special Forces Training School. The Exercise aimed to share experiences and best practices in mission planning and operational tactics of SF Operations.

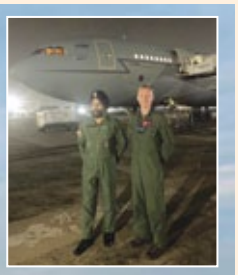
Korean T-50 stopover in India

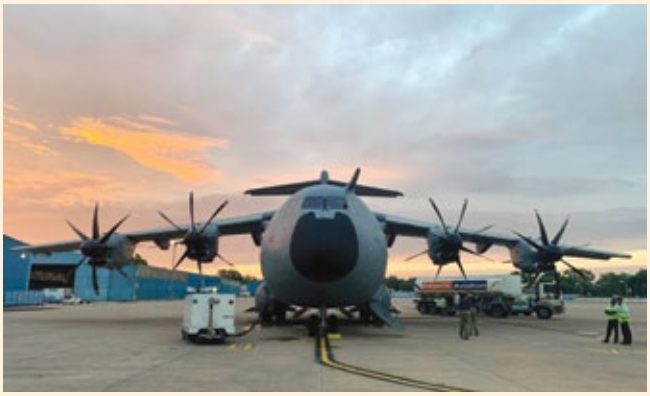
After participating at a UK aerospace exhibition, nine Korean Air Force T-50s landed at Kolkata Airport, India for refueling and crew rest on 9 August 2022.

(Photos: @aaikolairport)

RAF contingent in India

After a great reception by the IAF on 15 August 2022, six Royal Air Force aircraft departed from India on 16 August 2022. RAF contingent comprised a Voyager, four Typhoon's and an A400M. "We look forward to being back in India in a few weeks and flying together. It's a wrap for now. Our RAF A400 departs flying the Tricolour after a great visit. Huge thanks to IAF COO and all the team at Palam for your outstanding support and hospitality", stated the RAF team.





IAF enroute Australia

Post the stint at Malaysia, some superb photos courtesy @Armee_de_lair of Indian Air Force Su-30MKIs enroute Australia to participate in Ex Pitch Black-22. A French A330 Phénix MRTT deployed at Amberley for PB'22 refuelled IAF MKIs and it was the first time France supported India in its projection interoperability.

IAF contingent transits Indonesia

Four IAF Sukhoi-30MKIs and two C-17s had a successful transit stage-through at Juanda Air Station, Surabaya, Indonesia on 18 August 2022 enroute for Exercise Pitch Black in Australia. "A big thanks to all in Indonesia for the support", said the IAF.

IAF at Exercise Pitch Black 2022, Australia

An Indian Air Force contingent reached Australia for participating in Exercise Pitch Black 2022 which was held from 19 August 2022 to 8 September 2022 in Darwin. This was a biennial, multi-national exercise hosted by the Royal Australian Air Force (RAAF). It focussed on Large Force Employment warfare and the last edition was conducted in 2018. The 2020 edition of the exercise was cancelled due to the COVID-19 pandemic. This year's exercise saw participation of over 100 aircraft and 2500 military personnel from various air forces. The IAF contingent, led by Group Captain YPS Negi, comprised over 100 air warriors, deployed with four Su-30 MKI fighter and two C-17 aircraft. They undertook multi-domain air combat missions in a complex environment and exchanged best practices with the participating air forces.



F/A-18s, Eurofighters, A330MRTT and IAF Su-30MKIs together in the first phase of the exercise

INS Tarkash in Brazil

INS Tarkash mission deployed to Brazil participated in a maritime partnership exercise with the Brazilian Navy Ship Uniao, a Niteroi class frigate on 19 August 2022. Operations included cross-deck landing, replenishment at sea, RAS approaches and tactical manoeuvres.


Indo–US Special Forces joint exercise

The 13th Edition of India - USA Joint Special Forces Exercise Vajra Prahar 2022 culminated at Bakloh (HP) on 28 August 2022. This annual exercise is hosted alternatively between India and the United States. The 12th edition was conducted at Joint Base Lewis Mc Chord, Washington (USA) in October 2021. The 21-day joint training provided an opportunity for the Special Forces from both nations to train in air borne operations, special operations and counter terrorism operations in a joint environment under United Nations Charter. The exercise was conducted in two phases; the first phase involved combat conditioning and tactical level special missions training exercises and the second phase included 48 hours of validation of training received by both contingents in the first phase.



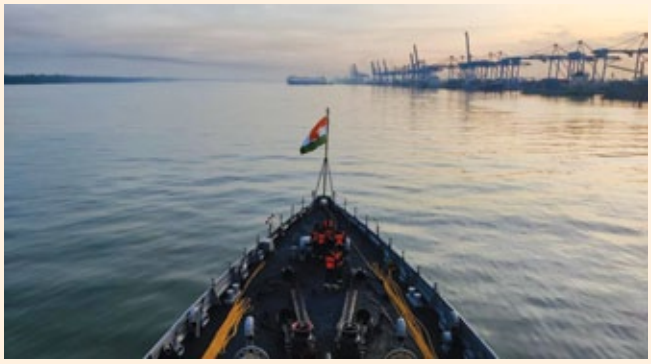
Interservice synergy

To enhance interservice synergy between Indian Navy MARCOS and Rudras of Thar Raptors Brigade, the formation conducted Exercise Rudra Prahar, a Joint Exercise to hone their skills of jointmanship and interoperability on 27 August 2022.

INS Sumedha visits Port Klang, Malaysia

As part of the Indian Navy's long-range operational deployment, INS Sumedha deployed to South East Asia, visited Port Klang, Malaysia on 27 August 2022. INS Sumedha's visit to Port Klang is aimed at strengthening bilateral ties, enhancing maritime cooperation and interoperability between Indian Navy and Royal Malaysian Navy (RMN).

INS Sumedha is an indigenously built Naval Offshore Patrol Vessel deployed for multiple roles independently and in support of Fleet Operations. She is part of the Indian Navy's Eastern Fleet based at Visakhapatnam and functions under the operational command of the Flag Officer Commanding-in-Chief, Eastern Naval Command.



New equipment at Exercise Red Hunt

Indian Army top brass reviewed Exercise Red Hunt on 27 August 2022. Augmentation in lethality, survivability, mobility and situational awareness was demonstrated, exploiting the newly inducted weapons and equipment.

ICG's SAREX-2022

The 10th National Maritime Search and Rescue Exercise SAREX-2022 was conducted by Indian Coast Guard on 28 August 2022 off Chennai. The Sea exercise involved two large scale contingencies was carried out off Chennai coast with participation of 16 ICG ships, 1 naval ship, 6 ICG aircraft, 1 naval ALH, 1 IAF helicopter, passenger vessel Swarajdweep, 1 tug from Chennai Port Trust and 1 boat from Customs. The 1st contingency simulated distress onboard a passenger vessel having 500 pax onboard whereas the 2nd scenario depicted ditching of a civil aircraft with 200 passengers. Amongst the air elements used in the sea exercise was the newly inducted Advanced Light Helicopter (ALH-MK-III). In addition to 51 participants from national Maritime SAR stake holders, the exercise was attended by 24 foreign observers from 16 friendly foreign countries.

Week 2 at Exercise Pitch Black, Darwin: After practice duels in the skies, IAF and Luftwaffe pilots flew exchange sorties on the Su-30 MKI and Eurofighter Typhoon. (photos IAF and German AF)

Week 3 at Exercise Pitch Black, Darwin: Great interaction and professional exchanges between CAF RAAF Air Marshal Robert Chipman, AM CSC and Air Marshal Vikram Singh AOC-in-C SWAC IAF in Darwin. (Photos: IAF)

Exercise Pitch Black 2022 concludes

The Indian Air Force contingent participating in Exercise Pitch Black 22 in Australia returned on 13 September 2022 after successful participation in the multinational exercise. The exercise provided an opportunity for the air forces to share best practices and experiences. The event witnessed "collaborative spirit that has led to a better understanding of each other's capabilities and a bonhomie that will lead to enduring ties between the participating nations".

Vostok- 2022 East Military District Russia

A multilateral strategic and command Exercise Vostok-2022 took place at the training grounds of the Eastern Military District of Russia from 1 to 7 September 2022. The exercise was aimed at interaction and coordination amongst other participating military contingents and observers. The Indian Army contingent comprised

troops from 7/8 Gorkha Rifles and undertook joint manoeuvres including joint field training exercises, combat discussions and firepower exercises.

INS Satpura in Fiji

INS Satpura visited Suva, Fiji from 1-3 September 2022 as part of its operational deployment in the Pacific Ocean. The ship's visit was aimed at further strengthening the friendship and cooperation between the two nations. During the port call, there were high level exchanges between the ship's crew and the Fiji Navy. The crew led by her Commanding Officer also paid homage to martyred soldiers at Fiji's National War Memorial.

IA's Ex Gagan Strike

The Kharga Corps conducted Ex Gagan Strike, a joint training exercise of the Indian Army Aviation and attack helicopters at Patiala on 7 September 2022. Combined team operations comprising ALH WSI and AH-64E were validated in the role of aerial manoeuvre arm in support of ground operations and force multipliers.

INS Tarkash in Gulf of Guinea

INS Tarkash is currently on an operational deployment in the crucial Gulf of Guinea on the West Coast of Africa. The region has certain non-traditional maritime challenges, and the deployment of INS Tarkash is aimed to enhance professional interactions, exchange best practices in tackling common threats and further interoperability with navies in the region. INS Tarkash had recently visited Togo, the first ever by an Indian naval ship. She's currently in Nigeria.

Integrated training

The Desert Warriors of the Indian Army honed their combat skills and fostered jointmanship with the Indian Air Force during an annual field firing exercise at Mahajan Field Firing Ranges in Rajasthan in September 2022.

Exercise Parvat Prahar

Gen Manoj Pande, COAS, Indian Army visited the Ladakh Sector and witnessed Exercise Parvat Prahar on 10 September 2022. The COAS was briefed on operational preparedness by commanders on ground. He interacted with the officers and troops and complimented them for their steadfastness and professional standards.

India-Japan JIMEX

The 6th edition of India-Japan maritime exercise JIMEX-22 took place in the Bay of Bengal on 12 September 2022. JMSDF ships Izumo and Takanami exercised with Indian Navy ships, submarines, MiG-29K fighters, long range maritime patrol aircraft as well as shipborne helicopters.

Multinational Exercise Kakadu, Australia

INS Satpura and a P8I maritime patrol aircraft of the Indian Navy reached Darwin in Australia on 12 September 2022 for participation in the multinational Exercise Kakadu–2022 hosted by the Royal Australian Navy. The two week-long exercise, both in harbour and sea, involved ships and maritime aircraft from 14 navies.

Air Marshal (Retd) Nirdosh V Tyagi talks about

How IAF transitioned into a formidable force

The Indian Air Force (IAF) is the fourth largest air force in the world today, the top three being US, Russia and China. It is bigger than the air forces of the UK and France. Though short of its sanctioned strength, it is a modern and strategic force with internationally recognised credentials. It has been a transformational journey in the last 75 years for the youngest of the three services of our Armed Forces.

At the time of independence, India had inherited the Royal Indian Air Force (RIAF) with six fighter squadrons equipped with Tempest and Spitfire aircraft, one squadron of C-47 Dakota transport aircraft and one Air Observation flight. RIAF dropped 'Royal' to become IAF only in 1950, when India became a republic. This fledgling force was still trying to absorb the impact of division of resources between the two nations, when it was pressed into operations. Intrusion of insurgent forces into Kashmir from Pakistan called for a quick response. Troops were airlifted on 27 October 1947 from Palam to Srinagar and the Indian army went into action to save Kashmir. This airlift was remarkable because operations were successfully executed without losing time in detailed preparations. Within days, fighters were engaged in strafing the raiders

IAF Jaguar

and their advance was checked. The fighting continued for 15 months till cease fire came into force on 1 January 1949.

Our national leadership was quick to realise the importance of air power in the then existing geopolitical scenario. Initial effort was directed at creating an organisational structure under Air Headquarters and increasing the force strength with whatever resources could be mustered. USAF (US Air Force) discarded B-24 Liberator bombers were retrieved to equip an additional squadron. The Jet era arrived soon with the induction of Vampires in November 1948. Due to deteriorating relations between India and Pakistan, it was


MiG-29

Rafale


IAF Su-30MKI

decided to expand the IAF to make it fit for a full-scale war. 100 Ouragans (Toofanis in IAF) were procured from France, starting in 1953. Progressively, French Mystere and British Hunters were inducted by 1957, which heralded the beginning of the transonic era for the IAF. Canberra Bombers and Fairchild Packet transport aircraft also put into service during this period. Incidentally, Ouragan and Mystere were products of Dassault, the same company from which Mirage-2000 and Rafale were procured later. By early 1960s the IAF had grown to be a 33-squadron force. Indian Canberra bombers participated in UN operations in Congo in 1961-62. China had emerged as another adversary for India by then. India had started procuring aircraft from the Soviet Union. Induction of Mi-4 helicopters and An-12 transport aircraft had a profound effect on the air logistics capability of the force, as demonstrated during the 1962 conflict with China. In October 1962, Government of India accorded sanction for 45 squadrons for the IAF. By then, it had been decided to get urgent supplies of fighters and missiles from the Soviet Union and order was placed for MiG-21 supersonic fighters and SA-2 long range surface to air missiles.

Air power was utilised to full extent in 1969 and 1971 conflicts. Pakistan had been armed with active support of the USA. The Gnat proved immensely successful against the F-86 in 1965 war and earned the sobriquet of 'Sabre Slayer'. By 1971, the MiG-21 had been operationalised. Hindustan Aeronautics Limited (HAL) designed and manufactured Marut HF-24 had also been inducted. In order to bolster ground strike capability, it was decided to procure Sukhoi-7 from the Soviet Union. At the start of 1970s, the IAF had 26 fighter and bomber squadrons, 12 transport squadrons and a handful of other units of smaller planes and helicopters. Aerial action during the 1971 war started almost 12 days before the outbreak of full-fledged conflict on 3 December. On 22 November, a formation of Sabres attacking Mukti Bahini positions in East Pakistan was intercepted by Gnats and three Sabres were shot down.

The highlights of 1971 in the eastern sector were Tangail AirDrop to induct Indian troops behind the enemy line and air attacks on enemy's lines of communications and Command centres to weaken its war waging capability. MiG-21 strike on the Governor's House in Dhaka finally expedited surrender of Pakistani forces and formation of Bangladesh. MiG-21 proved superior to the US origin F104 starfighter in every engagement in the western sector. Force modernisation and strength enhancement


LCA Tejas

Mirage 2000

was pursued with vigour in order to maintain an edge over the adversaries. HAL started production of the MiG-21 and it remained the mainstay of IAF in various versions for decades. Four squadrons of MiG-21 Bison are still in service.

In the decade starting 1978, Jaguar, MiG-23, MiG-25, MiG-27, MiG-29 and Mirage-2000 were added to the fighter fleet. Of these Mirage-2000 proved to be the most successful. Airlift capability got a major boost with the procurement of An-32, IL-76 transport aircraft and Mi-8 helicopters. Mi-25 attack helicopters and heavy lift Mi-26 were also sourced from the Soviet Union, so were the surface-to-air missile systems. Mirage-2000 was a class apart amongst the fighters of that era. For the first time operators got the feel of modern computer-based systems and precision guided weapon systems. This aircraft is still in service. It proved to be a game-changer in Kargil Operations in 1999 and was used for an air strike over Balakot in 2019.

The financial crisis of the early 1990s created a setback for modernisation. The Light Combat Aircraft programme was running behind schedule. China had initiated modernisation of her armed forces. There were replacements needed for retiring aircraft. India decided to procure the Su-30 from Russia. The planned strength of 190 finally got enhanced to 272 and 12 more are likely to be procured. This fighter in Su-30MKI version has been manufactured by HAL through transfer of technology. Experience of the Kargil operations highlighted the shortfalls in military hardware in India. The matter was examined by a group of Ministers and various committees were set up to overhaul India's defence procurement system. An Acquisition Wing was formed in the MoD and instead of processing cases on files; decisions were taken in collegiate meetings. Acquisitions were to be made based on competitive merits, instead of political and other considerations, as was the case earlier. Defence procurement procedure gave elaborate guidelines in 2005/06, which streamlined the process. Despite criticism of the procedure, the forces have been able to modernise to a great extent during the ensuing period.

Indian Air Force today has Rafale and Light Combat Aircraft (LCA) as the latest additions to the fighter fleet. C-17 and C130-J have given strategic airlift capability to the IAF, which is unmatched in the region. Apache attack helicopters and Chinook heavy lift helicopters are top class assets. IAF has made tremendous progress towards Network Centric Operations. Radars, missiles and air defence fighters deployed all over the country are linked to the Integrated Air command and Control System. This included the airborne radar systems such as AWACS and AEW&C. Air defence capability of the nation has also been boosted by providing tiered missile defence to all vital points and vital areas. The S-400 system procured from Russia is being deployed. MRSAM and Aakash are the main elements of the inner tiers.

It is very heartening to see indigenous capability coming up very fast. Several long gestation projects of DRDO are reaching their fruition point. Some examples from a long list are Uttam radar for fighters, Astra air-to-air missile, Nirbhaya Cruise missile and Rudram anti-radiation missile. HAL has consolidated its design and production capabilities in helicopters through ALH and LCH programmes and it is ready to move on to medium lift helicopters. Next generation AWACS will be made in India. Indigenous fighter programme is also well on track with HAL executing an order for LCA Mk-1A. ADA is continuing with design and development work on LCA Mk-2 and AMCA. A large number of start-up entities have shown great promise in developing small high technology systems and subsystems in areas such as unmanned platforms and precision guidance. The private sector is being encouraged to play a greater role in development of full systems. Creation of indigenous design and development capability has strategic imperatives.

The IAF is supporting the national endeavour of capability building under the banner of Atmanirbhar Bharat. As the shortfall in equipment gets filled largely through indigenous routes, the Indian Air Force will remain poised to take on a two-front contingency.

All photos: Simon Watson/Vayu Aerospace & Defence Review

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Sankalan Chattopadhyay writes for us on

The Extraordinary Journey of LCA Mk-II

As the euphoria over the sanction of Rs 10,000 crores for the development of LCA Mk-II ebbs, it's time we went down in the annals of India's most ambitious defence project, paving the way for future generations to indulge in nostalgic reminiscence of the glorious past.

LCA-early development phase

In the quest to become self reliant on combat aircraft technology, India has initiated multiple projects since independence. It was in 70s when a replacement for older variants of MiG-21 and other old platforms was realised. Initially a light platform with much simple configuration was sought. The Air Staff Target (AST) 201 was issued in 1982 and next year the Light Combat Aircraft (LCA) was formally approved. Following the formal air staff requirement (ASR) of 1985, the project definition was completed by 1987. At that time the series production was envisioned in 1994! In 1991 the Cabinet Committee on Political Affairs approved execution of the LCA project in two Full Scale Engineering Development (FSED) phases.

Why did the IAF request for Mk-II?

What was initiated as a simple, rugged project soon emerged as an ambitious one featuring cutting-edge technologies. Limitations in indigenous capability was a major constraint. Successful development required time, inadvertently dragging if not delaying the project significantly longer. The prolonged time also witnessed the rapid rise of new generation technologies critical for future combat environments. Even long before that, the Project Definition Phase (PDP) document of LCA, prepared by ADA and reviewed by Air HQ in 1989, was found deficient in the crucial parameters of aerodynamic configuration, volume and weight as set in ASR. The FSED was persuaded in stages. The LCA IOC will fail to meet the ASR in terms of increased weight, reduced internal fuel capacity, non-compliance of all-weather operations, non-achievement of single point refueling, failure to meet required sustained turn rate (STR), transonic acceleration and climb rate, lack of Self Protection Jammer (SPJ), Radar Warning Receiver (RWR), and Counter Measure Dispensing System (CMDS), leading to a deficiency in electronic warfare (EW). Thus, an initial 53 shortcomings were noted. It was precisely with this forethought that the Empowered Committee headed by the Chief of Air Staff (CAS) recommended in October 2007 the building of LCA Mk-II under FSED Phase-III in order to meet the ASR parameters. The project for design and development was sanctioned in November 2009 at a cost of Rs. 2431.55 crore with a Probable Date of Completion (PDC) of December 2018.

Mk-II in initial days

In 2009, for the first time, an official statement about Mk-II was made by Ashok Baweja, the Chairman of HAL at Aero India 2009, confirming work on a bigger platform with a more powerful engine. Later, under P.S. Subramanyam, Director of the Aeronautical Development Agency (ADA), five squadrons of the same was envisaged with indigenous content of 70% and first flight in 2014. A Request For Proposal (RFP) for the required engine was issued to two contenders—General Electric

(GE) F414 and Eurojet EJ200. In 2010, General Electric bagged the contract to supply F414-GE-INS6 to power the future platform. But the deal worth Rs. 3,000 crore could be finalised only by 2013 with an option to procure 100 more.

Under this contract, an initial batch of engines will be supplied by GE and the rest will be manufactured in India under the transfer of technology. However, the current status of the deal couldn't be assessed by the author. In 2021, HAL signed another contract of Rs. 5,375 crore ($716 million) with GE to procure 99 F404-GE-IN20 engines to power LCA Mk-I and Mk-IA variants.

In February 2011, Defence Minister A.K. Antony mentioned 2015 as envisioned induction time of Mk-II. But the next year, ADA pushed the timeline to 2018 subject to successful flight-testing. However, the course of the development was to be changed very soon!

Days of work on two projects

Air Chief Marshal N.A.K. Browne in 2013 officially stated Tejas as a replacement for the MiG-21, allowing induction of the Mk-II version at a later stage. "The LCA Tejas Mk 2 will have a better engine with higher thrust and an improved radar system," he stated. According to those reports, the IAF would contemplate acquiring four squadrons of Mk-II. ACM Arup Raha initially explained the expansion of the IAF fleet strength with four squadrons of improved Mk-II. But later, the number for Mk-I with some improvements was increased to 120 from just 40. It was done as an interim measure to slow down the diminishing squadron strength as well as to provide the necessary time for the development of the desired variant. That year, by September, a "Standard of Preparation-2018" (SoP-18) was envisaged by the four stakeholders of the LCA programmes—the IAF, HAL, ADA, and MoD. There were four major and several minor improvements. This improved version would later result in Mk-IA. The work for Mk-II continued on the parallel track. The Director General, Missile and Strategic Systems (MSS), DRDO, Satish Kumar, during Defexpo 2016, predicted the timeline for the completion of the design by 2018. Next year, H Siddesha, project director and technology director of LCA (ADA) mentioned 2021 when the Mk-II would be readied. That time all 123 Mk-I would have been inducted by 2024! However, none has been a reality in 2022.

ACM B.S. Dhanoa in 2018 mentioned procurement of a large fleet of LCA. According to reports, "We're looking at 12 squadrons of the Light Combat Aircraft Mk-II," he stated. Though many were skeptical of this statement, later, in another statement, he said, "The process of induction of 231 Light Combat Aircraft (LCA) is in pipeline... There was a proposal to induct LCA in big numbers and with this the total number of LCA squadrons will go up to 12."

The number envisaged hasn't been changed much since then. In the same year, Defence Minister Manohar Parrikar confirmed that the Mk-II would address the shortcomings of the Mk-I. Dr. Girish Deodhar, programme director of ADA, confirmed Mk.2 was being developed to replace the Mirage-2000.

The MK-II in its final avatar

On 22 February 2019, at the grand of Aero India, the Chairman of DRDO, Dr. G. Satheesh Reddy, handed over the FOC of Tejas Mk. 1 to the CAS ACM B.S.Dhanoa. It was also the first event where a scaled model concept of the Mk. 2, rechristened as the as the Medium Weight Fighter (MWF), highlighting all the new features was unveiled. At that time, the aim was to take the first aircraft into the air by 2023. ACM RKS Bhadauria in 2020 stated, "In the long run, the IAF will have 40+83 Tejas Mk-I/IA and around six squadrons of Tejas Mk-II." This echoed what the former chief had stated. In January 2021, the Cabinet Committee on Security approved the procurement of 73 LCA Tejas Mk-IA fighters and 10 LCA Tejas Mk-I trainers at a cost of Rs. 45,696 crore along with Design and Development of Infrastructure sanctions worth Rs. 1,202. The Mk-IA conducted the first flight in May 2022.

Now - 2022

The CAS reiterated the commitment to the procurement of six squadrons of the improved variant. In the same year, the Govt. gave the gave the nod for the development of Mk-II and the CCS gave

clearance for another Rs. 6,500 crore. Thus, a total of total of Rs. 10,000 crore is sanctioned for the design, development, and flight certification. The mega sanction will be followed by TEDBF and AMCA.

Design Evolution

The Mk-II has gone through several design modifications in the past eight years. The first Preliminary Design Review (PDR) came in 2014. The fuselage was just 500mm longer than the than the Mk-I. The internal fuel capability was limited to 2,672 kg and a payload capacity of 4,500 kg. It was envisaged for an all-up weight (AUW) of 15T. It was changed again in 2017. For the first time, a pair of canards were attached and were made 1,000mm longer (interestingly, LiveFist back in 2011 shared a fan-art image by Ranjan Saha featuring canards). The payload was increased to 5,500kg with an internal fuel capability of 3,300kg. As a result, it was converted into a 16.5T AUW platform. However, the requirement for future challenges steered elaborated changes. The 2019 design made the platform 1350mm longer and 300mm wider. The internal fuel capacity was increased to 3,300 kg. With 6.5T of payload the AUW increased to 17.5T.

Latest Status

As of 2022 the detailed design drawing is ready and critical design review has been completed. The configuration has been frozen along with system architecture being finalised. The first flight is expected by 2024/2025 and expected production by 2027/2030. New updates are expected at Defexpo 2022.

The features

The evolution of LCA Mk-II from LCA Mk-I is being envisaged in two steps. The first Tejas Mk-IA integrates 43 improvements. Some of these are: Open Architecture Mission Systems, Active Electron Scanned Array (AESA) radar, Digital Wideband Radar Warning Receiver, podded Self Protection Jammer (SPJ), New Generation Helmet Mounted Display System (HMDS), etc. The LCA Mk-II further evolves to meet the rest of the requirements. It will have a longer fuselage equipped with a more powerful GE F414-INS6 engine with a maximum thrust of 98 Kn, enhancing the MTOW up to 17.5 T and the ferry range of 3,500 km. The low RCS platform will feature Smart Large Area Display (LAD), Head Up Display (HUD), upgraded Fly by Wire (FBW) controls with advanced Digital Flight Control Computer (DFCC), indigenous actuators, new smart cockpit, Internal Unified Electronic Warfare Suite (UEWS), On Board Oxygen Generated System (OBOGS), Infrared Search and Track (IRST), Missile Approach Warning System (MAWS), and many more. A much more detailed piece has already been published in the Aero India Issue of 2021.

The entire LCA programme has witnessed vicissitudes. It had to progress braving unimaginable odds and tribulations. The original requirements of 220 platforms once was about to cut down to just 120. But now it has a confirmed order of 123 and commitment of further six squadrons, which according to many reports might touch even ten! As India struggles for the acquisition of advanced multi-role fighter through the infamous MMRCA programme, the dwindling IAF squadron strength has got a new hope in shape of an indigenous option.

At the end only one sentence can be said in its honour- the past of it might be lackluster the future will be glorious!

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All photos: Vayu

Hawk AJT: The story unknown and future behold

While there are numerous tales associated with majestic battle machines, performing on the frontlines and acting as primary caretakers of Indian Air Defence, we have missed a quiet number of interesting anecdotes of some platforms that serve behind the scenes. The Hawk is one of them that is undoubtedly shouldering the responsibility of one of the principal tasks in the Indian Air Force, which is to train the aviators and offer exposure to the future top guns of IAF. Combat aviation is not just about excellent flying, but performing risky tasks, and applying full-fledged efforts to achieve the objectives in combat. All this, while evading a variety of threats, ranging from high Gs to hostile airborne/surface-based threats. This demands conciseness and merit, both physically and mentally, and that is why mastering the British Aerospace (BAe) Hawk Mk.132 is the core of the Stage III pilot training programme of IAF, preparing the pilots in a simulated environment, before they head into their operational squadrons and execute the learnings in real-world challenges. We are going ahead to explore this significant yet rarely discussed platform, looking at the procurement process that took 19 long years, the modern capabilities it carries apart from a trainer, and the foreseeable future to multiply its potential.

Acquisition, that took longer than the infamous MMRCA

The Medium Multi-Role Combat Aircraft (MMRCA) tender is quite well known for the disappointments it brought, if we talk about the time taken before it was formally scrapped with new tender replacing it with less airframes procured. However, while it

Hawk Mk.132 of the IAF (Photo: Angad Singh)

took 8 years for New Delhi to finally sign the deal for new supersonic fighter aircraft, the same nation had to wait for 18 years to purchase a much less costly jet trainer. In 1986, the IAF Air Staff Requirements (ASR) pitched the demand for new Advanced Jet Trainers, on the advice of the La Fontaine Committee, a dedicated committee that studied the accidents in IAF between April 1977 to August 1982 and came to the conclusion that human error turned out as a primary cause of the majority of accidents, especially in the MiG-21 cases as pilots were used to be transferred directly to the supersonic fighter after completing the preliminary jet training. Back then, after completing Stage-I (basic) training on piston engine HT-2, HPT-32, IAF had homegrown Kiran and Polish TLS-11 Iskra for Stage 2 (intermediate) jet training services, while Hunter F56/T.66 under Operational Training Unit (OTU) would impart Stage-III (advanced weapon and tactics) training (since 1967). The training was said to be inadequate for pilots to adapt with more complex machines in the air arm, like the MiG-21, which was in fact the backbone of IAF in the period. MiG Operational Flying Training Unit (MOFTU) formation in 1986 with MiG-21FL/U aircraft turned unsustainable in the long term since it was not an ideal platform for newcomers. The Soviet machine needed excellent experience with a precise man-machine bond to perform well, and young pilots had to witness fatal side effects if committed a single mistake. The ASR demanded a dedicated jet trainer aircraft to facilitate safe and docile training sessions for cadets, especially in the spin and recovery processes. Furthermore, it could be capable of providing weapon and tactics training as well, flaunting armament like rockets and cannon.

Between 1986 to 2002, multiple overseas AJT designs were evaluated, which included Spanish CASA Aviojet, Italian Aermacchi MBB-339, SIAI-Marchetti S.221, Franco-German Dassault-Dornier Alpha Jet, Czech Aero L-39 and L-159,

Russian MiG-AT, and finally British Aerospace Hawk. Two platforms, Alpha Jet and Hawk stood on the standards set by the Indian Air Force. However, when the tender was formally floated in 2000 for acquisition and price negotiations, only BAe submitted its proposal as Alpha Jet production was already suspended in 1991. The price negotiation committee came to the final price of USD 9 Million per aircraft, featuring all US-built components replaced by British-origin counterparts, as India was still reviving from the sanctions imposed by

Uncle Sam after nuclear tests in late 1988. Though the original requirement was for 122 airframes, the consequent delays led to rewarding the contract to BAE Systems on 26 March 2004 for 66 aircraft, with 24 to be built-in United Kingdom while the rest 42 by HAL Aircraft Division in Bengaluru on license. In 2008, the first Hawks entered service under Hawk Operational Training Squadron (HOTS) at Air Force Station Bidar, Karnataka, replacing the legacy MOFTU and MiG-21s. In 2010, a follow-up order was placed for 57 airframes,

worth over US$590 million, in which 17 units would be built for the Indian Navy as well, which was also seeking a compatible solution for training naval aviators before they jump into MiG-29K, which would become the sole fighter jet serving in the Indian Naval Air Arm.

So, how long did it take for India to find a viable solution for modern Stage III training of aviators? 19 years, and innumerable peacetime deaths to be precise.

Hawk in IAF today

With over 100 airframes in active service, the Hawk Mk132 fleet is unquestionably the mainstay of the IAF jet training programme, the strength of which lies in providing safe but imperative exposure to young guns before they hold the stick for their first and future solo combat aircraft sorties. The jet offers great stability and capability to perform a great range of aerobatics, with complete control on all three axes. The aircraft has the potential to withstand negative 'g' capability while being inverted for 30 seconds. Surya Kiran Aerobatics Team (SKAT), proudly flaunts itself as "The Ambassadors of Indian Air Force" while having 9 Hawks in the inventory that pulled off several successful air shows in India and overseas since 2016, with the latest overseas deployment done during Dubai Air Show 2021.

Alongside being a trainer and aerobatics platform, the Hawk can also act as a credible attack aircraft. Fitted with Rocket and Gun Pods on its four hardpoints, the aircraft can effectively perform slow-speed Close Air Support (CAS) missions to support ground forces in offensive and defensive scenarios. The all-weather robust airframe can be launched for training and combat missions in either day or night conditions. In 2019, the Vayu Shakti Fire Power Demonstration put up a striking public show involving the Hawk firing a salvo of rockets on a simulated hostile vehicle convoy, proving its ability to carry out such direct Within Visual Range (WVR) strike missions with precision.

Future of Hawk: Smarter, Bolder and Commendable

The modern-day Hawk Mk132 is good enough to fulfill the requirements of the Indian Air Force in the contemporary warfare demands. However, as the battlefield is an ever-evolving subject, people at the Air HQ are very much interested to prepare the platform for threats of the future as well. For this, a smarter derivative termed "Hawk-i" is flying today that will be embedded with state-of-the-art technologies. Initially, there was a plan to co-develop "Advanced Hawk" with BAE Systems but later the programme was shelved by the Ministry of Defence (MoD).

In August same year, the 100th unit of Hawk was rolled out from the HAL factory, designated "Hawk-i" and it was specially configured to act as a testbed for various programmes on the platform, converting it from limited attack aircraft to a dedicated combat solution. The airframe already carries an indigenous Radio Altimeter,

Identification to Friend or Foe (IFF) MK-XII, Data Transfer system, Counter Measures Deployment System (CMDS), and Radar Warning System under its customised avionics and Electronic Warfare architecture.

It also introduced the upgradation of ground attack package, one of which is the addition of Smart Anti-Airfield Weapon (SAAW), the maiden launch test of which was carried out in January 2021, is an indigenous precision-guided munition designed against runways, bunkers, aircraft hangars and similar reinforced structures within range up to 100 kilometres, employing Inertial Navigation System (INS) complemented by GPS. More system integrations are planned, which includes similar precision guided munition and laser designator pod. Then is the plan of enhancing the self-protection capability with new Close Combat Missiles (CCMs), the current one in process of integration is the MBDA Advanced Short Range Air-to-Air Missile (ASRAAM), touted to be one of the smartest weapons for WVR air combat, with a range up to 50 kilometers, homing on the target by an Imaging Infra-Red (IIR) seeker and incorporating approximately 90-degree High Off-BoreSight (HOBS) lock-on capability, evincing its precision and agility in slow speed aerial engagements. However, firing trials are pending but scheduled to be conducted soon.

Apart from all these, the programme is also under work to make it a drone carrier, that would launch a swarm of Unmanned Aerial Vehicles (UAVs) while airborne. NewSpace Research and Technologies, a Bengaluru-based start-up is already in collaboration with HAL to roll out the drone that would be used for such missions, named ALFA-S, or Air-Launched Flexible Asset (Swarm). Pre-mission, these would be fed with target information, like location and type, that could be a radar, the surface to air missile, or a strategic site, and when launched, they would navigate towards the target location and carry out suicide missions, hitting the target using the high explosive warhead carried onboard. Airborne deployment of swarm UAVs is still being studied by nations like the United States, China, Russia and a few European countries but there is yet any example of successful implementation of the project by any such nation. Once fully developed by India, Hawk-I would be the first of its type (light subsonic aircraft) to carry the role of a drone carrier.

Overall, while AJT Hawk is very effectively doing its job, already clocking more than 1,00,000 hours (last recorded in 2017), its future is very well planned that seeks to bring exceptional potentiality, especially to convert it from merely a trainer aircraft to something more important, more capable and more valid for next generation of challenges. It would be telling how IAF would field it to complement the next generation of assets coming along with it.

Rishav (Twitter @_devildog_rv_)
Photos: Simon Watson, Angad Singh and the Vayu Team

Durgesh Singh gives us indepth details on

Modernisation and Future of the Indian Air Force

(Photo: Phil Camp)

This year, the Indian Air Force will celebrate its 90th foundation year along with India's 75th Independence year, which makes the celebration much more special. It shows that we came a long way. The Indian Air Force is just a decade short of being a century-old air power.

Being this old with a glorious past, the future must remain equally promising and being an air power of a country, which is one of the fastest growing economies in the world with a challenging neighbourhood is also a responsibility. Our direct competition in the economic battle can be our rival in an actual battle, considering the border disputes with China. It's a known fact, that the Chinese military modernisation and expansion is going at a very rapid pace, we don't need to catch up for sure, as China has a giant economy to support the modernisation and expansion, also due to large landmass and disputes their interests

are different too, but we surely need to protect our interest, and we need to protect them from two nuclear power militaries which are becoming close allies and one of them is a Superpower.

The challenge is big, keeping in mind that we are still a growing economy, we need to modernise our military as well as expand it in terms of power and effectiveness. And for a modern military to be a powerful and effective force, it should be technologically advanced and completely self-reliant.

So, keeping this in mind, in this article we will discuss the modernisation and future of the Indian air force. From the glorious past till this date, the Indian Air Force remains a potent air power, which is a mixture of experience combined with modern machines.

Clockwise: MiG-29UPG, Jaguar, Rafale and LCA

The aircraft in service may appear older, but they are heavily modified to match today's combat demands. Even the older MiG-21 Bison, which is an upgraded MiG-21 Bis based on the Russian MiG-21-93 upgrade is one of the best MiG-21s out there.

Indian MiG-21 Bison is a BVR (Beyond Visual Range) capable fighter and uses the modern Russian R-77 for BVR combat. And not only that, the performance is even enhanced for WVR (Within Visual Range) combat, with the R-73 now supported by the Russian HMS (Helmet mounted sight) can take off bore shots, which is very lethal in close combat.

Even the EW (Electronic Warfare) capability is enhanced using the Israeli Elta EL/L 8222 Jammer.

And the same story goes on with the other platforms which are operated by the Indian Air Force, be it Mirage 2000 I/TI, MiG-29UPG, Jaguar DARIN III, Rafale EH/DH, or even the Su-30MKI, they all are modified to become one of the best variants of their platforms.

So, everything appears fine, but the question is, are we powerful and effective enough to contain a superpower to protect our interests if needed?

The answer is, that we are managing, and it requires more work. We can say we are technologically advanced, but we are not self-reliant, which holds us back, especially when we are a growing economy as well as a military power. This has to change and fortunately, it's changing.

MiG-21 (Photo: Simon Watson)

MiG-29UPG (Photo: Simon Watson)

what's more interesting here is, that it is in parallel development with a level-up 5th Generation fighter i.e., Advance Medium Combat Aircraft (AMCA). Now, the benefit of the parallel development is, that both the aircraft are sharing technology here, some 5th Gen Technology from AMCA is also present in the Tejas Mk.2, this way we are saving the R&D cost and time for two different projects as well as getting a sophisticated 4.5 Gen machine, which will be very capable and will be much more economical to operate as in comparison with a 5th Gen platform. And things don't end up here, we even have a project for the Indian Navy too, i.e., Twin Engine Deck Based Fighter (TEDBF), which is again a parallel project and will share the development features from AMCA as well as Tejas Mk.2.

IAF Rafale (Photo: MoD)

All thanks to the LCA project, we have a strong base to build a robust aerospace infrastructure in this country, with the support of the Armed Forces and the Government.

The LCA project has led to multiple sister projects where the sophistication level is increasing project by project. First, we have a Tejas Mk.2 project or the Medium Weight Fighter (MWF) project, which is an enhanced version of the LCA Tejas, and it is supposed to be better than Tejas in everything, be it avionics, weapon carrying capacity, maneuverability, networking capability, etc. The platform is being developed as a 4.5+ generation fighter and

The projected timeline for their service induction is 2028 for Tejas Mk.2 and 2030 for AMCA as of now. They are supposed to replace Mig-29UPGs, Mirage 2000 I/TI as well as Sepecat Jaguars from IAF service along with the induction of MRFA aircraft to increase IAF's squadron strength.

LCA Tejas (Photo: Vayu)

So, these sophisticated machines are in development here, but are they completely indigenous? The answer to that is a "No", no they are not completely indigenous, and they are not supposed to be. No country makes everything on its own, we can try for maximum indigenous components, but reaching 100% is not economical. Also, reaching the maximum should be our goal, and with these projects, we are trying to achieve that, and with Tejas Mk1A, Tejas Mk.2 and finally AMCA, we are constantly increasing the percentage of indigenous components from 50% to 80% and to even 90%.

And the biggest development here will be making a completely indigenous jet engine, which is going to be a 110 kN class engine, in the category of GE's F414, Rolls Royce's EJ200 and Snecma's M88.

For this, unlike the Kaveri project, we are looking for a partner with experience, also, we have gained experience too from the Kaveri project itself, so now we have a good chance of developing a successful jet engine in the given time, unlike before. And with the development of a jet engine, we will be able to increase the percentage of indigenisation on aircraft like Tejas, Tejas Mk.2 and even in AMCA Mk.1 in the future, thus making us more self-reliant for these platforms also.

HTT-40 (Photo: Phil Camp)

We are already developing advanced avionics including Active Electronically Scanned Array (AESA) Radar, next-generation jammers, Infrared Search and Track (IRST), Missile Approach Warning System (MAWS), Countermeasure Dispensing System (CMDS), Electronic Warfare (EW) suite, etc, which are responsible for increasing the percentage of indigenisation in Tejas Mk1A, Mk.2 and even in AMCA, but the jet engine development will be a game changer.

Along with the development of a 110 kN class jet engine, we are developing a small 25 kN thrust class jet engine too, that too completely indigenously. The name of the engine is HTFE 25, it is currently in its final development phase, and after its development, we will be able to use it, to power our made-in-India jet trainer, BAE HAWK, which is originally British, but under the project "HAWK i", HAL is already making it mostly with indigenous components, thus almost ending the reliability on Britain for the aircraft, while making it a combat effective platform at the same time.

And since we are talking about trainers, it is also very important to talk about other indigenous developments in this field. And this is a field where we can truly feel proud, as from basic trainer to even Lead in Flight Trainer (LIFT), we will be making all of them in India for the Indian Air force, and most of these projects are in the final phases of their development, whereas some are even close to induction.

The basic trainer here is HTT-40, which has cleared most of its developmental trials, the Intermediate Jet Trainer or IJT

LCA Mk.2 and AMCA models on display (Photo: Vayu)

is HJT-36 Sitara, which has again cleared its critical 6-turn spin trials, after some redesigning and now it's in the final phase of its developmental trials, also the advance jet trainer is BAE Hawk, which is now being converted into an indigenous trainer as well as a light strike platform as discussed up there and finally, we are developing a LIFT which is based on LCA platform, which is going to be highly sophisticated machine forming the base of Indian manned-unmanned teaming system, known as Combat Air Teaming System (CATS). The CATS will include a mothership, which is going to be an LCA-based platform, teaming with unmanned drones, or the Loyal Wingman with swarm drones and smart weapons.

So, at least, in the case of flying combat aircraft, it is safe to say, that in the coming 15-20 yrs. we will be mostly flying indigenous combat aircraft except for Su-30MKI, Rafale and MRFA (yet to be decided).

Also, even with the Su-30MKI, we are trying to increase the percentage of indigenisation, with future upgrades, and even with the licensed components including the engine, hence there also we are trying to be less reliant on Russia, and not only for the platform but also for the weapons the platform will carry. We are already developing next generation air to air missiles (Astra Mk1, Mk2, Mk3, and NGCCM), next-generation air-to-ground missiles (Rudram 1,2,3 and Brahmos), and next-generation smart air-to-ground munition (SAAW, Gaurav, Gautham, TARA, etc.). The good thing here is, that these weapons are going to be compatible with all of our platforms, be they indigenous or foreign.

Thus, even with world-class weapons, we will be self-reliant. Now, an Air force is not only a combat aircraft, it's far more than that, it includes, support aircraft, transport aircraft, combat helicopters, air defence systems, surveillance systems, electronic warfare systems as well as a robust ground infrastructure. So, we will discuss each field one by one.

Combat Air Teaming System CATS (Photo: Vayu)

Support Aircraft

These are the platforms, which support missions of combat platforms. These are Advance Early Warning and Control systems (AEW&CS), air to air refuelers, as well as intelligence, surveillance, target acquisition, and reconnaissance (ISTAR) platforms. And this is the field where we are struggling the most and mostly because of budget issues leading to delays.

It's only now, that we can say, we are progressing on a practical path, to contain budget issues while fulfilling our requirements.

Right now, we have 3 Phalcon AWACS, which are huge 360-degree coverage AWACS, with 3 Netra Mk1 AWACS, which are small 240-degree coverage AWACS, making a total of 6 platforms in service. Our requirement is projected to be 18 AWACS, that too for now. In the future when the squadron numbers will increase, the requirement will go further up.

So, to bridge the gap economically, we went into an innovative direction, in which 6 pre-owned Air India's Airbus A319 aircraft are acquired, modified, and right now, being converted into an advanced Netra platform, known as the Netra Mk2 for now which is going to have an enhanced range as well as capabilities over the existing Mk1s. Also, there is some news that IAF can go for a further 6 more Netra Mk1 for completing the requirement, but it is yet to be confirmed.

Here also, if we exclude the main platform, the system is Indian in the case of Netra Mk1 & Mk2, which will be forming most

Netra with a pair of Su-30MKIs (Photo: Phil Camp)

Phalcon AWACS (Photo: Pushpindar Singh)

of our AEW&CS capabilities. The platform is an exception, and it will remain an exception for a long time, as there are only a few companies around the globe that make these platforms, and since, our requirement is limited, making an entire platform for few numbers, doesn't worth the expenses in R&D as well as time.

So, we can say that we will be self-reliant in the case of AEW&CS too. Now, coming to air-to-air refuelers, again we struggle here also. As of today, the IAF operates 6 Il-78MKIs, but the requirement is far beyond that, since, almost all of our combat aircraft are capable of air-to-air refueling, but we don't have the required numbers to support a large-scale operation.

So, to solve the issue, again we went for a similar innovative way, where HAL will develop a multirole transport tanker (MRTT) platform with Israel's IAI, based on 6 pre-owned Boeing 767 platforms.

The MoU is signed, and IAI has already converted one such platform for the Colombian Air Force, so not much is left here regarding the R&D work, hence we can expect results sooner.

Coming to the ISTAR platform, again it is a long battle for us, and currently, we don't even have a single ISTAR platform.

But we are in a process of acquiring one and making more here in India, as a joint project with the United States. Most likely the platform will be based on Raytheon's Sentinel.

Il-78MKI refueller (photo: Simon Watson)

Transport Aircraft

The IAF's transport fleet is made up heavy lift aircraft like Russian Il-76 and American C-17 Globemaster III, medium-lift aircraft like C-130J-30 Super Hercules, An-32s, HS748 Avro, light transport aircraft like Dornier Do228 and then in helicopters, we have Mi 17V1/5, CH-47F Chinook, ALH Dhruv, Cheetah, and Chetak. Almost all of these platforms are imported with an exception of ALH Dhruv and Dornier Do 228, which are made in India.

In the case of the rotatory wing, we are making good progress, ALH Dhruv is an example of that, which is operated by the IAF in decent numbers. In the future, we will be replacing all the Mi 17 helicopters with an Indian helicopter, known as IMRH, which is currently under development.

Cheetahs and Chetak will also be replaced by indigenous LUH. So, except Chinook, almost all the rotatory wing transport platforms of IAF are going to be indigenous.

Coming to the fixed wing, this is an untouched territory for most countries, as the requirement here is limited, so putting R&D work for limited numbers is not




Some IAF vertical lift assets: Chinook, Dhruv ALH, Apache and Mi 17V1/5 (Photo: Vayu)

economical, although India tried with a joint MTA project with Russia for medium lift transport aircraft which we need close to 100, but things didn't work out and the programme stalled.

Now, we are acquiring Airbus C295 aircraft as HS748's replacement, the contract has been signed for 56 aircraft and these aircraft will be made in India under ToT, which will ensure, self-reliance for the platform, which is the next best thing.

Similarly, there are some reports, that India can land in a similar arrangement with Brazil's Embraer for C-390 Millennium aircraft, as An-32s replacement. Again, if this happens, we will have the next best thing to a completely indigenous platform, almost making us self-reliant in fixed-wing transport fleet too, as except the heavy lift category, in all the other categories we will have platforms, which will be completely made in India.

Combat Helicopters

In the case of combat helicopters, we have the American AH-64E Apache, Russian Mi-35s, and the Indian ALH Rudra. The American AH-64E Apache and the Russian Mi-35s are heavy-category combat helicopters whereas the ALH Rudra is a completely Indigenous platform based on ALH Dhruv Mk3.

These platforms will be accompanied by India's very own Light Combat Helicopter (LCH) very soon. And in the future, the heavy category helicopters will be replaced by an upcoming Indian heavy combat helicopter, which will be developed after IMRH. Hence, IAF will mostly operate an indigenous combat helicopter fleet in near future and a completely indigenous fleet in the distant future.

Air Defence Systems

Historically, IAF-operated air defence systems originated from mostly Russia and


C-130J (Photo: Pushpindar Singh) and C-17 (Photo: Boeing)


IAF An-32 and Dornier Do-228 (Photo: Angad Singh)

Akash SAM (Photo: Vayu)

Israel, but this is changing very fast. We are replacing most of the legacy Russian air defence systems with completely indigenous systems like the Akash Family (Akash, Akash 1S, Akash Prime, and Akash NG) and the MR-SAM for medium-range engagements. And in the future, IAF will operate, QRSAM, VL-SR SAM for point defence and XR-SAM for long-range engagements. So, we can say that most of IAF's air defence missiles are going to be indigenous with an exception of the Russian S-400 for long-range engagements.

Surveillance and Drones

If we look at IAF's current drone inventory, we operate two types, IAI Searcher and IAI Heron and both of them are from Israel. Right now, they are only being used for surveillance, but Heron will be upgraded with a limited combat capability, under project Cheetah.

In the future IAF can acquire around 10 American MQ-9 Predator B drones, which are MALE UAVs with combat capability.

Also, in a period of 2-5 years, IAF will give orders for the indigenously developed TAPAS- BH-201 drone, which is under its final development phase, and in a time frame of 10-15 yrs, IAF will acquire DRDO's Ghatak stealth UCAV which is currently under development and its SWIFT prototype has already conducted its first flight.

Electronic Warfare System

IAF operates a few EW platforms, but the information about them in the public domain is very limited and it is estimated that a total of 3 American-upgraded Gulfstream III platforms are used for the role. Although our fighter aircraft are also modified to perform limited EW roles, but for dedicated EW operations, we have no fighter squadrons. But some new reports suggest that a few Su-30MKIs might be converted into dedicated EW platforms in the future.

ADE/DRDO SWIFT displayed as a model (Photo: Vayu)

Robust Ground Infrastructure

A robust ground infrastructure is also very important to support all-weather, day, and night operations. With the threat of electronic attack, it is also important to ensure proper connectivity and situational awareness.

For this, IAF provided a contract to TATA power SED, for modernising 30 IAF's airfields, while in parallel, upgrading the air bases with modern DRDO's surveillance radar like DRDO Arudhra and ensuring proper connectivity with the installation of Software Defined Radios (BNET).

Also, after the Jammu Drone attack, IAF upgraded its air bases with indigenous anti-drone capability, developed by DRDO itself. The system is very capable and can act in two operating modes, hard kill and soft kill. It can engage drones of any size up to a range of 4km.

So, as we can see, the IAF is already on a path of being a completely 'desi' air force, and relying mostly on indigenous options for completing current and future requirements.

These developments are leading the way to a completely indigenous and self-reliant Air Force.

And hence we can say, the future is bright and strong.

By Durgesh Singh
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MMRCA – Bees Saal Baad! (20 years later)

Saab Gripen E (Photo: Saab)

In the sixties and seventies, the IAF, with its superior capability, played a pivotal role in dominating the battlefield and changing the course of war in India's favour. Then, in the eighties, it went through an evolution in terms of both enhanced operational capabilities and squadron strength. The quick inductions of Mirage-2000, Jaguar, MiG-29, MiG-23, MiG-27, and MiG-25 saw a rapid enhancement in strength. At the same time, HAL manufactured the last of the MiG-21 series, the "Bis", which in coming decades would go through extensive modernisation to be the "Bison". But that advantage quickly started to dwindle as several platforms got obsolete, requiring immediate replacement. Dassault Aviation reportedly offered to transfer production line of Mirage-2000 to India. But ultimately there was no progress. At that time, IAF squadron strength plummeted to an all-time low of just 32

Dassault Rafale (Photo: Dassault)

squadrons! To combat this, the IAF issued a RFI in 2001 for the procurement of 126 multi-role fighter jets. Yes! It is that old.

And it started (2007)

On 28 August 2007, the Request for Proposal (RFP) for the procurement at an estimated cost of Rs. 42,000 crores (then $10.4 billion) for the Indian Air Force was issued to six vendors. These six participants were MiG-35 (RAC MiG of Russia), JAS-39 Gripen NG (SAAB of Sweden), Rafale (Dassault of France), F-16IN Super Viper (Lockheed Martin of the US) F/A-18E/F Super Hornet (Boeing of the US) and Eurofighter Typhoon (Airbus, a consortium of British, German, Spanish and Italian firms).

The entire procedure was envisioned as follows: First, the proposals from the contenders would be technically evaluated to check for compliance with operational requirements and RFP conditions by the IAF. Then extensive field trials would be carried out to evaluate the performance. Then eligible vendors will be short-listed after technical and field evaluations. Finally, the commercial proposals of the vendors would be examined and compared.

It was decided that the first 18 aircraft would come in a "fly away" condition while the remaining 108 would be manufactured under the Transfer of Technology (ToT). There was an obligation to undertake a 50% offset in India by the selected vendor. It had been hoped that the ToT and offset contracts would provide a great technological and economic boost to the indigenous defence industries. The aurcraft were to serve over 40 years.

The requirements were not made public. However, in an interview in 2007, then Chief of Air Staff Air Chief Marshal F.H. Major stated, "We want the aircraft to have an adequate long-range and endurance to meet our operational requirements with additional mid-air refueling capability, ease of maintenance and low life-cycle costs." In the same year, according to a report, the RFP specified an option to go in for an additional 60-65 more jets if required. He debunked rumours of multi-vendor acquisition. This acquisition procedure under Defence Procurement Policy (DPP) 2006 was laid down in August 2007 with the issuance of the RFP. The first squadron was expected to be ready by 2012.

Lockheed Martin F21 (Photo: LM)

Days of all-out war (2008–2011)

The technical bids were thoroughly evaluated in 2008, followed by grueling field trials in 2009 in Bengaluru, Jaisalmer, and Leh. Thus, the full potential of the competing platforms was evaluated by subjecting them to extreme adverse weather conditions such as humidity, scorching desert heat and blistering cold at high altitude. At the end of August 2009, ACM P.V. Naik informed the media that the trials of the F-16, F/A-18, Rafale, and MiG-35 had been completed. According to reports, by May 2010, all contenders had completed their trials. All platforms vying for the competition had to conduct various combat maneuvers, air-to-air refueling, dummy weapon firing, and so on. Interesting was the high-altitude trial where one had to land, refuel, and take-off again. The media reported that though the weapon tests in Pokhran went smoothly, a few platforms faced problems restarting their engines amidst the rarefied atmosphere of Leh.

The technical evaluation report of the tests was mentioned as "virtually ready" by July and it was all set for the staff evaluation followed by assessment of commercial bids by contenders. For the first time commercial evaluation were to be determined by the "life-cycle cost". It would incorporate cost of acquisition, cost for operating cost the fighter for a 40-year period with 6,000 flying hours and cost of ToT. 50% offset was also mentioned in the contract, under which the contender had to invest half of the contract forex value back to India! It was a highly complex affair indeed.

In December that year, ACM P.V. Naik informed him about the completion of the evaluation. Addressing several subjects, he hoped for the signing of the deal by July of 2011 and delivery by 2014.

At the end of April 2011, four of the six contenders were officially ruled out of the fray, leaving only Dassault and Airbus. The disappointed American contenders wasted no time and rushed to understand the reason. The uneasiness was sorted out by a government-to-government debriefing between Indian and US officials. On 4 November the final bids were opened.

And it's Dassault (2012-2014)

It was 31 January and 1 February 2012. Multiple reports confirming the win from Dassault took the world by storm. The decision irritated the United Kingdom the most, prompting harsh criticism in British media. But the IAF vociferously rubbished all this nonsense. To ease the situation, the External Affairs Ministry (EAM) briefed the defeated party of the European consortium as well.

Axed: Mother of All Deals (2014)

In February 2014 the Defence Minister A.K. Antony revealed the reason behind deferring the finalization of the deal to procure 126 multi-role fighter jets as the lack of necessary financial capability! The deal then stood at est. more than Rs. 60,000 crores overwhelmingly overran the original estimation of Rs. 42,000 crores in 2007. Referring the procurement as the "mother of all deals", the defence minister was further quoted saying "there is no money left for this" and pushed the deal for the next government. Meanwhile many analysts estimated the overall cost would sky rocket to more than $20 billion!

As general election in 2014 knocked at door more log jam hit the deal regarding work share and responsibility issues. HAL and Dassault continued industrial coordination with HAL taking responsibility of directing

Boeing F-18 Super Hornet (Photo: Boeing)

70% of the work in India. Concerns over life cycle cost kept hammering the negotiation process.

On 8 August 2014, the MoD, under the new Defence Minister Arun Jaitley, officially stated, "The 18 direct-flyaway aircraft are expected to be delivered in three to four years from the signing of the contract. The remaining 108 licensed aircraft in India are expected to be delivered during the next seven years". The new Defence Minister, Manohar Parrikar, in December gave assurance that he would resolve the issue in a fast-tracked manner. But ultimately, both parties would be bogged down in interminable discussions.

MiG-35 (Photo: Rosoboronexport)

G2G (2015)

In 2015, during the Paris tour, Prime Minister Narendra Modi on 10 April announced a new deal to procure 36 Rafale's in flyway condition, citing critical operational requirements of the IAF. At a joint press conference with French President Francois Hollande, the procurement was announced under a government-to-government deal.

The same year, the government pulled the rug on the 126 MMRCAs. On 31 July 31 2015, Defence Minister Manohar Parrikar told the Rajya Sabha, "The Request for Proposal (RFP) issued earlier for the procurement of 126 MMRCA has been withdrawn." The next year, French President Francois Hollande was invited as the chief guest on the occasion of Republic Day. Both nations inked a MoU on the purchase of 36 Rafales. India finally signed the deal with France on 23 September 2016, at a reported cost of 7.8 billion euros. It was inked in New Delhi between Indian defence minister Manohar Parrikar and his French counterpart, Jean Yves Le Drian. On 8 October 2019, Defence Minister Rajnath Singh inducted the first Rafale F3R into the Indian Air Force. There were 13 Indian-specific Enhancements (ISEs) on the Indian Rafale.

The deal irked many and led towards a lot of controversies and slugfest involving various parties raising questions regarding various aspects of the contract. After many ups and downs, at the end the Supreme Court gave a clear verdict. The MoD would give official statement, "The Hon'ble Supreme Court in its judgment dated 14 November 2019 has categorically stated that the Review Petitions are without any merit and are dismissed." Further discussion on it is unnecessary as our subject focuses on only the process of the project.

A single engine contest (2016-2018)

In 2016, India reinitiated the global contest for a medium multi-role fighter, but this time only for a single engine! Thus, it automatically narrowed down the competition to only two contenders: Lockheed Martin and Saab. LM was already pushing its offer through the Indo-US Defence Trade and Technology Initiative (DTTI). The F-16 production line was offered to be shifted to India. Saab offered to help with the LCA programme and the development of the Tejas "Mk.1A" as well

as the AMCA fifth-generation fighter jet! It quickly became a contest between the F-16 Block 70 and the Gripen E.

In early January of 2017, Raksha Mantri Manohar Parrikar said that a new line of production for single-engine fighter jets in India would be approached under the Strategic Partnership model. This discussion was to be concluded by the end of that month itself. But it hit the corner at the end.

2018-2022

As complexities arose in single-engine conditions, the government scrapped that in February 2018. On 6 April, the IAF released another RFI for the procurement of 110 multi-role platforms, of which 85% were to be made in India by a strategic partner. At that time, the squadron strength further went down to just 31!

The cost of the project was estimated at $15 billion. At a press conference just days before his retirement, Chief of Air Staff Air Chief Marshal Arup Raha said the 36 Rafale jets bought by India were not enough and more aircraft were needed in the medium weight category. He also said that India needed at least 200 more fighter aircraft in the next ten years.

New Players

Lockheed Martin positioned the F-21 as the most advanced variant and evolution of the F-16.They even offered a maintenance, repair and overhaul (MRO) facility in India to sweeten the bid. Boeing is mulling offering the F-15EX, the latest upgraded variant of the F-15 series. Other than these two, all the old players (F/A-18E, Gripen E, Su-35, MiG-35, Eurofighter Typhoon, and Rafale) remain in the game.

Eurofighter Typhoon (Photo: Bundeswehr/Dahmen)

Current Status

In 2020 the entire stage was at the RFI evaluation stage. The entire process was shifted from 'Strategic Partnership' to 'Buy Global, Make in India' under under Defence Acquisition Procedure (DAP) 2020. The selected OEM will have to comply with the requirements of ToT. The last update on it came from current (2022) CAS ACM V.R. Chaudhari who confirmed the progress on MRFA. Expect some new development during Defexpo 2022.

The quest for an advanced multi-role fighter to be manufactured in India originally dates back to the 80s! To combat Pakistan's acquisition of the F-16, which at that time was undoubtedly a game changer, the IAF procured Mirage 2000s from France and MiG-29s from the USSR. But for various reasons, the IAF abandoned the original plan to manufacture either of them on Indian soil. Then came the twenty-first century. And it's just gobsmacking that a decision has not materialised since 2001! It has already been 20 years since India's quest for MRFA type aircraft and the country cannot afford to wait any longer. Chinese military strength is growing rapidly. And Pakistan too, leaves no stone unturned to modernise itself. In the end, we can just hope for a final decision as early as possible.

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Boeing F-15EX (Photo: Boeing)

Does India really need a strategic bomber?

(Photo by Vitaly Kuzmin taken at the Moscow Victory Day Parade)

It has been a long debated issue whether India should consider a long range strategic bomber or not and once again this issue flared up recently when the former Indian Air Force Air Chief Marshal Arup Raha stated in a dialogue with Chanakya Forum that Indian strategic command forces needed a squadron of such bombers. The need for these has become more important as there are multiple roles that simply cannot be replicated with multirole aircraft like Rafale and Su-30MKI's. However, a major question also arises that given the condition of Indian defence where IAF is not able to meet its basic requirement of combat aircraft; so, does having a "luxury" like strategic bombers make any sense?

The modern active strategic bombers currently in service are Northrop Grumman B-2 sprit, Boeing B-52 Stratofortress, Rockwell B-1 Lancer with United States, Xian H-6 with China and Tupolev Tu-95, Tu-22M and Tu-160 with Russia. As of now only three nations, ie, US, Russia and China operate strategic bombers. Multiple futuristic bombers like B-21 Raider from US, Xian H-20 from China and Tu PAK-DA from Russia are under development with these featuring improved stealth characteristics and longer endurance.

Utility of Strategic bombers from Indian perspective

A strategic bomber is like an aircraft carrier of skies, it would give a similar increase in firepower and physiological impact as an aircraft carrier does to an enemy's navy. The bomber that can be most likely operated by India in future is the Russian Tu-160 White Swan having a maximum range of 12,000 kms, ability to carry 45,000 kgs of weapon load and travel at 2.05 Mach (faster than multiple combat aircraft). The strategic bombers can perform multiple roles in general and can prove to be even more efficient from an Indian perspective as we are going to discuss in detail.

Neutralising enemy air defence systems: The reason why we believe a quote from the distant past that "A bomber will always get through, no matters what defensive systems are used" is still valid today is because strategic bombers like Tu-160 and B-1 Lancer can carry long range standoff weapons that can easily neutralise air defence systems as modern as they get. Hypothetically if a Tu-160 is modified to carry 10 air launched BrahMos missiles with extended range in future, it can easily release this payload from a safer distance and can rain a havoc over enemy SAM sites. The collapse of ADS can easily make way for other aerial assets or bombers to march quite deep into a country.

A counter argument could be that enemy ADS can also be suppressed by ground based missile launchers, however it should be understood that the ground base launchers are stationary targets that are themselves under threat of enemy cruise missiles while relatively it is difficult to shoot or intercept a bomber which is constantly maneuvering and moving at speed of Mach-2 at a distance that is out of range of enemy SAMs. It should also be understood from Indian perspective that not every nation operates ADS as deadly as S-400s so it would make airspace of our western neighbors as a cakewalk, deep punitive strikes like Balakot could be done anytime without much consideration, while in regions like Ladakh the ADS either of China or India have reduced potential due to hilly terrain which creates line of sight issues and can drastically reduce effective combat range of ADS, the bombers on the other hand with advantage of height can make Chinese ADS even more vulnerable to strike.

The Indian Ocean region: If strategic bombers are procured then from Indian perspective they'll find its most utility in the Indian Ocean region. The first Deputy Chief of Staff for Intelligence, Surveillance and Reconnaissance Lt. Gen. David Deptula of USAF wrote in an air force magazine, "In a modern threat environment, especially in Asia Pacific region, the advantage of using bombers in a maritime strike role is becoming more relevant to future military strategies, plan and budget priorities", he further emphasised on how bombers could strike mobile naval assets with precision in no time and at a less risk than what a naval warship would face. It should also be understood that once a naval warship had exhausted its weapon load, it would have to travel back to coast to get them refilled, the process could take days or even weeks depending on distance from shores while at same time the warship itself remains a potential target to offensive assets. On the other hand a bomber having supersonic speed with adequate range could reach at

any point in Indian ocean region within hours and could deploy a devastating amount of warheads in a single sortie which would be enough to neutralise something as large as a carrier battle group, further even if it ran out of weapon load it could easily replenish it within hours and perform another combat sortie at a pace much faster than naval warships.

The effectiveness of using such bombers for maritime purposes could be understood from the example of Russian Tu-22M Backfire bombers. They were the first bombers dedicated for maritime purposes and Russian tests revealed that its primary weapon Raduga Kh-22 cruise missile, when laden with 1000 kgs of warhead, created a hole 40 ft deep and 16 ft in diameter in naval vessels (we have also seen the footages of BrahMos doing even bigger damage). These kinds of impacts are enough to sink a number of aircraft carriers or at least decommission them for months. The authors of book called Soviet Air power by Bill Sweetman and Bill Gunston described Backfires as capable of "scaring the bejejus out of carrier groups". Due to the excellent capability of strategic bombers to neutralize enemy's ADS, it can also destroy enemy's costal ADS, hence paving way for other naval assets to safely move in.

A counter argument could be that when India which had already deployed a squadron of Su-30MKIs based in Thanjavur that are capable of carrying the long range standoff missile like BrahMos with its descent range, then what is the requirement of a strategic bomber for maritime purposes?

It should be understood that Indian Air Force may not be always available to respond to Navy's requirement in a momentary notice, a reason why even the Indian Army is raising its fleet of assault helicopters rather than being dependent on IAF. Even if we suppose that IAF is capable of responding quickly one should also understand that radar and avionics on IAF jets are not that efficient over water, there's a whole different communication and software linking network between naval assets and naval aircraft which may not be that suitable for IAF aircraft.

The maritime strike bombers would also be an adequate reply to Chinese Navy, which is today world's largest navy with three active aircraft carriers and seven more planned in future. It would be impossible and unsuitable for India to ever think of ten aircraft carriers or even half of it. In such a case submarines are another alternative to counter increasing Chinese naval dominance, however a maritime strike bomber (although can't replace submarines and warships) would emerge as an appropriate force multiplier at a fractional cost of an aircraft carrier or submarine.

Using Sukhoi-30MKI's for bombing purposes

A strong argument against strike bombers is provided by giving reason that the Su-30MKI that is itself a long range heavy multirole aircraft can be used as a bomber due to its huge weapon carrying capability, ability to carry BrahMos A missiles and large internal fuel reserves giving it a decent combat range. It is indeed true that Su-30MKIs could be used as tactical bombers but then it would be quite risky to do so and a waste of actual capability of aircraft. The Su-30MKI can carry only one BrahMos A missile, if we assume that somehow the missile fails to hit its target then the whole mission could fail, further with a weapon as bulky as BrahMos the flight characteristics of aircraft are also severely impacted that would make it difficult for aircraft to evade a surface to air or air to air missile by maneuvering if enemy retaliates. Even assuming that missile will hit the target, then considering an average Su-30 squadron and 70% availability rates, 14-15 aircraft would have to be in flyable condition which would be able to carry 14 BrahMos A missiles. Now given the capability of Tu-160, a single bomber can carry 10-12 BrahMos missiles after modifications.

Tu-22M Backfire (Photo: Dmitry Terekhov)

Future perspective

The HAL Combat Air Teaming System comprises a set of UAVs, UCAV and a mother ship that controls all these systems, although variant of Tejas is planned as a mother ship, but something as mighty as strategic bombers can also work as mother ship with ability to deploy hundreds of mini UAV's in no time. The weapons like hypersonic missiles and directed energy weapons will also require a platform able to carry mighty payload and is able to provide huge electrical power to support future systems, and a strike bomber fits perfect for that role.

Are strategic bombers an immediate requirement for India?

The increase in firepower that a long range strategic bomber brings with it is quite impressive, it would be not wrong to call a strategic bomber an aircraft carrier of the skies. It should be noted that currently there exist no immediate requirements for mission oriented aircraft like strategic bombers, instead the focus should be on at least completing basic requirements of Indian Air Force like AWACS, long stuck MMRCA for depleting fighter squadron and tanker aircraft. During the dissolution of USSR, India could have acquired a hundred Tu-22M's at a fractional cost as Moscow was wondering what to do with 300 surplus of these but India missed an opportunity while on the other hand China tried extensively to procure Blackjacks or even their design blueprints that clearly indicated their utility in future.

It is indeed sure that someday or another, especially when China touches 5+ aircraft carrier mark, India will feel the need for a strategic bomber. The cost wouldn't become a huge constraint when we are thinking from perspective of operating them by strategic command forces, further it would be better to import these bombers rather than indigenously manufacturing them because of the lack of technical know-how, funds etc.

By Pratisht Chaudhry
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The AMCA – a 2022 review

By Prof. Prodyut Das

A statement of the situation

If a combat aircraft cannot obtain a clear IOC within twenty years of start it will be overtaken by further progress. Our scientists cite lack of technology and facilities but the clear evidence is that the problem is localised to certain projects. The ALH, AWACS programmes indicate what is possible. The crucial Tejas and the simpler technology HJT 36 continues to be "work in uncertain progress". Technology disparities alone do not explain the great disparity in outcomes. The Government should commission an analysis of different projects' performances; the findings will help AMCA timelines which is already critical. Given the closer Government monitoring and that the Customer been taken on board ab initio means that in the AMCA programme there will be less insouciant flouting of dates seen earlier. Whether that alone will be enough is doubtful.

The 2025 dateline for first flight will probably not be seriously overrun. Whether the performance objectives have been met will be clear only when the prototypes start to fly. By then, it will be too late to avoid delays if things need serious mending. This misgiving about the need for serious mending stems even from the scant "open source" evidence it seems ADA/DRDO and the higher direction of the project has not put to use the earlier lessons. ADA will once again use critical new technologies that it has not yet mastered- stealth, DSI intakes, and the design of the weapons release system in the stealth mode to name but a few. Mending mistakes on the prototypes, mis-labelled as "Technology Demonstrators", is time consuming as Tejas has amply demonstrated.

The matters are not helped by the fact that the IAF DCAS Plans has issued a very challenging specification. The specifications are very good but will cause delays because of overreach; the fault of the specification lies in being "excellent" instead of "good enough". The Raptors and J 20s need to be countered. Rather than "matching" specifications we should explore combinations of simpler airborne platforms with ground- based systems. This alternative, unacceptable for "expeditionary" war plans, is the only option for us.

The final fear that we may repeat the history of infinite delays and depleting squadron strengths is that there is no parallel AMCA programme which run until the proposed AMCA takes off and trials show sufficient promise and reassurance, optimistically circa 2027. Insurance programmes e.g., the YF 23 to the F 22 and the Boeing YF 32 to the LM F 35 works out cheaper surer and faster. What happens if the AMCA needs massive corrections?

Timelines of the AMCA

The AMCA programme's details are available on the Net and the following is a summary.

The project studies were initiated in 2005 with official start in 2007 and the ASR was issued in 2010. The Project definition phase PDP was completed in 2013. There should have been several tens of alternatives examined but only known is a finless design-which was, perhaps mercifully, not proceeded with it being as ugly as sin. The layout finally chosen, a shoulder mounted rhomboidal wing design with a "chined" fuselage, twin engines with a matching rhomboidal tail and twin fins has a general resemblance to this genre of aircraft e.g., the Raptor/FC 31. The configuration was refined through studies 3B01 to 3B09 between November 2013 to December 2014. These studies were related to the checking out of area ruling, weapons bay details and similar basic project detail design rather than examining configurational

alternatives. It was finally round 2019 that the AMCA began to emerge, barring minor irritants, as a reasonably competent looking aircraft.

The US timelines

The corresponding US ATF programme ran like this: One year (September 1985 to September 1986) for Request for Information from six companies GD/LM/Boeing/Northrop/MD/BAe. These included aircraft proposals followed by immediate funding for two prototypes for the two winning projects in 1986. The data generated by the six proposals were pooled to refine the two finalist's proposals who also collaborated with the "losers"- and first flights of both competing types was within five years i.e., 1990-91. In America the IOC, never suffixed or numbered, signifies the aircraft is fit to go war if required, happened in December 2005. Subsequent to IOC Raptor deliveries was 30 plus per annum. The production of 187 aircraft ended in 2011 i.e.,16 yrs. after first flight. The entire programme from RFP to finish of production of the 187 aircraft took 26 years. Eight decades since independence we have ignored the need for speed.

AMCA Predictions

We have taken sixteen years to do what the US did in two. If henceforth we match the Raptor exactly in pace of development, we can expect a first flight in 2027, IOC in 2040 and seven squadrons by 2047 i.e., 25 years from today and 40 yrs from first funding. 40 years for the Tejas and optimistically 40 years for the AMCA. What then has been the Tejas project's "learning"? The Tejas created physical infrastructure and assertions of an aircraft development ecology. A corpus certainly has been created but medically it is "brain dead". Between MoD, DRDO and South Block the cat has to be belled-a massive soul-searching, reorganisation, honesty and hard work and finally, a sense of purpose beyond personal foibles. Technology is not the problem; it is the "informed decision making with integrity" leadership that has been lacking.

Funding History

The Funding summary was 10 crores in 2007, 90 crores in 2009, 447 crores in 2019 and now 15,000 crores in 2021. Did late funding delay progress or the funding could be released only when ADA progressed is an important unknown. The progress we can expect of the AMCA depends on this "unknown". Delay in funding can be corrected but slow rates of progress- requires significant changes in ADA itself.

Circa 2018 i. e. eleven years -as compared to one year for the US -after the start of project studies the design was approved for Detailed Design Phase (DDP). This kind of delay makes one seriously wonder if there is a clerk in South Block whose life's mission is to make projects obsolete before they even fly! "We do not have the Technology" is a refrain but should we make it worse by procedural delays? Having funded project studies in 2008 the DDP should have been funded by 2009 - or the project studies should not have been funded at all. If ADA design progress was too slow the work would be rendered obsolete and if funding was too slow, technology, requirements and concepts change and the work done is wasted. Perhaps to the project "babus", aerospace administration was just another form of the MGNREGA.

A funding of 15,000 crores with an aim to produce 7 squadrons worth of AMCAs has been released, 2 squadrons with the F 414 and 5 with a yet to be developed homegrown engine of 85 (?)/ 121 kNs each. There have been recent comparisons of the "huge" American funding versus ours. 80 to 90% of the development cost of a combat aircraft is the cost of trained engineering manpower which in America is horrendous -compare Boeing with HAL/ADA/PSU salaries - so officials quoting American cost of development to show how cheaply we may be getting the AMCA is evasive logic and that too of poor quality! Actually, American projects, considering their input costs, are economical, well managed and finally, profitable. Delays are quadrupling our costs.

Weakness of the review

One presumes that the views of the reviewers has been respected. The last time the then Chairman by-passed serious objections by declaring the unsatisfactory

(to the customer, mind you!) design as a "Technology Demonstrator"- it was an administratively "clever" but engineering-wise fatal misstep. A serious re-engineering of the "unsatisfactory" proposal to meet the customer's inputs may have "delayed" the project then by one two years, it probably would have shown up the serious deficiencies of confidence to engineer the changes needed, but it would have avoided much of the subsequent delays and the current and urgent need for the Mk1A and the risky Mk2- even before the Mk1 is in stable production. Why this correction was not done and the authority under which a "part time" person or a coterie could take such a decision needs to be re-examined because this decision was disastrous- for the IAF. The IAF had a stake, HAL had a stake, DRDO had a stake; what stake does a "multi hat" wearing IIT/IISc professor or secretary, both species "part time" have? A mechanism of non-accountability rather than enterprise allowed such liberties but there was no concomitant mechanism to review the decision let alone to hold people responsible, when committed dates began to be repeatedly missed. The cause of unacceptable delays in import sensitive projects like the HJT 36 and the Tejas need analysis because the lessons apply to the AMCA. In successful countries the critical decisions are taken by the industry/ people who finance the project and "own" the money; accountability and speedy implementation is automatic. In India who one knew mattered more than what one knew!

Technical Features

The AMCA has fifth generation features and is to be used as an air supremacy, strike, SEAD, EW roles and is viewed as a replacement for the Su-30MKI. The later versions will be having sixth generation features. The caution is that wonderful specifications by themselves are as useful as the paper license for a gun when there be tigers about.

Some of the features of the AMCA are: Stealth, 3D thrust vectoring (at some future date), AESA radar, OBOGS, Internal weapons bays with the capability to house to two missiles and two SDRAMs, AESA radar, DSI air intakes with low RCS "snake" engine inlet trunking and the latest trends in a glass cockpit with all the usual concepts in terms of displays-MFDs, touch screens, voice inputs, sensor fusion coupled to MAWS, EW suite etc.

The front fuselage from the radome to the first wing attachment point extensively use composites and even the fuselage formers in this region are composites- possibly to increase stealth in the frontal lobe. The intake ducts are labelled "stressed". Whether the duct is stressed to withstand the usual ram pressure recovery or for giving structural rigidity is not known. If for structural reasons - two skins with supporting webs does make for a rigid "box"- though why this would be needed is not known. There would be a weight penalty. The centre fuselage wisely stays away from too much composites particularly for the areas of point loads- wing and undercarriage and I presume air brake attachments. Titanium is used in the region of the engines.

Weight and CG control or the lack of it was the hubris and nemesis of the Tejas. Guarding against this will apply equally to the AMCA. The empty weight is given as 12,000 kgs. To achieve that the airframe weight has to be held below 4500kgs. If we add another 3000kgs for the two engines and its fuel systems and perhaps 700 kilos for the U/C the team have about 3200 kilos for all the rest of the systems- hydraulics, avionics, ECS, harness and plumbing, seat and safety etc.

In a recent Blue Skies Podcast there was a surprising mention of a shortage of fuel tankage in the Tejas. The internal fuel is 2480 kilos but estimates show that despite the Tejas' small size 2760 kilos could be possible. My belief is that an honest and thorough revision could make the Mk1/ Mk1A quite acceptable. The AMCA carries 6500 kilos of fuel. The smaller F 35 carries 25% more fuel. If the figures are right, it reflects poorly on the AMCA detail design. The physical details of the aircraft and its equivalents are placed in the Table 1.

Prospects

That the aircraft as specified will meet the threat is obvious. Indeed, it is my case that the aircraft is over specified and over capable and there may be simpler alternatives but that is for another piece! Taking the specifications as a given, what are the worrying signs about delayed induction into service?

The Tejas lessons having been learnt there will be less of the delays the Tejas programme faced. Structural weights, systems performance, inlet trunking design, space for various items, weight and CG control, serviceability issues and a consequent host of elementary problems caused by the "on the job training" nature of early Tejas will not recur. Given the start of metal cutting a short while ago and the greater monitoring by the "owner" i.e., GOI/IAF, a prototype roll- out/first flight circa 2025-27 should be possible. We have eaten away all the fat that the 42 squadron Airforce of the 1990s afforded to the Tejas project. Similar delay with the AMCA will be fatal- for the IAF. It is in getting AMCA into service on schedule that I say, as marked in ancient maps, "Here be dragons!"

Portends of delay

One cannot put a finger on the sense of unease about development "subsequent to roll out" phase of the project but the portends are:

The ADA has not shown the kind of "on the top of the job" expertise that is expected as a necessity. Open-source information is scant but I mention some disturbing symptoms:

i) The initial models even as late as 2014 were showing a fin so "agricultural aircraft" that it could not have been stealthy. How could the project team even think of it -never mind that the Koreans used it!

ii) The models displayed until recently showed air intakes with diverters when stealth is supposed to be a feature. DSI (Diverter less Supersonic Intakes) technology- sometimes called "Ferri" (after its inventor) intakes- was known in the early sixties e.g., Chance Vought F8U Crusader 3 and declassified in the 1970s. It was not used then because everyone wanted Mach 2 speed and that meant some form of variable geometry for the intake. With the F 16 the Mach 2 speed requirement became- "officially"- (i.e., appeared in US specifications) - passe, the DSI became both acceptable and superior being lighter, simpler and stealthier. By the time of the start of the AMCA project i.e., 2007 the DSI intake was common or garden variety of aeronautical schoolboy knowledge and a slew of fighters including the F 35 and the JF 17 were featuring it. The AMCA project models did not show this until perhaps 2017. DSI s are more demanding of surge

and supplement "shuttering" and the released information shows nothing in this line. The point I am making is it is not enough that the DSI has been incorporated finally. The point is about the indifferent quality and tempo of the Project studies- "laboured" -in one word-progress indicate things amiss.

iii) The other disquiet is about using unproven technology. The AMCA needs DSI (Diverter less Supersonic Intakes). I find it indicative of poor programme management that ADA has in 17 years has not converted or rigged up one Tejas prototype to prove the DSI and other stealth concepts and generate hard design data. The conversion for DSI did not require major effort or funds, it needed the right spirit. ADA has failed to take this precaution and if ADA luck does not hold-and it won't because development is unforgiving of neglect- there will be massive redesign because the outer envelope of the fuselage may slightly change.

iv) It is troubling to note that the full- scale testing of the radar cross section is yet to commence -the full-scale model was expected to be transported to Chennai sometime in August and of course the effect of ageing on stealth has not been mentioned. This was a problem which warranted priority tackling in detail before being integrated into the design.

v) The design of the internal stowage systems of weapons is a key feature of the 5th generation aircraft. There has been no news so far on a technology demonstrator of this feature being flown.

Spirit and Credibility

Finally, it is a question of right spirit; The Tejas team took over 3 years from roll out Nov 1995 to start Taxi trials (February 1999). It was another 2 years thereafter for first flight (January 2001) i.e., over five years between roll out and first flight. It was painful to hear recently the ADA Chief publicly mention that it took two years to increase the A o A by two degrees. With that kind of "spirit" we can forget first flight by 2025-27. Examining the taxi trials, it will be noted that sanctions kicked in 1998. Was the aircraft at "roll out" in 1995 incapable of taxying under its own power until at least mid-1998 whereafter the sanctions may have caused delays? A thousand percent improvement in the above timings and the willingness to bite the bullet is now required. Crash-less development, an excuse worn out with overuse, is barren if the product becomes obsolete during development.

Needing correction is also the poor kind of oversight, direction and advice provided by the "many hats" wearing bureaucrats and academicians "expert" committees which really should have full-time professionals from the Industry and the Services i.e., people with a real stake in the issue, in the driver's seat. What stake would an Academician or a Bureaucrat have when neither his promotion, posting nor pension would not be stopped if the project went into a tailspin. The generally realistic Indian Private Sector Industry expertise at the critical level was never sought.

Based on open-source information what I observe is alarming. Perhaps my disquiet is a case of the homely saying "Singed Cattle will start at the sight of vermillion-coloured clouds". It is already too late to correct the mistakes cited above, close monitoring by the Government and the IAF is now imperative if painful history is not to be exacerbated. The IAF cannot afford delays; it will, after making the right noises, import.

To put it in short: Worry is the Designer's best friend and it appears that ADA has not worried enough. If things go wrong and they will, we are in for a repeat of lengthy delays. Correcting mistakes on a prototype is time consuming. There was a need for real "Technology Demonstrators" before embarking on the AMCA. We have again missed that bus. The prototype may fly on time but development will be protracted because we have already courted some very avoidable risks. Now ADA needs to be very lucky.

Engines

The AMCA will be flown with the GE 414 but the desired engine will be a yet to be conceived engine of 125kN. This again

is of a pattern with the HF 24/ B.Or.12 and the Tejas/Kaveri and we know where they led to which is why I wondered about that clerk in the South Block! As a rough estimate the AMCA will need at least 85-90kN dry thrust from each engine. 85 kN dry is well above the "stretch" of the Kaveri or the 60/90 kN M 88 of the proposed collaborator. The full flowering of the AMCA therefore is subject to the successful development of the bigger new engine with foreign collaboration which will require major redesign of the fuselage. That is asking for trouble and delay!

Engine collaboration

It is a standard risk that the collaborator will use the collaboration to try out his riskiest ideas. He, irrespective of success or failure, gets the data and - if lucky- we get the product. If we are not lucky, we get a Saras- an interesting but fundamentally flawed configuration. Algorithms can perhaps be obtained from the collaborator but without caritas, without love, "know why" cannot be acquired

There is also the proclivity of GTRE, presumably the chosen Indian agency for collaboration, to jump from one incomplete project to another, GTX/Kaveri and its appetite for "big" projects rather than doing what is needed- e.g., ignore the relatively low budget Orpheus dry thrust improvement in the '60s to go on chasing technical butterflies of a fixed nozzle A/B of doubtful service value. Developing an A/B without first fixing the "upstream" dry thrust issue first was "cart before the horse" wasteful and showed a lack of "common sense" and connectedness between developer and user. This trait is observed in other projects also. Then there was GTX and Kaveri which were left to flounder half-baked. The Government pressure in the cold Kaveri and the Marine Kaveri is welcome and has to be kept up or it may be "picnic money" again from the new 121 kN engine programme because without developing the Kaveri to full satisfaction GTRE will not be "spiritually" ready to collaborate with Safran/RR.

How essential is super cruise?

The AMCA, thanks to its need for internal stowage of war load in stealth configuration, needs a much larger cross section and supersonic drag is a direct relation to the aircraft cross section. The physical explanation is simple. Above M.0.8 the wing and the fuselage cross section begins to act as a "piston" compressing the air ahead of it and gives rise to the so called "supersonic drag rise" when in addition to the usual drags- profile, induced, skin friction etc we get "wave drag" something to the tune of double even between Mach 0.8 and Mach 1.3. By knocking off the super cruise M 1.6 -M1.7 from the specifications the developed Kaveri can become a contender. "Aatma Nirbhar" weapons are the means of politics which the development team must keep in mind- it is his CPR as a chief designer.

The HF 24 could go supersonic M 1.05 on 20kN engines the AMCA will need 85-100 kN i.e. 400% more dry power to go 50% faster. Can "super cruise" to M 1.6 be degraded to allow the improved Kaveri as a contender? Focus on the Kaveri is a national need. If GTRE is too busy with advanced work -let a private sector consortium do the job with official funding. If we can get the Kaveri right, we will get the collaboration also right- if we still need it!

AMCA/Raptor/J20

Comparing the figures in the table 1 shows that the aircraft as specified is a reasonable one except perhaps the empty weight is "optimistic"- by about a ton. The lower specific fuel availability of the AMCA is to be noted. Should it come to a "dogfight" at low altitudes the AMCA should actually be slightly superior to the F 35 and the J 20. Without TVC, dog fight capability at altitude is zero. The "dog fight" ability of the J 20 at high altitude even with TVC would be quite poor. The greater length -some 4 mts-of the J 20 is noteworthy and the significantly greater fuel capacity indicates that the Chinese probably see the J 20 as a stealth "weapons carrier" intruder rather than a "dog fighter" which as a design approach is astute-even if it is Chinese! Incidentally the "radar signature" of the J 20 has come in for some derision but jubilation is unwarranted. Putting radar reflectors on the J 20s being observed by the IAF is exactly what Sun Tzu/ Dr. Fu Man Chu would do with a chuckle! Incidentally during their airshows in pre-covid times the Chinese ensured that the radar/IR and EM signatures were masked to the extent possible.

There is much "common sense" merit in the Chinese approach. They have based

their design on an existing TV engine which they (don't we?) have in production; they will work from a firm base. Our approach on the AMCA with two different engine types will require us to re-engineer the airframe substantially when the new engine comes along; not the best thing to happen when the airforce needs numbers.

Re- examining the specifications

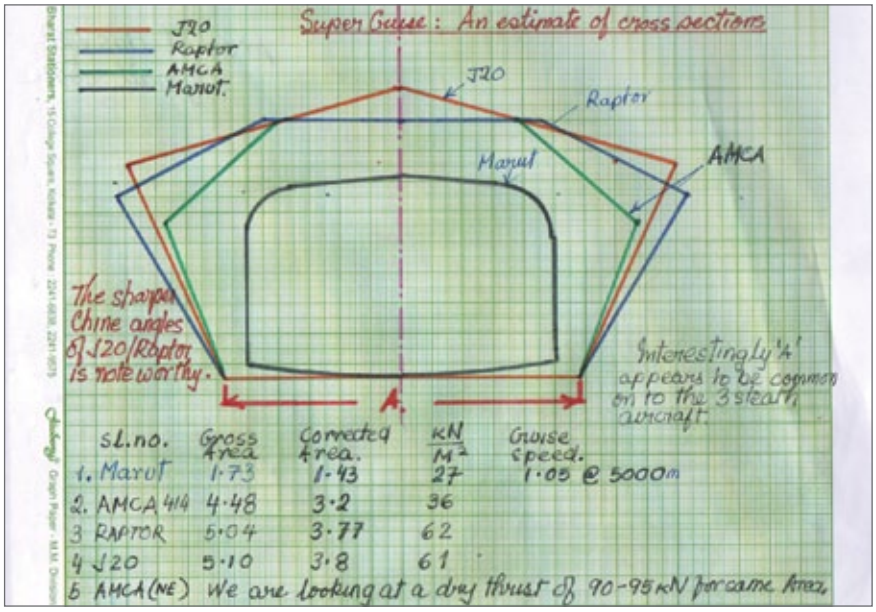
Do we really need the AMCA specifications of M 1.6 super cruise because without that we can use the Kaveri as a base; weapons are political tools! The Chinese and the US have those "specs" because they have the Technology. At this point we have neither the technology nor the need. Should we have a Raptor clone? The genesis of the requirements of the Raptor shows that it would be a case of overreach for our scenario.

It endorses my view that it is the Government that should spell out our political war aims along with anticipated time scales and only then will the Services release the weapons specifications. Specifications should be tied to the political situation; In the case of the F22/23 the collapse of the USSR in 1989 saw a prompt revision of the F 22 specifications. High altitude ceiling, field length restriction, STOL and significantly, Mach 2.5 top speed, were waived all of which significantly reduced the challenges of engineering development.

The Americans have a Global Strike Task Force (GSTF) comprising at one time around of 48 F 22As, 19 B2A Spirit and 56 B 52 bombers with necessary E3A surveillance aircraft along with associated tankers et cetera i.e., an aerial equivalent of the US Navy's Carrier Group. The scenario in which the Raptor is supposed to operate is in the opening phases of the war when flying at extreme altitudes about 18,000mts. i.e., well beyond the capabilities of SAMs (many types of which lose KE and become sluggish at high altitudes) and knock out the opposition's command and control centres. Once this air superiority is achieved the legacy weaponry and UAVs can the move in and destroy in detail. The F 22s specifications make sense only in context of an aggressive political scenario but it is also an expensive capability. Some of this capability is specified simply because the American Industry is capable of such tremendous abilities -never mind that their solutions are never cost effective.

Such capabilities of course come at horrendous cost and the planned procurement of Raptors declined from 750 to 560 to 322 to 280 to finally in 2005 to 189 aircraft. I give the figures to underline that the cutbacks were hard fought; The USAF surely wanted them- at least 379- but the aircraft was unaffordable -and quite possibly not quite so "developable"- even for the formidable US Industry. So where do we stand with realising our air power needs- especially without an insurance programme?

Our more pacific war aims- of defending home territory- requires us to neutralise the Raptor and the J 20s but not necessarily by dogfighting them. This can be achieved by a series of transportable low-cost ground-based systems and an aircraft much smaller and simpler than the AMCA. Specifications themselves do not win wars.



Speed (of development) is the need

There have been considerable self-congratulations about technology development and creating a technological ecology. That is not visible so far. We always overcame technological challenges. The real issue is timely development with honest certifying -no FOC X,Y, Z etc-and productionising within twenty years. The Raptor development programme went from start to end of production in twenty-six years. If the F 22 had "failed" they had the F 23! Note well the most effective and ROI conscious aircraft development businesses in the world has always taken the precaution that it is cheaper to have TWO contenders for development funding.

To rub it in, if this class of aircraft is so difficult to develop and so expensive to afford, what will be our own prospects? ADA's capabilities, even after forty years existence, is more hope than certainty - and there is no back up and the Air Force is in bad need of numbers? What "think tank" and of what "hands- on experience" planned it this way and who hangs if there is failure with timelines? The Government as the financier and the IAF as the customer and the full time Industry as the "carrier of the can" must own the systems not "many hat"-ed part time amateurs.

A recent DRDO monograph of the Tejas development recounts several incidents where appointed officials were reluctant to take responsibility and sign documents releasing the aircraft for the next step. Fortunately, there was always a dedicated someone else who stepped in. Unthinkable in the Private sector, the underlying lack of spirit is worrisome. Tackle the structural issues of leadership, the technology will take care of itself.

In Sum

Summing up: ADA in the AMCA design has not this time made any mistakes of the kind which any "School boy with the Observers Book of Aircraft" can point out but it has left too many loose ends; these will cause trouble, redesign and delay; brace and plan for it. The IAF and GOI must monitor the project closely and start a second project -may be with a different approach. The lack of an "insurance backup" project is going to be fatal for the IAF air strength and a

bonanza for the import lobby. That clerk has ensured that our private sector remains a lowly Cinderella to the DPSU/DRDO/DST sisters! By "stepchild" -ing the Private Sector we are at present using only the "socialist" half our capabilities and denying Aerospace the leadership and dynamism of the Private sector will provide.

The Tejas took us forty years. If from now on the AMCA progress equals that of the Raptor's it will be the same forty-one years as Tejas. We have to ask ourselves dispassionately what capability is it that we claim we have built which will deliver-without significant and professional correction- the future projects? More importantly how can we inject that vital still missing ingredient X – the "soft, instinctive engineering design skills" that we have not been able to create? My "A change of tack" in Vayu I/2013 discusses the need for small, innovative short term "people building" projects may be of interest.

For the AMCA team "We will show them" can be admirable as an attitude but it cannot be a plan. Now that we claim we have the technological base the Government/IAF has to see where the system repeatedly is going wrong in developing an aircraft to a time scale or accept that we are being dangerously complacent and look for "new think" solutions. Regarding the AMCA projects itself, the project is necessary but the warning lamps are on!

Notes:

1. The lighter projected weight of the AMCA vis a vis the smaller (smaller wing area, shorter single "engine" fuselage) of the F 35 is worrisome. The AMCA empty weight could be 1000kg-1300 kgs "optimistic".
2. The AMCA/414 should be able to super cruise at approx. M1.2-M1.3. That makes the Kaveri viable and only the development of TV is (perhaps) needed.
3. The F 414 variant will not super cruise at M 1.7 nor has TVC. The M88/ F 414's tongue will hang out much beyond 58/99 kN. against the 90 kN /121 kN needed. This would mean new technology which international manufacturers may not share with us or a reduced engine life in comparison with the M 88 or an engine 15% bigger. The present AMCA weight is doubtful even with F414. TV /Super cruise will need further weight increase of about 780 kilos. In sum, we are looking at significant re design for the 5 squadrons of super cruising AMCAs.
4. Without TVC the AMCA's high altitude dogfighting capabilities will be nil. With TVC the projected AMCA figures above will go out of the window.
5. The J 20 figure 12,000kg internal fuel even allowing for its much greater wetted area gives it a long reach. Despite its flaws the J20 is an interesting warplane if the tactics used are right. The alternate AMCA should explore the concept of a stealthy multi Brahmos carrying intruder rather than a fighter.
6. The sharper chine angles of the F 22 and J 20 is noteworthy and indicate lower radar signatures at 90/270 degrees azimuth. The other interesting point is the cross sections of the Raptor and the J 20 are pretty close to each other and co-relate to their respective engine diameters which I take as a possible index of the level of engineering proficiency/alleged espionage proficiency(!) the Chinese have achieved.
7. Readers may wish to read my earlier assessment "AMCA -Look before you Leap" in Vayu III/2015. This was subsequently nominated for the Bill Sweetman Prize-Ed. Issues of Vayu III/2010, V/2010, I/2015, V/2019 carry discussions on the LCA development process lacunae.

Table 1

SL.No.	Item	AMCA	J20	Raptor	F 35
1	Crew	1	1	1	1
2	Span	11.3	13.1	13.56	11
3	Length	17.6	21.2	18.90	15.7
4	Height	4.5	4.69	5.08	4.4
5	Wing Area	55	73	78.09	43
6	Weight We	12,000	18,000	19,000	13,290
7	Normal Weight	18,000	30,000	29140	22,471
8	MTO	25,000	35,000	38,000	37,151
9	Thrust	GE F 414 2x57.8 /97.9 2x 90(?)/121kN	Chengdu 2x106/161	P&W F 119 116/156	P&W F135 1x128/191
10	Int. Fuel	6500	12,000	8,200	8278
11	Fuel fraction (kg/ kN dry max thrust)	28.11	56.6	35.34	64.67
12	Aspect Ratio	2.32	2.35	2.354	2.81
13	Weapons bay (Length x Width X nos.) depth is suitable for 400 mm di munitions	2240x4000 (Ventral only)	6354x2363 (Ventral)+2x 3634x560 (side)	Ventral bay (4585x3275) + Side bays 2x3250x500	No information

The Ukraine/Russia conflict: an analysis on air warfare

RuAF MiG-35 (left, photo ROE) and Ukr AF Sukhoi Su-27 (right, photo Ukr AF)

Introduction:

Since the beginning of the invasion of Ukraine by Russia on 24 February 2022, so much has happened on the ground and in the air, but in the absence of significant reliable information, it is very difficult to separate propaganda from facts and reality. So far, in Western media, what we have seen is mostly Ukrainian propaganda/version, but in reality, very little is known about the actual situation, and both sides are pushing their information warfare capabilities to their limits.

After the beginning of the Russian invasion of Ukraine in late February, many articles appeared regarding the mystery of missing Russian Air Force and its inability to establish visible air superiority. So, in this article, I will briefly summarise the air war till end of June 2022 and highlight the problems and weaknesses of both Russian Aerospace Forces (VKS) and Ukrainian Air Force (UkrAF), and offer my personal opinion on why there is no such mystery. No loss estimates (either Russian or Ukrainian) can be mentioned since no reliable information regarding the same is available.

Brief History of Air War

February:

- 23 February: intelligence, surveillance and reconnaissance flights by 10-12 VKS Su-24MRs.
- 24 February: about 120 Russian cruise and ballistic missile strikes against Ukrainian air defences, air bases and other targets; about 100 VKS fixed-wing sorties and SEAD missions using Kh-31P-series anti-radiation missiles; P-14 VHF early warning radar chain near Mariupol destroyed; Ukrainian S-300Ps largely destroyed; high Russian helicopter and aircraft losses.
- 25 February: UkrAF Su-27 shot down over Kiev by a Russian S-400 battery deployed in Belarus from a distance of more than 100 km; salvos of Russian cruise and ballistic missiles continue.
- 26 February - 28 February: UkrAF low-level defensive counter-air and ground-attack sorties continue; Russian cruise and ballistic missile barrages increase.

March:

- 1 March - 10 March: VKS sorties increase to about 200 per day; no UkrAF air base fully operational.
- 11 March – 20 March: VKS sorties decrease to about 120 per day; VKS shifts to medium altitude operations wherever possible; Russian cruise and ballistic missile strikes continue; UkrAF starts to operate from dispersed and improvised locations.
- 21 March – 31 March: VKS sorties average between 200 to 300 per day; first use of hypersonic Kh-47M2 Kinzhal missile.

April:

- VKS sorties between 100 to 200 per day; Russian cruise and ballistic missile

strikes continue; Ukraine receives S-300 from Slovakia, Starstreak MANPADS from the UK and 11 Mi-17s.

May-June:

- VKS employs Su-57s in Ukraine; Ukraine declares all airports and airbases inoperable.

July-August:

- Russian Su-34 shot down over Luhansk in a friendly-fire incident.
- Ukrainian and North Macedonian media report transfer of four North Macedonian Su-25s to Ukraine, but no official confirmation from either Ukraine or North Macedonia.
- US announces six additional NASAMS air defence systems for Ukraine; UkrAF MiG-29s begin firing AGM-88 High-Speed Anti-Radiation Missiles supplied by the US.

Decoding the mystery of missing Russian Air Force

As stated earlier, in my personal opinion, there is no mystery. To understand why this is the case, it is imperative to understand the different doctrine of US/NATO and Russian air forces.

US/NATO Doctrine: US and NATO forces approach any campaign in a systematic way with the objective of first conducting counter-aviation and suppression of enemy air defence (SEAD) missions to acquire air superiority and destroy/degrade opponent's ability to interfere with air and ground operations. The next stage involves projecting air power on ground and naval targets, and providing close air support (CAS) and intelligence, surveillance and reconnaissance (ISR) to ground forces. This was clearly observed in multiple conflicts such as Operation Desert Storm in 1991, invasion of Iraq in 2003 and military intervention in Libya in 2011.

The Western analysts had expected the Russian Aerospace Forces (VKS) to conduct the air campaign in Ukraine in a similar way. The entire VKS was expected to surge and commit most of its assets in the destruction of UkrAF air assets and air-defence systems by flying about 500-1000 sorties per day for about a week. This, obviously, did not happen.

Russian Doctrine: The Russian air doctrine today is defensive in nature. It has shifted to accept the idea that it may not control the airspace it's fighting in. The Russians obviously realise the importance of air superiority, although, the Soviets and then Russians have been training to fight without air superiority since the 1960s. The primary objective of the Russian air doctrine is to deter or impede the opponent's air force's ability to interfere with Russian military operations, and conduct airstrikes in support their own ground forces. As such, the Russians place heavy emphasis on long-range air defence systems and their integrated air defence systems (IADS) to dominate the opponent's airspace.

In the beginning of the invasion, the VKS conducted several counter-aviation strikes, ground strikes and SEAD missions that severely damaged Ukrainian air defences, air bases and UkrAF's fighter jet fleet. All this happened with minimal risks from the VKS, as almost every target in the west of Ukraine was left to cruise and ballistic missile strikes. The VKS shied away from long-range penetration and strike missions. The Ukrainian air defences which survived went into hiding. Since the air bases were left inoperable, UkrAF resorted to operating from dispersed, improvised and austere airfields in occasional surges. However, the UkrAF still has fighter jets, trained pilots and weapons, but the fighter jets are probably poorly maintained and in dire need of spares, weapons and logistics. It becomes a particularly dangerous proposition for the UkrAF if and when its pilots undertake strike missions for some high-value targets, due to the dense Russian air defence cover in the east and the south. The Russians suffered bad loss/sortie ratio due to clever Ukrainian air defence tactics and employment of man-portable air defence systems (MANPADS) in large numbers.

Several Western military analysts have debated why the VKS has failed to achieve air superiority in Ukraine. However, in my personal opinion, the VKS established air superiority over Ukraine within the first couple of weeks. There are several reasons for this conclusion. First, the average daily sorties for the VKS are about 200-300 per day while that for UkrAF is about 5-30 per day. Second, the famous 40-mile-long "traffic jam" of Russian military vehicles north of Kiev (which many Western analysts speculated was bogged down due to logistics) was not bombed by the UkrAF. This was a particularly high-value target. Third, the Kerch Strait Bridge separating the Sea of Azov from the Black Sea which was the only supply line for the Russian forces in southern Ukraine during the initial phases of the war was also not bombed. No surge in UkrAF was reported during these two events. Fourth, since the beginning of the war, Ukrainian government's main demands were for fighter jets, air defence systems and no-fly zone over Ukraine, and repeated requests were made for the same.

RuAF Sukhoi's (photo: ROE) and Ukr AF Su-25 (photo: ITAR-TASS/EPA/Sergey Popsuevich)

The obvious question is why such requests were made when adversary's air superiority is not the primary concern.

So, to conclude, the VKS did what it was supposed to do. The VKS effectively suppressed the Ukrainian air defences, severely degraded the capability of UkrAF to the extent that it is unable to undertake sorties without considerable risks, and the VKS enjoys air superiority over eastern and southern Ukraine. They did not achieve this in the Western way, but in the Russian way.

Russian Aerospace Forces Problems

Although the VKS has much more numerous and modern aircraft, weapon and equipment than the UkrAF, still it suffers from several important issues that have definitely inflicted a toll on its performance in Ukraine. Some of these are listed below.

1. **Training:** The training received by the VKS fighter crews is limited when compared to their NATO counterparts. While actual numbers across various units is hard to find, Russian official documents suggest an average of 100-120 hours per years for the VKS as a whole. Transport and helicopter units tend to have higher flying hours compared to fighter units, the estimated flying hours per year for fighter units should be less than 100. Most VKS training sorties involves operating in uninspiring environments and simple tasks such as navigation flights, unguided munitions delivery at open ranges and flying in coordination with ground-based air defence systems. Russia also lacks complex large scale air exercises with realistic threat simulations such as the Red Flag. Russian pilots also have fewer and less sophisticated simulators than their NATO counterparts which limits their ability to practice complex missions in complex scenarios. On the contrary, NATO fighter pilots fly upwards of 200 hours per year. They have access to modern simulator facilities and are rigorously trained to fly complex missions in challenging environments, against both ground and aerial targets. On the positive side, pilot/cockpit ratio in the VKS is better on average, leading to more combat sorties per aircraft.
2. **Limited stockpiles of PGMs:** The quantities of air-delivered precision-guided munitions available to most VKS fighter units is very limited. During combat operations over Syria, only Su-34s regularly used PGMs, but also frequently used unguided bombs and rockets. Extensive combat operations in Syria should have further depleted the already limited PGM stockpiles, unless replenishment orders were placed. Most VKS units also have little familiarity in using PGMs, although Su-34 crews are usually better trained. Today, NATO air forces almost exclusively use guided ordnance.
3. **Lack of targeting pods:** In the absence of targeting pods capable of laser designation or similar internal system, laser-guided bombs can only be precisely dropped on targets designated via "buddy-lasing" from another aircraft, drone or ground forces. Also, missiles with IR/TV/EO seekers need to be manually slewed on to the targets from the cockpit, and the seeker has to be itself used for target recognition and designation. The problem is that these seeker heads are unable to rotate freely like the sensor ball on a targeting pod and have a much lower resolution, range and field-of-view when compared to a modern targeting pod. The lack of a modern targeting pod restricts the effective employment of guided munitions in complex combat environments and generates a much higher pilot workload. The quality and reliability of exiting targeting systems in service with the VKS is also questionable. For instance, the Su-34 features an internal and retractable EO/IR targeting system with laser designation capabilities known as Platan, but with lower resolution and field-of-view. However, modernised Su-34Ms will also feature an external modern targeting pod, which casts some doubts on the reliability of the Platan system. Russia's newest fifth-generation fighter, the Su-57, also features an external modern navigation and targeting pod, designated as 101KS-N. However, Russian targeting systems for unguided weapons are believed to be better than their Western equivalents.
4. **Complex strike packages:** The VKS conducts most of its training flights in single, pairs or occasionally four-ship formations. It is very possible that its operational commanders have very little experience in planning, executing and coordinating complex air operations in complex high threat environments. These packages come nowhere near to complex strike packages of NATO air forces which routinely involve SEAD units, air-to-air and strike packages. The VKS strike missions are usually preceded just by a combat air patrol (CAP). Another problem with the VKS is the lack of coordination with ground-based air defences. This was well-documented in Russian military literature before the war and numerous cases of simulated friendly-fire were observed. Running joint engagement zones in which combat aircraft and ground-based air defences can effectively engage enemy aircrafts simultaneously in complex high threat environments without friendly-fire is an incredibly difficult task, and requires excellent coordination and regular training to master.
5. **Lack of specialised SEAD units:** The VKS has modern anti-radiation missiles (ARM) for SEAD missions like the Kh-31P and Kh-58USh, and its Su-35S and Su-30SM fighters have been regularly using Kh-31-series ARMs to conduct SEAD missions in Ukraine. However, the absence of specialised SEAD units, like those in the United States Air Force, has probably resulted in greater losses for the VKS. Specialised SEAD units could have completed the job of destroying Ukrainian air defences quickly and with fewer losses.
6. **Limitations in ISR:** The VKS has fairly limited numbers of intelligence, surveillance and reconnaissance (ISR) platforms in its inventory. Due to their high value, these generally operate from very large standoff distances. Battle damage assessment is designated to Su-24MRs or to reconnaissance satellites.
7. **Limitations in close air support:** Close air support is a highly complex and technically demanding mission which requires rigorous training and deep knowledge of air-to-ground ordnance, delivery profiles and procedures. Due to limited training, lack of PGMs and modern targeting systems, it is likely that proficiency of majority of pilots in VKS in executing close air support is fairly low. Also, due to attrition of several units on the frontlines, the distribution of Joint Terminal Attack

A variety of RuAF helicopters seen here at MAKS

Controllers (JTACs) is presumably very uneven, further complicating CAS missions.

Ukrainian Air Force Problems

Several of the problems discussed above such as training, limited stockpiles of PGMs, lack of modern targeting pods and specialised SEAD units, limitations in ISR and little training in executing complex missions also apply to the UkrAF, even more so than the VKS. The other problems facing the UkrAF are as follows:

1. **Technology:** The combat aircraft used by the UkrAF are still technologically obsolete, and haven't improved significantly since the Soviet era. In contrast, the VKS operates same combat jets, but in highly upgraded form.
2. **Logistics:** Ukraine's domestic defence industrial base, which was quite critical in maintaining and servicing UkrAF's entire fleet of fixed-wing and helicopter assets has already been destroyed by Russia, and this has been publicly admitted by Government of Ukraine. It is now extremely difficult for the UkrAF to arrange spares and other logistics for their assets.

What can be done to help the Ukrainian Air Force?

This is a complicated question, and bears no straightforward answer. Since Russia has already destroyed Ukraine's defence industrial base, so, without any external help, UkrAF has practically no options.

With external help, several things can be done. However, the extent of aid received from other nations will be significantly influenced by geopolitical conditions, industrial capacity and their own national security demands. So, here, only available options will be discussed without diving into geopolitics and national security requirements of a potential donor, as how the national security apparatus of any nation thinks is beyond prediction.

It can be argued that Ukraine's most urgent requirements are for ground-based air defence systems, with medium or higher altitude launch envelope and high mobility. These systems should most preferably be of Soviet origin, especially the types that Ukrainian military already has/had, and has trained personnel for immediate use. Highly mobile ground-based SAMs are significantly harder to defeat, and thus are far more survivable than their static counterparts. The best options include the following:

- **S-300P:** S-300P is one of the older iterations of the S-300 long-range SAM family, and one of the most capable air defence systems in service with Ukraine. Earlier variants of S-300P, designated as S-300PT and S-300PS, were also operated by Ukraine. Within NATO, Bulgaria owns one complete S-300PMU system. Greece has 12 S-300PMU-1 systems, an improved variant of the S-300PMU, which features an upgraded 30N6E and can launch 48N6 interceptors (with maximum range between 90 and 150 miles). Slovakia also transferred its only S-300PMU system to Ukraine. Russia claimed this system was destroyed before it became operational, however, this was rejected by Slovakia.
- **S-125:** The S-125 Pechora is a medium-altitude SAM system, which entered Soviet service in the 1960s. Despite its age, it still remains an effective system and it was this system that shot down the famous stealth Lockheed F-117 Nighthawk attack aircraft during Kosovo war in 1999. The downside is that the S-125 uses static launchers, and thus is not optimised for mobility. Ukraine had previously operated these systems, but Ukrainian military was seen training with them as recently as 2020. Within NATO, only Poland and Bulgaria still operate these systems, in upgraded iterations.
- **Buk-M1:** The 9K37M1 Buk-M1 is a medium-range SAM system with a maximum engagement range of 22 miles and altitude of 45,000 feet. Coupled with its high mobility, this system is one of the best options for Ukraine. The system has already been extensively used by both Russia and Ukraine in the war. No NATO country presently has these systems, although Finland previously operated these systems.
- **Tor:** The 9K330 Tor is a short-range SAM system with a maximum engagement altitude up to 20,000 feet and high mobility. Within NATO, Greece is the lone operator of this system.
- **Osa:** The 9K33 Osa is also a short-range air defence system with a maximum range between 7 to 10 miles, and a maximum engagement altitude of 40,000 feet. Despite its age, Osa is still an effective system and within NATO, it is operated by Greece, Poland, Romania and Bulgaria.
- **Strela:** The 9K35 Strela-10 and 9K31 Strela-1 can still be useful for Ukraine to a lesser extent. Many NATO nations still field or have fielded these systems including Hungary, Bulgaria, the Czech Republic, Croatia, Poland and Slovakia.

The United States also owns the limited stocks of almost all the air defence systems mentioned above through its Foreign Materials Exploitation (FME) programmes. The US can also provide these systems and their spares to Ukraine, however, doing so will amount to a critical training capability degradation for the US, as these systems are often used during major training exercises such as Red Flag.

Another option for the UkrAF is to procure similar aircraft (MiG-29s/Su-25s/Su-27s) and/or their spares and weapons from other operators. No country with NATO or the European Union operates Su-27s, so acquiring additional Su-27s for Ukraine is simply not an option. As for MiG-29s, Bulgaria, Slovakia and Poland operate MiG-29 variants. While the Bulgarian MiG-29s are slightly upgraded, those operated by Poland and Slovakia have been deeply upgraded since the fall of the Soviet Union. Bulgaria also operates Su-25 ground attack aircraft. Bulgaria, Slovakia and Poland are already in the process of replacing their MiG-29 fleets. Poland is due to receive its first F-35A stealth aircraft in 2024, whereas Bulgaria and Slovakia will begin inducting their F-16 Block 70/72 jets from 2025 and 2023 respectively. Any degradation in air defence capabilities from the transfer of these jets can be easily attenuated by requesting other NATO allies to guard their airspace as a stopgap measure until new jets are delivered.

MiG-21s could also be a potential option, as within NATO, Croatia and Romania also operate highly upgraded variants of MiG-21. The Croatian Air Force has already ordered 12 Dassault Rafale F3R variants to replace its MiG-21 fleet. Romania, on the other hand, has about 20-30 aircraft in its MiG-21 LanceR fleet. The MiG-21 LanceR-Cs are single-seat versions optimized for air superiority whereas MiG-21 LanceR-Bs are two-seat trainers. These MiG-21 variants are upgraded with Israeli avionics, similar to those found in a 4th generation fighter aircraft. Other upgrades include a new cockpit with hands-on-throttle-and-stick (HOTAS), heads-up display, multi-function displays, upgraded radios, modern mission computer, helmet mounted display, hybrid GPS-INS navigation system and a defensive aid suite. The MiG-21 LanceR-Cs also feature the Elta EL/M-2023 multi-mode pulse-doppler radar and Elta EL/L-8222 self-protection jammer. They also have the ability to employ western PGMs using Israeli LITENING targeting pods. When it comes to aerial combat, these MiG-21s can employ R-60, R-73 and Python-3 missiles, and also retain the option to integrate beyond-visual range missiles. MiG-21 is not a complicated machine to fly, and for Ukrainian pilots, this might be even easier due to prior experience in Soviet combat jets. Romanian MiG-21s have suffered a spate of crashes, so much so that the Romanian Air Force grounded them indefinitely in hopes of replacing them with second-hand Norwegian F-16s. So, Romania might even be tempted to dispose of its MiG-21s. However, Romania ordered them back in service due to delays in Norwegian F-16s delivery. Many people may consider MiG-21s to be an outdated fighter, and in some aspects it is. It is definitely not comparable to a true 4th generation fighter aircraft, but with the upgrades mentioned above, is a capable adversary.

The UkrAF should also seriously consider procuring a Western 4.5/5th generation fighter aircraft, but it will take years for the aircraft to become fully operational.

It should also be noted that NATO nations are also supplying Ukraine with Western air defence systems. The US is providing Ukraine with National Advanced Surface-to-Air Missile System (NASAMS), which can engage aircraft, drones, helicopters and low-flying cruise missiles. NASAMS can be deployed in a distributed configuration using the Fire Distribution Centre (FDC), which enables the system to continue operating if one or more nodes gets destroyed, or goes offline, making it much more resilient to SEAD missions. NASAMS also has the option of passive engagement of targets via its EO/IR sensor. The sensor also enables visual identification and kill assessment. NASAMS 2 employs the surface-launched variant of AIM-120 AMRAAM air-to-air missile, whereas the latest NASAMS 3 uses the improved AMRAAM-ER missile, which is just an AIM-120-C7 AMRAAM fitted with another motor for extended range. The NASAMS 3 can also fire the infrared-guided AIM-9X Sidewinder, primarily for intercepting cruise missiles.

Germany has also promised to deliver IRIS-T SL air defence system to Ukraine. This system uses the surface-launched variant of the highly manoeuvrable IRIS-T air-to-air missile. The system uses a multifunction radar and data link to guide the missile to its target. In the terminal phase of the engagement, due to its imaging infrared seeker, the missile cannot be jammed or decoyed by chaffs and flares. As an extended luxury, the IRIS-T SL missiles can also be integrated with NASAMS 3 launchers. Since these are entirely new systems for

Russian missile types on demonstration

Ukraine's Armed Forces, the time required for training and operational deployment is unclear.

The US has also supplied UkrAF with AGM-88 High-Speed Anti-Radiation Missiles, or HARMs, and it was confirmed that UkrAF MiG-29s are employing them in combat against Russian radars at the frontlines. The exact variant of the missile supplied by the US is unclear, but AGM-88s primarily feature three modes of operation – self-protect mode, target of opportunity mode and pre-briefed mode. Self-protect and target of opportunity modes require full compatibility and integration with the aircraft's avionics and electronic support measures, and since UkrAF MiG-29s date back to the Soviet-era and lack the necessary interfaces and data bus architectures, there remains a high possibility the UkrAF is unable to utilise the full capability of the missile. In the pre-briefed mode, the missile is pre-programmed with the coordinates of the hostile radar site, and once the fighter aircraft reaches a particular altitude and speed, the missile is launched. The missile navigates towards the coordinates and then the missile's passive seeker autonomously searches and locks the radar. Even if only this mode can be used with UkrAF MiG-29s, with precise targeting information supplied by NATO, the AGM-88 remain a very potent threat to Russian radars.

Guided bombs are good, but free fall munitions are better

As discussed earlier, the quality of targeting systems in the VKS for unguided munitions is better as compared to Western equivalents. The VKS uses the SVP-24 blind bombing system, which is an assembly of several subsystems designed to implement a highly sophisticated continuously computed release point (CCRP) system. The SVP-24 can be integrated with the aircraft's sensors such as radar, infrared or TV to designate a target. Targets can also be designated in real time by another aircraft or forward air controllers via a data link and the process is entirely automated and does not necessitate any input from the pilots. The system integrates satellite navigation (GLONASS) and aircraft's kinematics to receive precise position updates about the targets and aircraft. The parameters, such as wind, temperature, humidity and target's speed and direction, can also be updated via a ground controller. The computer processes these parameters and calculates the optimal trajectory for bombing (such as level bombing, toss bombing, etc), however, the final decision is left for the pilots. Once the aircraft has arrived at the release point, the system automatically authorises ordnance release.

The SVP-24 was first tested under combat conditions in Syria. Unconfirmed reports suggested at the time that the system achieved a CEP of 13m while another unconfirmed report stated the system scored a direct hit on a tank using unguided munitions. These claims appear to be exaggerated, since unguided bombs have a minor lateral velocity component on separation from aircraft's pylons, and the impact of wind on the released payload is very difficult to estimate. Free fall bombs are always expected to have dispersion. A more realistic estimate of the CEP is around 20-25m during level flight at medium altitudes, which was frequently observed during Russian bombings in Syria.

A system like the SVP-24 drastically reduces the requirement of large stocks of PGMs, as PGMs can be reserved for strikes where extreme precision is required, such as a CEP of 10m or less, or where collateral damage is a concern.

Article by Pushpan
Twitter: The Covert Brigade (@BrigadeCovert)
All photos: MAKS-PR and Rosoboronexport/ ROE except where mentioned

An ode to the PT-76

By Maj Gen (Retd) PK Batra

One often reads statements like "It a man behind the gun or its man behind the machine which matters". There is no gain saying that gun/machine is man's creation. Out of curiosity, I decided to check what a soldier feel about the weapon/ weapon system he handles in war. I met a few infantry soldiers who had participated in the '71 War. Most of them became nostalgic about their weapons and said, "If I am alive today I owe it to my rifle/ LMG or weapon" he/they were handling. When they prayed they kept their weapon with them. In nut shell the soldier and his personal weapon became one - complimenting each other. They became very emotional about their weapon and it is sad that their weapon can't reciprocate their feelings.

Since my Regiment 45 Cavalry had taken part in the '71 war in Bangladesh with PT-76 tanks, I decided to get some details about this tank. The PT 76 made its debut in Indian Armoured Corps in Aug '65 with 7 Cavalry, one of the finest Cavalry Regiments. Before conversion, training and even zeroing the tank was launched into the battlefield in '65 war against Pakistan. This Goliath had not been seen by its own troops and the enemy and came as a surprise. With little armour protection (being an amphibious tank) it could not match the Davids in the form of Sherman's and Pattons and had to be withdrawn. I lost a dear friend my coursemate. PT 76 was basically designed by Russians in 1950 for operations in Europe to cross water channels with impunity. A few countries acquired them for its amphibious capabilitiy. PT 76 won its spurs in Vietnam against Americans. Its main gun has a limited range and no night firing capability. Driving requires skill with its inner reduction gear system which has three positions: land, land and water and water. To change from one to other requires experience and skill. Being light weight with little armour protection, and ground pressure it was ideal for terrain obtaining in Bangladesh. However, it was introduced into Indian Army and three Armoured Regiments were converted to PT 76, with one Independent Squadron of 7 Cav and one of 63 Cav.

I thought I will share my personal experience of handling this tank during '71 Ops in Bangladesh. I spent 31 days in my tank, No.UX 1144.

It had become my second home and part of me. I remember vividly my tank crews would pray and put a bit of "samagri" on the tank gun every morning–incidentally it was a homogeneous crew of Hindu, Muslim and Christian, they were one in their prayers. We went through many rivers, marshy areas, wooded terrain and the tanks never failed us. We crossed many rivers and other water obstacles. The acid test of man and machine was crossing of Madhumati River on a pitch dark night right under the enemy's nose. The river was 500 yds wide, water depth of 10 to 15 feet and water current of 4 to 5 knots. It is in such moments where life and death success or failure can be a decisive factor in war. As I drove the leading tank into the choppy river with silent prayer on my lips, my tank did not fail us. Crew faith in their machine and their own ability results in success. Earlier in battles a few tanks went on mines but did not suffer serious casualties. With each passing day subjected to artillery shelling, SA fire the confidence in our tanks kept going up. We covered over 700 kms of operational mileage. My Squadron took part in four actions at Div level, five at Brigade level and six at Bn level and established three road blocks including one 23 kms deep inside enemy territory. I attribute this success to both man and machine. Faith and confidence in machine/weapon and self is very important to achieve success. I vividly remember after each action we touched our tank with both hands as sign of gratitude to thank for protecting us.

It reminded me of our NDA days when at the end of our riding class the "Ustaad" used to say "Make march your horses" and we patted our horses as acknowledgement of thanks. I spoke to many crews, all echoed same view of faith in their equipment and their own ability. I feel the credit must go both to man and machine. In the end I will say PT 76 which as a tank knocked off Pak Chaffees -- a superior tank off the battle field in Garibpur, provided effective fire support to infantry, proved its worth in amphibious role and used its fire power, mobility and shock action to the hilt. PT was a beauty and when required a beast. An unsung Hero of '71 war in Bangladesh. Thank you Plavushi Tanka we will miss you.

(All images for representational purposes only)

Dr. Kandarpa Kumar Sarma writes on

Warfare with Artificial Intelligence (AI) and how the IDF leads the rest

(Images: US Dept of Defence)

Oblivious to all the political controversies around the conflict in Gaza, technology has written a new chapter in the history of warfare. Artificial Intelligence (AI) has made a significant impact in the execution of operations in the battlefield and that too in direct aid of combat missions. Israeli Defence Forces (IDF) for the first time directly used AI in the 11 days of fighting in the Gaza Strip during May 2021 to reduce collateral damage, enhance precision strikes and make overall war-fighting effective in congested spaces.

Ever since the mid-1950s when AI received recognition as a formal and independent discipline, it has made spectacular strides in every sphere of human activity. Lately, AI has been attributed to have started the fourth industrial revolution. Naturally, warfare cannot remain ignorant or stay isolated without the influence of AI.

Most of the applications of AI in warfare till now have been concentrated in the domains of material management, training, strategic modelling, equipment health monitoring, optimal utility of electronic resources, developing threat perception, processing support in case of targeting, tactical scenario visualization etc. Several professional militaries including Indian forces have given high priority to AI and have accepted it to be a disruptive technology in the area of war-fighting. In tune with such vision, leading military forces have developed and deployed techniques and tactics to execute combat operations with the help of AI.

All such efforts of considering AI as a real-time element of war-fighting have not been demonstrated in the battlefield until the IDF used it for a range of combat operations which have yielded remarkable outcomes. The key attribute of the Israeli effort has been to install and execute a centralised AI aided mechanism to keep an eye on the emerging threats, identify the nature of threats, provide targeting solutions and set priority that too in real-time and share the knowledge with combat units deployed in the forward edge of the battlefield. The centralised system has been collecting details of information of all the radical elements operating in the Gaza strip and the facts pertaining to their offensive capability and simulated unpleasant scenarios that these could create and suggested counter-measures.

The IDF used signal intelligence (SIGINT), visual intelligence (VISINT), human intelligence (HUMINT), geographical intelligence (GEOINT) and raw data to train AI based mechanisms called "Alchemist," "Gospel" and "Depth of Wisdom," and deployed these to help the frontline troops. The Alchemist system provided forewarning to ground troops regarding impending attacks by the radical forces. The prediction was passed on to the formation commanders who shared these with all soldiers in ground units with details presented in handheld tablets resulting it enhanced situational awareness.

The Gospel system was used to provide target details and evolving scenarios to the IDF Air Force enabling it to hit locations with very little collateral damage. Location and movement of missile launchers aimed at Tel Aviv and Jerusalem, rocket strikes, manufacturing and storage sites, intelligence offices, drones, commanders'

residences and naval resources all were selected, identified, tracked and targeted in real-time. This system received inputs from satellites, drones, SIGINT and HUMINT resources and used big data analytics to map with highest precision hundreds of kilometres of the underground tunnel used by the radicals and destroy it with accurate air strikes.

The precise mapping of the tunnel presented visual representations to the unit commanders and the combat aircraft with such reliability that gauzing the depth, nature of material used for construction, strength of the concrete structure, surrounding environment both under and over ground including habitation etc became crystal clear for which weapon aiming and launching turned out to be near error free. This ability of the AI aided Gospel system nullified the effectiveness of the stealth and surprize of the radicals which they had been using effectively against Israel. The entire tunnel system extending over hundreds of kilometres collapsed due to the relentless precision strikes.

In several cases when specific radical commanders were targeted while they were hiding under the tunnel system, there were no civilian casualties, damages to surrounding residential blocks, schools etc. For smooth coordination of these efforts, a multi-disciplinary centre was set-up by the IDF and it deployed the Depth of Wisdom shield to integrate AI with military operations and connecting it with the Iron-Dome deployed for protecting Israel. The heart of the all-weather Iron-Dome is the Elta EL/M 2084 radar which along with the battlefield management block and the Tamir interceptor units can shoot down rockets, artillery shells, missiles, drones etc between 4 to 70 km.

The Iron-Dome also receives AI aided target location, identification and tracking details enabling it to monitor an airspace of several hundred kilometres, detect atleast 100 hostile launches and simultaneously identify and attack 20 at a time. This count of 20 depends upon the number of interceptors connected at a given point of time. While over 90% of the 4000 rockets fired at Israel were shot down by the Iron-Dome, it can identify the intended strike spot of a hostile rocket and thereby prevent the unnecessary launching of the expansive Tamir interceptor if a projectile is likely to fall in an uninhabited area.

AI helped IDF not to suffer from the war of attrition which the radicals from Gaza strip started with the relentless barrage of rocket fire. Israel found it very difficult to accept the cost of a USD 50,000 Tamir interceptor shooting down an unguided rocket valued at less than one tenth that price. The targeting of the rocket launchers and the tunnel system by the combat aircraft with the help of AI driven Gospel system nullified the effectiveness of the war of attrition. For the IDF, AI made the war effort effective, less damaging and shortened the path and time to achieve the outlined objectives.

This successful employment of AI in war-fighting has been an outcome of efforts undertaken as part of the IDF Strategy Development of the AI aided tools for IDF has been a national effort coordinated by the Directorate of Defence Research and Development (MAFAT) in the Ministry of Defence with active support from military and security agencies, private sector, veterans and related stake-holders. Since the `Momentum' plan required multi-domain force integration, a Digital Transformation Administration was set-up within the Intelligence Directorate as one of the facilitator mechanisms. Further, agencies like Multi-Branch Force Build-up Directorate and Warfare Methods and Innovation Division "Shiloah" were assigned to formulated plans and execution strategies for multi-domain planning, target information gathering, analysis, interpretation and operational employment of AI.

The benefits derived from such visionary effort has been many. First, due to the employment of AI, analysis of continuously growing intelligence data became smooth which enhanced situational awareness to unprecedented levels. Battlefield related contents when combined with previously collected crowd sourced data, enabled operational forces to derive relevant details about imminent threats, select and destroy targets with unmatched precision. Next, AI allowed scalability of decision making connecting the highest ranking officials, planers, stake-holders and the unit level assets to derive the most viable solutions while handling critical situations. Furthermore, true network centric operations facilitated by AI aided analytics enabled accurate threat assessment and deployment of appropriate counter measures which resulted in reduced losses and collateral damages.

In the near future, AI with swarm of drones will usher in an era of warfare where the mastery of these disruptive technologies will ensure defeat and victory. Countries with strong foundations of science, technology and manufacturing will find it easier to shift to this new paradigm of war-fighting.

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The drone swarm demonstration on Indian Army Day 2021 (Images PTI and Army PRO)

VAYU Interview with

Air Chief Marshal Vivek Ram Chaudhari, Chief of the Air Staff, Indian Air Force

VAYU : There is a lot of confusion on whether the IAF will go in for the LCA Mk.2 or MRFA. Are they separate programmes or will the IAF go in for both types?

CAS: LCA Mk 2 and MRFA are separate programmes and IAF plans to induct both these fighter aircraft in a phased manner. The differences in the two plans are as explained below: -

(a) **LCA Mk 2:** LCA Mk 2 is a more capable and potent variant of the indigenous Tejas fighter aircraft (LCA). The IAF's Qualitative Requirements have been handed over to ADA for the LCA Mk 2, the induction of which is likely to commence from 2030 onwards. On 31 August 2022, CCS has approved the D&D of the LCA Mk 2 programme. Initially, the IAF plans to place an order for six Sqns of the LCA Mk 2.

(b) **MRFA:** IAF plans to induct six squadrons of MRFA in a phased manner. It is studying the responses to the RFI issued in April 2018. The Air Staff Qualitative Requirements for the current proposal are being finalised prior to seeking Govt approval. The programme would be progressed under the 'Make in India' initiative of DAP-2020, with a focus on a substantial transfer of key technologies to an Indian Production Partner.

VAYU: Can you update us on the current UAV status: are the current ones operated by the IAF being upgraded and what are the acquisition programmes across UAV platforms, ie, small, large, MALE/HALE, loitering munitions etc?

CAS: The IAF has prepared a roadmap for induction of RPAs to meet both the short term and long term operational requirements by addressing the limitations of the existing RPAs. The plan includes various types of RPA systems ranging from Small Drones and Counter Drone systems to the MALE and HALE class of RPAs, including those having an offensive capability.

Su-30MKIs and C-130J Hercules

Upgrade of a select fleet of UAVs to possess a weapon capability is being progressed, the case for which is at an advanced stage.

Efforts are being made to indigenously design and develop RPAs to meet the stated requirement. Work is also on for the development of armed Drone technology by DRDO. As far as Loitering Munitions are concerned, we are working with many companies in the private sector and have seen good progress.


MiG-29s and MiG-21s


LCA Tejas


Rafale and Su-30MKI


SKAT Team with Hawk Mk.132s


Sarang Team with Dhruv ALHs

VAYU: Can you tell us about the IAF involvement with the AMCA?

CAS: IAF has had and continues to have extensive collaboration with the DRDO. The operational experience of the IAF has contributed immensely to the successful development of indigenous platforms. The service has also supported DRDO in the resolution of issues arising in development, flight testing of aircraft, etc.

The draft Preliminary Services Qualitative Requirements (PSQR) have been forwarded and DRDO has undertaken comprehensive design studies on the project. The detailed design has also been reviewed by the IAF. The IAF will also be fully involved in design iteration, flight testing and programme management. Induction of AMCA is likely to commence from 2035 onwards.

VAYU: On the helicopter front, can you update us on potential Chinook/Apache further orders as well as the status of the LCH and IMRH programmes?

CAS: Presently, the IAF does not plan to induct more Apache and Chinook helicopters and is focussing on inducting indigenously developed helicopters.

A contract for 10 x LCH Limited Series Production (LSP) was signed with HAL on 30 March 2022. Training for aircrew and ground crew has been completed and the helicopter was formally inducted in to the IAF on 3 October 2022. The IAF plans to procure 55 LCH SP (Series Production) in future.

Considering the requirement of the Indian Armed Forces, HAL has carried out Preliminary Design Studies of the IMRH in the 10-15 tonne class and has arrived at a configuration for the basic platform. Currently, IMRH is planned to be developed under the SPV route. As per HAL, the D & D is likely to take six to eight years and would cater for future MLH requirements of the IAF and a deck based version (DBMRH) for the IN. Induction of IMRH/ DBMRH is likely to commence wef 2031 if there is no delay in the D&D.

VAYU: As for upgrades, what is the status of the Sukhoi Su- 30 MKI's plan for the so called "Super Sukhoi"?

CAS: There is no project called 'Super Sukhoi'. However, the IAF is processing an upgrade programme for the Su-30 in collaboration with DPSUs, DRDO labs and Indian private industries.

All photos of air assets: Sujan Singh Chopra at Sukhna Lake, Chandigarh on 6 October 2022 during IAF rehearsals.

All photos of CAS courtesy IAF

Mi-35 and AH-64E Apache

IAF ALH

MiG-29s, Su-30MKIs and Netra

Su-30MKI

Rafale

CH-47F Chinook

Restructuring of India's Defence Forces

The modernisation/reforms of defence forces is a continuous process based on threat perception, operational challenges and technological changes to keep the Armed Forces in a state of readiness to meet the entire spectrum of security challenges. In order to reduce arms dependency and promote indigenous manufacturing of defence equipment, a comprehensive revamped 'Make and Innovation' procedure has been introduced in DAP-20 to facilitate indigenous design and development of defence equipment by private participation both with Government funding and industry funding according to India's Ministry of Defence.

Progressive Promulgation of Positive Indigenisation Lists: A series of Positive Indigenisation Lists of defence weapons and equipment which would not be imported from abroad have been promulgated. 1st Positive Indigenisation List comprising of 101 items was promulgated in August 2020, 2nd Positive Indigenisation List comprising of 108 items was promulgated in May 2021 and 3rd Indigenisation List comprising of 101 items was promulgated in April 2022.

The impact of 'Aatmanirbhar Bharat' in defence manufacturing is as following:

- In line with the budget announcement for F.Y. 2022-2023 of allocating 25% of the Defence R&D budget for industry led R&D, 18 major platforms have been approved by the Government for industry led Design and Development under Make I, Make II, SPV Model and iDEX routes.
- An innovation ecosystem for Defence titled Innovations for Defence Excellence (iDEX) has been launched in April, 2018 to foster innovation and technology development in Defence and Aerospace by engaging Industries including MSMEs, Start-ups, Individual Innovators, R&D institutes and Academia, and provide them grants/funding and other support to carry out R&D which has potential for future adoption for Indian defence and aerospace needs. So far, 125 problems have been opened, 136 start-ups have been engaged, 102 contracts have been signed.
- iDEX route of procurement have been simplified and timelines have been compressed from 2 years earlier to just 5 months by reforming the trial process.
- The Government has approved a scheme with an outlay of Rs 498.78 crore (2021-22 to 2025-26) to push innovation and support start-ups in defence and aerospace sector. This will enable more than 300 start-ups to participate in the new design and development projects and also support 20 partner incubators.
- As part of the efforts to achieve self-reliance in defence manufacturing and minimise imports by the DPSUs, a positive indigenisation list has been notified by the Department. The list contains 2,500 imported items which have already been indigenised and 351 high value imported items which will be indigenised in next 3 years. Out of 351 items, 147 items have already been indigenised.
- Another list of DPSUs for indigenisation of 107 Line Replaceable Units (LRUs)/ Sub-systems of high value platform was notified on 28.03.2022. As on date, 4 LRUs have been indigenised; 5 LRUs are at trial stage and 31 LRUs are at design and development stage.
- An indigenisation portal namely SRIJAN has been launched in August 2020 for DPSUs/OFB/Services with an industry interface to provide development support to MSMEs/Start-ups/Industry for import substitution. So far, more than 21,000 defence items, which were earlier imported, have been displayed on the portal. 388 private vendors have expressed interest in indigenising more than 4,700 items and so far 410 items have been indigenised.
- Separate procedure for 'Make-II' category (Industry funded) has been notified to encourage indigenous development and manufacture of defence equipment. Number of industry friendly provisions such as relaxation of eligibility criterion, minimal documentation, provision for considering proposals suggested by industry/individual etc. has been introduced in this procedure. So far, 72 projects relating to Army, Navy and Air Force, have been accorded 'Approval in Principle'. 38 Acceptance of Necessity (AONs), 5 prototypes developed and 2 procurement contracts have been signed by the Services.
- Further, Make-II route of procurement have been simplified and timelines have been compressed from 2 years earlier to just 5 months by reforming the trial process.
- As part of ease of doing business, the export procedure has been simplified and made completely online. This has resulted in an exponential increase in the number of Export Authorisations issued.
- Defence Testing Infrastructure Scheme (DTIS) has been formulated for creating 6 to 8 Greenfield Defence Testing Infrastructures in the country and attain 'Aatmanirbharta' in the Defence Testing Infrastructure for the domestic industry.
- As part of the 'Azadi Ka Amrit Mahotsav', the Government organised an event 'AiDef' on 11 July 2022 where for the first time 75 defence specific Artificial Intelligence (AI) products were launched by Raksha Mantri. During the event, three AI products of DPSUs were also launched for the market.

Indigenously developed equipment/systems handed to the Indian Army

India's Defence Minister Mr. Rajnath Singh handed over indigenously-developed equipment and systems to the Indian Army in New Delhi on 16 August 2022. These included Future Infantry Soldier as a System (F-INSAS), new generation anti-personnel mine 'Nipun', rugged and automatic communication system with enhanced capabilities, upgraded sights system for tanks and advanced thermal imagers. State-of-the art high mobility Infantry Protected Vehicles and Assault Boats were virtually handed over by Raksha Mantri enabling the troops deployed along the borders to respond to any challenge in any manner. The equipment/systems have been jointly developed by Indian Army in collaboration with Defence Public Sector Undertakings, Defence Research & Development Organisation (DRDO) and the Industry, in line with the Prime Minister Mr. Narendra Modi's vision to modernise the Armed Forces, under the 'Aatmanirbhar Bharat Abhiyan'.

Tonbo Imaging multisensor target acquisition system seen here

Future Infantry Soldier as a System (F-INSAS)

Mr. Rajnath Singh exuded confidence that the equipment and systems would enhance the operational preparedness of the Indian Army and increase their efficiency. "It is a shining example of the country's growing self-reliance prowess, in partnership with the private sector and other institutions", he stated. The Raksha Mantri asserted that the infrastructural needs of the Armed Forces were increasing with constantly-changing times. He called for infrastructural development based on latest technology to help the Armed Forces remain prepared to deal with future challenges. He urged the Armed Forces to strive for excellence and continue dedicating themselves towards Nation Building.

Details of the equipment and systems handed over to the Indian Army are as follows:

Future Infantry Soldier as a System

Future Infantry Soldier is being equipped with three primary sub systems. The first sub system is the modern state of art assault

rifle along with day and night holographic and reflex sights. The sights are mounted on the weapon and also on helmet to enable a 360-degree visibility and accuracy in operational conditions. In addition to the primary weapon system, the soldiers will also be kitted with multi-mode hand grenade which has also been procured indigenously along with multi-purpose knife.

The second sub system is protection system. This gives protection through a specially designed helmet and a bullet proof jacket. The third sub system consists of communication and surveillance system. This F-INSAS system is capable of further upgradation by incorporating real time data connectivity.

Anti-Personnel mine Nipun

For a long time, the Indian Army has been using vintage NMM 14 mines. With the efforts of Armament Research and Development Establishment, Pune and the Indian industry, a new Indian mine named Nipun has been developed. It will enhance the protection provided to the troops on the borders. The mine is more potent and effective than the existing anti-personnel mine.

Hand Held Thermal Imager (Uncooled)

This equipment is for surveillance and detection. It gives visibility in both day and night and in adverse weather conditions to the soldiers to detect enemy movement and activities.

Commander Thermal Imaging Sight for T-90 tank

This equipment gives enhanced visibility and range to the commanders of armoured columns. Earlier, in T-90 tanks had image intensification systems which had its own limitations and constraints. The limitations have been overcome by use of thermal imaging sight produced by India Optel Limited.

Downlink Equipment with Recording Facility

This downlink equipment helps the helicopters in carrying out constant reconnaissance and surveillance of the borders and operational areas. While on missions, reconnaissance data observed is recorded in the system and can be accessed only when the helicopter returns to the base. The equipment, produced indigenously by Exicom Private Limited, is fitted on the Advanced Light Helicopter.

Semi Ruggedised Automatic Exchange System Mk-II

Indian Army had exchanges that provided line communications to the operationally deployed units. However, there were limitations in terms of numbers of subscribers and quantum of data that could be communicated. Also, the equipment could not work with latest internet protocol technology. A new system has been developed by the Bharat Electronics Limited, Kotdwar, which overcomes all inadequacies of the older system.

Upgraded Radio Relay (Frequency Hopping)

In challenging forward areas, where no lines or other forms of communication are available, Indian Army has to extend its communication system. With this radio relay system, forward troops are in a position to operate their communication equipment and radio sets at much longer ranges and in greater depths than hither-to-fore. This is an advanced system with frequency hopping technology and very high capacity. It has been developed by Bharat Electronics Limited, Bengaluru.

Solar Photovoltaic Energy Project

One of the most challenging terrain and operational sectors of the country is the Siachen Glacier. The complete power requirement in the area to operate various equipment was met only through captive generator supply. A solar photo-voltaic plant has been installed to improve the overall energy requirements and also obviate dependence on fossil fuels. This plant at Partapur was virtually dedicated to the Nation by the Raksha Mantri.

Landing Craft Assault (LCA)

There are boats operating in Pangong Tso lake, however, they have limited capabilities. The LCA is much more versatile and has overcome the limitations of launch, speed and capacity. It has enhanced the capability to operate across the water obstacles in Eastern Ladakh. LCA has been indigenously developed by Aquarius Ship Yard Limited, Goa.

Mini Remotely Piloted Aerial System (RPAS)

RPAS removes the operational limitations faced by the Indian Air Force aircraft and the heron Unmanned Aerial Vehicles at tactical level. It empowers the Indian Army by removing the restricted capability for surveillance, detection and reconnaissance at the infantry battalion and mechanised units level.

Infantry Protected Mobility Vehicle (IPMV)

IPMV provides mobility and more protection to a large number of infantry soldiers posted at the Northern Borders. It has been made by Tata Advance Systems Limited.

Quick Reaction Fighting Vehicle (Medium)

The second vehicle along with the Infantry Mobility Protected Vehicle for enhanced mobility of our troops in Eastern Ladakh is the Quick Reaction Fighting Vehicle (Medium). It facilitates quick deployment of troops and will enable much faster reaction. The vehicles have been procured from Tata Advanced Systems Ltd. These are tailor made vehicles with high mobility, enhanced firepower & protection. It will facilitate in creating moral ascendency in our Northern Borders.

On the occasion, the Raksha Mantri also unveiled Scales of Accommodation (SoA) 2022, which provides authorisation for construction facilities for operational, functional, training, administrative, living and recreation for the Defence Services. The SoA 2022 is in line with the Government policies and vision like Swachh Bharat, Sugamya Bharat, Digital India, Green Buildings, Sustainable Development, Renewable Energy, Reduction of Carbon Footprint Promotion of Yoga & Fit India etc. Mr. Rajnath Singh asserted that with the implementation of SoA 2022, there would be tremendous improvement in facilities/infrastructure and specifications commensurate to contemporary requirements and will further improve the working and living conditions for the defence personnel including civilians. He described SoA 2022 as a testament to the hard work and dedication of MES.

Safran expands presence and industrial footprint in India

On 7 and 8 July 2022, Safran inaugurated three new production sites in India and announced construction of a major new facility in 2025, bolstering its strategic partnership with the country. Safran has operated in India for 65 years and now counts 10 facilities and 750 employees in the country. These announcements, which represent more than $200 million of investment between 2018 and 2025, clearly reflect the Group's commitment to long-term development in the country.

"With these new sites, we're opening a new chapter in Safran's long history with the Indian aerospace and defence industries, and we are reaffirming our commitment to the government's 'Make in India' policy and sovereignty strategy," stated Olivier Andriès, Chief Executive Officer of Safran. "To support the country's dynamic aviation market, with passenger traffic set to more than double in the next twenty years, we are accelerating our investments and industrial development in India. Through the creation of our largest maintenance and repair centre for commercial engines we are also paving the way to expand our MRO activities in India to military engines. With our three new production facilities and our major in-house IT centre we will triple the number of employees in India over the next four years, building on the excellent local talent base."

Two new neighboring plants were inaugurated on 7 July in Hyderabad, for Safran Aircraft Engines and Safran Electrical & Power. The Safran Aircraft Engines plant, spanning 15,000 square meters (162,000 sq ft), will make rotating parts for the LEAP engine from CFM International. It will provide the additional capacity needed to meet the requirements of a production ramp-up for the best-selling commercial airplane engine of its generation. Eventually employing 275 people, this plant applies Safran's highest standards in terms of industrial processes, machinery and

Engines, a 50/50 joint venture between Safran Aircraft Engines and Hindustan Aeronautics Limited. This new site replaces the initial plant that dates from 2005, more than doubling the surface area and featuring state-of-the-art installations. It's located in a Special Economic Zone near the Bangalore airport. Spanning 11,000 square meters (118,800 sq ft), the plant makes complex piping, mostly for the LEAP engine, and has about 150 employees.

During his visit to India, Olivier Andriès announced the creation of Digit, an in-house entity tasked with development of digital systems for Safran. The entity's two main facilities, in Hyderabad and Mumbai, start operations in the summer of 2022. Digit plans to recruit 1,000 people over the next five years by calling on India's vast talent pool for the development of digital applications and systems, as well as cybersecurity.

equipment and sustainability, with one-third of electrical power to be provided by solar panels.

During the inauguration, Jean-Paul Alary, Chief Executive Officer of Safran Aircraft Engines, announced the creation of a new maintenance, repair and overhaul (MRO) facility for CFM LEAP engines, to be built near this plant. The largest MRO centre in the network, it will start operations in 2025 and will eventually offer annual capacity of 250 to 300 engine shop visits. The LEAP and its predecessor, the CFM56, now power over 330 Airbus A320/A320neo and Boeing 737/737 MAX airplanes deployed by airlines in the Indian sub-continent. More than 1,500 LEAP engines are currently on order in the region.

"Our new MRO 4.0 centre in Hyderabad will strengthen our global network and enable us to meet the needs of our CFM customers against a backdrop of booming air traffic in India and the region," noted Jean-Paul Alary. "We benefit from the fast growing aviation ecosystem and oustanding competences in the State of Telengana."

Safran Electrical & Power's plant, located in the same airport zone as the Safran Aircraft Engines plant and sharing all support functions, makes wiring for LEAP engines and the Rafale fighter. Opened in November 2018, the plant has 150 employees today, growing to 200 when it reaches full capacity.

The third plant inaugurated on 8 July 2022 in Bangalore, for Safran HAL Aircraft

News from Saab

Meteor live firing with Gripen E

Saab recently conducted the first test firing with the advanced Meteor Beyond Visual Range Air-to-Air Missile (BVRAAM) on Gripen E with a successful end-to-end result on the target. The Meteor missile was launched from Gripen E at an altitude of approximately 16500 ft above the Vidsel test range in northern Sweden. "Meteor from MBDA is an unmatched BVRAAM that can operate in in the most contested environments. It can successfully engage a wide variety of targets, from fighter aircraft to small unmanned aerial vehicles and cruise missiles at unrivalled ranges", stated officials.

The focus of the flight test programme for Gripen E is on continued development and testing of primarily the tactical systems and as well as integration of a variation of weapons, for example Meteor. The Meteor programme is one of Europe's most successful defence collaborations and has seen the UK, France, Germany, Italy, Spain and Sweden join together to create this "game-changing" missile for air combat. Saab is a partner in the Meteor programme in conjunction with prime contractor MBDA UK.

Service and maintenance order for SA Gripens

Saab has received a support contract for the service, repairs and maintenance of the South African Air Force´s Gripen C/D jet fighters. The order value is MSEK 333 over a three-year period. The contract runs for three years from 2022 until 2025 and covers

service, repairs and maintenance as well as minor updates of the support and training systems of the South African Air Forces Gripen system.

Production of advanced training aircraft fuselage systems

Saab has received an award from Boeing for the production of advanced training aircraft aft fuselage systems. The order value for Saab is USD 71.2 million (approximately SEK 750 million). The advanced training aircraft fuselage systems will be produced in Saab's new facility in West Lafayette, Indiana, and first deliveries to Boeing are planned for 2023. "This is an important milestone and underscores that we are delivering on our commitments to our customers and the state of Indiana. This order will allow Saab to continue ramping up production and hiring in West Lafayette. We couldn't be more excited about this new chapter, and the future of our growing aerospace operations in Indiana," stated Erik Smith, President and CEO of Saab in the US.

MSHORAD demonstrated with live firing

Saab has conducted the first Mobile Short-Range Air Defence (MSHORAD) live system firing for an audience of various national delegations. In a series of firings, the system identified, tracked and engaged several targets. The firings took place in Karlskoga, Sweden and potential customers from 15 nations attended the live firing. A

total of five successful firings were performed from the RBS 70 NG Mobile Firing Unit on the MARS-S330 vehicle against a variety of targets, including a drone and an elevated helicopter airframe. During one firing scenario the vehicle mounted sight was taken off and reconfigured as a man portable firing unit. A night firing was also conducted against a towed target.

MSHORAD is Saab's response to the new battlefield era, with evolved airborne threats such as the advent of drones, unmanned aerial vehicles and other advanced airborne weapons. MSHORAD is a vehicle-integrated solution that can identify, counter and neutralise air threats quickly, effectively and decisively. The system consists of the Mobile Radar Unit, based on the Giraffe 1X radar, the Mobile Firing Unit, based on the RBS 70 NG, all connected with Saab's GBAD C2.

Carl-Gustaf ammo and AT4 for US Armed Forces

Saab has received an order for Carl-Gustaf ammunition and AT4CS RS systems for US Armed Forces. The order value is USD 81.8 million (SEK 812.7 million) and deliveries will take place during 2024. The delivery order is signed within an Indefinite Delivery, Indefinite Quantity (IDIQ) framework agreement signed in 2019 between Saab and the US Army that allows the customer to place orders for Carl-Gustaf ammunition and the single-shot AT4 shoulder-fired weapon systems during a five-year period. The Carl-Gustaf ammunition and AT4 systems within this order will be used by the US Army, US Special Operations Command (SOCOM) and US Marine Corps.

Saab's Carl-Gustaf system (designated MAAWS in the US) has a long and proven record with the US military. The reloadable, multi-purpose system has been in service in the US since 1990 and a programme of record for the US Army since 2013. In 2018, the US Army announced it would acquire the latest version of the weapon, the Carl-Gustaf M4 (designated M3A1 in the US).

Saab in order from FMV for submarine upgrades

Saab has received new orders from FMV regarding submarine upgrades. The orders include a life-time extension of HMS Södermanland, as well as new batteries and battery development. The total order value is SEK 470 million. The life-time extension means that the submarine HMS Södermanland will receive around 50 modifications, prolonging and enhancing her operability for a further six years. The orders also include an exchange of batteries for the Swedish Navy's current submarine fleet, as well as a project focusing on battery development, to ensure capabilities both at present and long-term.

Saab partners with Heart Aerospace

Saab has committed to becoming a minority shareholder in the Swedish electric aircraft manufacturer Heart Aerospace with a USD 5 million investment. Saab and Heart Aerospace have also signed a collaboration agreement regarding the supply of subsystems and the exploration of further areas of collaboration, including certification and manufacturing. This is in line with Saab's ambition to support the transition to sustainable aviation. Heart Aerospace develops the ES-30, a regional electric airplane with a standard seating capacity of 30 passengers powered by batteries, allowing it to operate with low noise and with zero emissions.

WB Group of Poland forms Joint Venture in India

Grupa WB have established a Joint Venture named WB Electronics India Pvt Ltd to cooperate with Indian Armed Forces in advanced military projects under common R&D programmes and to offer new solutions for Indian military and industry.

WB Group, Poland's largest manufacturer of advanced electronic, unmanned, communication and information systems for defence and public security, has established the joint venture company in India. Nearly 25 percent of WB Group's (Poland) shares is owned by the Polish government. This means the company is a proven, stable and long-term partner of the NATO countries' Armed Forces. The maritime, land and air solutions offered by the Group are being used on all continents.

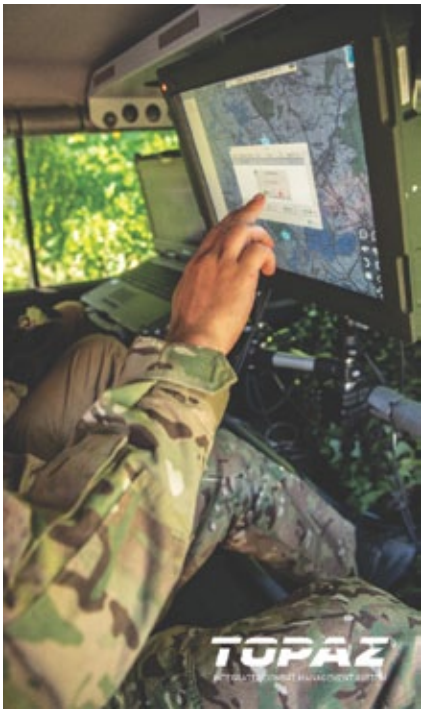
WB Electronics India Pvt Ltd (WB India) will have its headquarters at New Delhi. The head of the company is the experienced soldier and administrator, Col Sandeep Malik (Retd) as the Vice President.

"WB Group/WB India is planning to start a broad cooperation with the Indian armed forces, science and industry, all while respecting the "Make in India" and the "Atmanirbhar Bharat" approach of the Prime Minister, Mr. Narendra Modi, in the self-sufficiency principle in the field of defence," stated Piotr Wojciechowski, President, WB Group. "WB Group systems are already in service with the Indian Army," he further stated.

"WB has been engaged in cooperation with various Indian defence industry players since early 2000s – both state owned organisations like BEL, DRDO and private sector companies. Industrial cooperation as well as joint development of military technologies has been the essence of these early interactions," stated Adam Bartosiewicz, Vice-President of WB Group.

WB Group's aim is to start a large-scale participation in the Indian R&D projects and consequently join the great potential of the Indian and Polish engineers and constructors to the benefit of the Indian defence and public security. "The newly established Joint Venture, WB Electronics India Pvt Ltd is a proof of both WB Group's commitment to the Indian Armed Forces customers as well as a result of alignment between dynamism of hi tech community both on the Polish and Indian side", added Adam Bartosiewicz.

WB Group has been delivering the advanced defence solutions to armed forces globally for 25 years. The Polish manufacturer specialises in system integration and communication and information systems. WB Group's solutions are being manufactured under license in many countries, including the US. The Group offers battlefield management systems such as TOPAZ and FONET mobile Digital Communication Platform, tactical software defined radios with embedded cryptography PERAD and COMP@N. WB Group is a leader in the field of the multi-purpose unmanned reconnaissance systems Flyeye and FT-5, as well as tactical and operational loitering munition Warmate. All these systems are battle tested in some of the most demanding situations.



WB Group is a manufacturer of modern technical solutions and employs over 1,300 people. The company operates globally in the communication, crisis management, public security, transport, electromobility and defence markets.

WB INDIA
WB GROUP

Nammo's drone-mounted M72

Nammo has for several years been working on a concept where the M72 is mounted on a drone. The result is a flexible and powerful anti-vehicle or anti-tank weapon that can be operated remotely; the company is pleased to announce that the y are working on a drone-mounted M72 concept. The M72 is a 66mm caliber single use light anti-tank weapon effective against a range of targets such as armoured vehicles, personnel, lightly fortified structures, or similar.

The M72 is qualified and in use by a wide range of armed forces in several (mostly NATO) countries and offers a good combination of low weight and heavy firepower. In a regular usage scenario, it is fired from the shoulder of the operator. While most variants have a maximum effective range around 350 meters, the new drone concept opens up several new possibilities for versatile use and much longer ranges. With the M72 mounted on a drone, users can bring the weapon to the target in a way not previously possible. This opens up both a "top attack" option against more heavily armoured targets, even up to main battle tanks, while at the same time removing operators from the danger zone.

The M72 drone concept is also a low-cost concept that does not rely on GPS or similar to function. With a degree of automation, the number of operators can be kept at a reasonable level, and the light anti-tank weapon/drone combination can likely operate in so-called swarms. Compared to conventional anti-tank missiles, this can be an effective and inexpensive solution against armoured forces. M72 variants meant to be used against armoured targets can penetrate at least 450mm of steel. Currently the company is looking at using existing and commercially available drones. Since there is no or very little recoil from the weapon, it is an ideal combination within a range of 3 to 4 kilometers.

Nammo is also looking at options to extend the range of a drone-carried M72 systems even more. Currently, a live video feed from cameras on the drone is transmitted back to the operator. This has a maximum range of around 3-4 kilometers, but with improved signal strength, the company is experimenting with ranges up to 50 km. Nammo's M72 drone concept has been developed as an in-house project, with support from Norway's Defence Development Institute (FFI).

The next stage for Nammo is to refine and improve the system. "We believe a qualification process in cooperation with potential customers should be possible as well within the coming next few years. Even though the drone-mounted M72 is currently best described as a proof of concept, the individual components – the weapon as well as drone options – are already mature, qualified and in use. Now we need to make sure that everything works well together. Also, there are possibilities for enhancing sensor and system integration" stated company officials.

All photos from Eurosatory 2022

Boeing unveils Aatmanirbhar Bharat strategy

(From Left to Right) Satya Prakash, Senior Director – Business Development, GE Aviation, Alain Garcia, vice president, India business development, Boeing Defense, Space & Security and Global Services, Steve Parker, vice president and general manager, Bombers & Fighters, Defense & Space, Salil Gupte, president, Boeing India, Samit Ray, Regional Director, Government Affairs & Public Policy South Asia, Raytheon, Gyanendra Sharma, India Managing Director, Northrop Grumman International.

Boeing plans to further strengthen its Make in India initiatives, building on a successful track record of contributing to India's indigenous aerospace and defence ecosystem.

As part of this effort, Boeing anticipates $3.6 billion in economic impact to the Indian aerospace and defence industry over the next 10 years, with the F/A-18 Super Hornet as India's next carrier-based fighter. The economic impact would be over and above Boeing's current offset obligations and plans in the country.

"As a trusted partner of India's aerospace sector for more than 75 years, Boeing has made significant investments in India's aerospace and defence industry and will continue to do so. Our investments span the entire spectrum of local manufacturing, engineering and R&D, and training and skilling to help build a robust Aatmanirbhar Bharat in aerospace and defence," stated Salil Gupte, President, Boeing India. "The selection of the F/A-18 Super Hornet for India will help boost investments in India's defence industry."

Boeing plans to build on its existing industrial base and strengthen its commitment to Aatmanirbhar Bharat with continued investments in India across five pillars. These include supply chain development and manufacturing; engineering and technology transfer; long-term support and training; infrastructure investments; and contributions of the Hornet Industry Team, comprising of General Electric, Northrop Grumman and Raytheon.

"Designed from its inception as a carrier-based fighter for high-loading, high stress operations, the F/A-18E/F Super Hornet Block III will bring advanced, next-generation capabilities that will help the Indian Navy meet emerging and future threats. In addition, along with the contributions to the Indian economy by our Hornet Industry Partners – General Electric, Raytheon, Northrop Grumman, the Super Hornet will deliver significant benefits to India's defence sector," stated Alain Garcia, vice president, India Business Development, Boeing Defense, Space & Security and Global Services.

Boeing's advanced aircraft and services play an important role in the mission-readiness for the Indian Air Force and Indian Navy. Boeing has strengthened its supply chain with more than 300 local companies in India and a joint venture to manufacture fuselages for Apache helicopters. Annual sourcing from India stands at $1 billion. Boeing currently employs close to 4,000 people in India, and more than 7,000 people work with its supply chain partners.

Courtesy: Boeing

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Goa Shipyard Ltd

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Saab to set up manufacturing facility in India for Carl-Gustaf

Saab will set up a manufacturing facility for the shoulder launched weapon system Carl-Gustaf in India, further strengthening production in the country. Production in the new facility is planned to start in 2024.The facility will support the production of the Carl-Gustaf M4 for the Indian Armed Forces as well as components for users of the system around the world.

The new company Saab FFV India, currently under registration, will make the latest generation of the state-of-the-art weapon in India. Saab will also be partnering with Indian sub-suppliers and the systems manufactured in the facility will fully meet the requirements of "Make in India". Saab FFV India will deploy complex technologies including the latest sighting technology and apply advanced manufacturing techniques like carbon fibrewinding for the Carl-Gustaf system including the latest M4 weapon.

"It is a natural step to set up a production facility for Carl-Gustaf M4 in India given the long and close association we have with the Indian Army as one of the foremost users of the system. We are glad to be able to contribute to the Government of India's goals of developing a world class defence industry and proud to offer the Indian Armed Forces our Carl-Gustaf M4 made in India," stated Görgen Johansson, head of Saab's business area Dynamics.

Over the years Saab have partnered with Indian companies to make parts or components for Saab's products on the global market. This project is a continuation of Saab's commitment to "Make in India". Saab will continue its partnership with Munitions India Limited (MIL) and Advanced Weapons and Equipment India Limited (AWEIL) to manufacture the Carl-Gustaf weapon and its ammunition.

The Carl-Gustaf system has been in service with the Indian Army since the first cooperation agreement for production in India was signed 1976. Through its wide variety of ammunition, Carl-Gustaf has established itself as the main shoulder launched weapon in the Indian Armed Forces.

Updates from Rafael

Ice Breaker unveiled

Rafael Advanced Defense Systems has introduced the Ice Breaker: a 5th generation long-range, autonomous, precision-guided missile system, enabling significant attack performance against a variety of high-value land, and sea targets. Ice Breaker is a multi-service solution, across air, land, and sea domains. This unveiling comes one year since the introduction of the Sea Breaker, which serves as the naval and land-based version of the all-encompassing Ice Breaker.

Rafael and Philippine AF

In a ceremony, Rafael's Executive Vice President Pinhas Yungman, Head of the Air and Missile Defence Directorate. Secretary of National Defense of the Philippines Delfin Lorenzana, Commanding General of PAF Lt. Gen. Connor Anthony Canlas Sr., SIBAT Director for Asia and the Pacific Eytan Levi, and other officials took part in the official opening of the training centre. The SPADS Simulator - Training Centre is the Philippine Air Force's first missile training centre which will serve as a training ground for future air defenders to prepare them for real-time threats as well as enhancing personnel knowledge and skills. The training centre is part of the GBADS Acquisition Project of the Philippine Air Force which will further enhance the nation's defensive capabilities.

Spike Firefly evaluated by US Army

Rafael and its US subsidiary RSGS demonstrated the Spike Firefly loitering munition at the Army Expeditionary Warrior Experiment 2022 (also known as AEWE). AEWE 2022 is a collaborative venue under the Maneuver Battle Lab of the Maneuver Centre of Excellence at Fort Benning.

AEROSPIKE unveiled

As part of the 2022 Special Operations Forces Industry Conference (SOFIC), Rafael unveiled AEROSPIKE, a new advanced air-to-surface Stand-Off Precision Guided Missile (SOPGM) for fixed-wing airborne platforms. It is a state-of-the-art, next generation EO/IR SOPGM system, designed to meet the needs of complex modern warfare. It is light-weight, high precision (CEP ≤ 3 ft), and offers an significant stand-off range of 30 km, all within a contested environment, independent of GPS.

US Army completes test of Iron Dome Defence System

The US Army, in conjunction with the Israeli Ministry of Defence's Israeli Missile Defence Organisation (IMDO) took a critical step toward fielding the first of two Rafael-made Iron Dome Defence System-Army (IDDS-A) batteries. IDDS-A will defend supported forces within fixed and semi-fixed locations against sub-sonic cruise missiles, Unmanned Aircraft Systems (UAS), rockets, artillery and mortar threats.

News from Boeing

Boeing, US Navy demo manned-unmanned teaming

Boeing and the US Navy have completed a series of manned-unmanned teaming (MUM-T) flight tests in which a Block III F/A-18 Super Hornet successfully demonstrated command and control of three unmanned aerial vehicles (UAVs). Boeing system engineers connected Block III's adjunct processor, known as the Distributed Targeting Processor – Networked (DTP-N), with a third-party tablet to team with the UAVs. Boeing developed new software loads for the DTP-N specific to running the third-party tablet and transmitting commands. The software development, tablet connection to the fighter and all flight tests were completed in less than six months.

Boeing partnered with the F/A-18 and EA-18G Programme Office (PMA-265), Air Test and Evaluation Squadrons (VX) 23 and 31, Naval Air Warfare Center-Weapons Division at China Lake, Calif., and a third-party vendor on the demonstration. During the test flights, F/A-18 pilots entered commands into the tablet, which were processed and transmitted through Block III's hardware. The UAVs executed all commands given by F/A-18 pilots during tests over a two-week period.

50 years of F-15 innovation

On 27 July 1972, the Boeing F-15 flew for the first time with Chief Test Pilot Irv Burrows at the controls. Fifty years later, the undefeated F-15 continues to evolve and add advanced capability to the US Air Force fighter fleet. Boeing's F-15 programme was initiated at the request of the US Air Force, which needed a fighter jet designed to maintain the country's air superiority. Through its variants, the F-15 has also served that mission internationally with numerous global customers including Japan, Israel, Saudi Arabia, Singapore, South Korea and Qatar.

The newest F-15, the F-15EX Eagle II, delivers a state-of-the-art electronic warfare system, along with contemporary sensors and avionics. The airframe, known for its unrivaled payload capacity, is capable of carrying next-generation hypersonic weapons. More than 1,500 F-15s are in service worldwide. The US Air Force took delivery of its first F-15EX in March 2021.

Boeing delivers 150th P-8

The newest Boeing P-8 maritime patrol, reconnaissance aircraft took to the skies over Puget Sound early July 2022 bringing the total number of P-8s delivered to 150. The 150th multi-mission P-8 will be operated by Air Test and Evaluation Squadron (VX) One based at Naval Air Station Patuxent River, Maryland. Amassing more than 450,000 mishap-free flight hours, the global P-8 fleet includes 112 aircraft delivered to the US Navy, 12 to Australia, 12 to India, nine to the United Kingdom and five to Norway. The aircraft are designed for anti-submarine warfare; anti-surface warfare; intelligence, surveillance and reconnaissance and search and rescue.

(Photos: US Navy)

Dassault Rafale's Safran M88 engine clocks one million operating hours

M88 engine that powers Dassault Aviation's multirole fighter has clocked up more than one million operating hours. This major milestone is a testament to the operational excellence of the engine, which has been in service for more than two decades. More than 600 engines have been delivered since it was rolled out. The M88 entered service with the French armed forces in 2004 to power the Rafales used by the French Army and Navy. Designed, developed and produced entirely by Safran Aircraft Engines, the M88 engine has delivered the highest standards of performance and reliability, especially within the scope of external operations conducted by the French Army. Its outstanding capabilities have contributed to the large number of orders for the Rafale, France's military aircraft flagship and an emblem of our national sovereignty. To date, 284 aircraft have been sold to seven export customers: Egypt, Qatar, India, Greece, Croatia, United Arab Emirates and Indonesia.

Safran Aircraft Engines CEO Jean-Paul Alary stated, "Thanks to world-class performance, reliability and maintainability, the M88 is today Europe's most successful fighter engine. However, our mission doesn't stop here. We must continue to expand our production capacity to meet export demand, and at the same time work on upgrades to bring customers the benefits of the latest operational standards." To keep pace with orders, Safran Aircraft Engines will increase production rates three-fold in the next few years. This is an unprecedented industrial challenge, with more than 150 suppliers contributing to the military engine program, most of which are based in France. It will help safeguard thousands of jobs, as well as French expertise and technology.

"The M88 programme is highly strategic in terms of maintaining skills not just for us but for the entire French aerospace industry," added Jean-Paul Alary. "It's partly thanks to our experience in military engines, for which we develop the hot section, among other things, that we've earned global recognition as a complete engine-maker." Safran Aircraft Engines is currently working on the F4 Standard of the M88, which will power the Rafale fleet deployed by France and the United Arab Emirates. This upgrade, slated to be rolled out in 2025, will provide even more onboard electronics for storing the growing volume of data required for integrated predictive maintenance.

Courtesy: Safran

News from Thales

Thales strengthens partnership with Dassault

Thales has announced the expansion of its collaboration with Dassault Aviation through the signature of a maintenance agreement for electrical systems on Falcon 900 and Falcon 2000 Series Fleets. Through this agreement, Thales and Dassault Aviation will bring to Falcon operators unprecedented value for Premium Services along with significant reductions in Direct Maintenance Cost (DMC) and a robust incentive campaign for Starter Generators P/N 8060-160 upgrade to a new P/N 8060-170.

Thales and partners present new Sherpa A2M

Thales, Arquus and NTGS have officially presented the new Sherpa A2M (Advanced Mobile Mortar). The Sherpa A2M is an adequate answer to the tactical challenges met and created by artillery in the high-intensity warfare: mobility, protection, close support to the troops on the ground and mobile counter-battery options at the fraction of the price of a Self-Propelled Gun (SPG). The Sherpa A2M combines the mobility of a Sherpa Light, the proven Deployable Mortar System by NTGS and the 120mm rifled mortar barrel by Thales, into one full fully integrated new solution.

Thanks to Thales capability, the vehicle embeds 120 mm rifled ammunition and in the future the mortar laser guided ammunition. The rifled mortar barrel is three times more precise than smoothbore mortar. Due to this, it can achieve similar operational effects with much less shots; around 4 times less rounds needed than for a smoothbore mortar.

The Sherpa Light is a multipurpose, 4x4 armoured vehicle to provide with a wide array of versions and customisations for all needs and missions, built on a single, proven base for increased commonality and ease of maintenance. It is a modern, mature, new-generation vehicle, which is built on many years of industrial experience, operational deployments on the battlefield and maintenance.

Thales launches VisioLoc

Thales is launching VisioLoc to improve the effectiveness of the augmented soldier without adding to the cognitive and physical burden on the warfighter. The new functionality for the Sophie family of multi-function thermal imagers provides a high-performance geolocation capability and generates precise target coordinates even when no GNSS1 signal is available.

Thales and the Combat Digital Platform

Developments in the threat landscape and the nature of conflict call for significant changes in the way that missions are conducted. As the number of actors in the battlespace increases, the digital transformation and advanced connectivity solutions have become an integral part of military operations. Thales is introducing the Combat Digital Platform, a cybersecure platform designed to share, analyse and exploit the vast quantities of available data to guarantee information superiority for the forces deployed in the theatre of operations.

Rosoboronexport sums up its activities at Army 2022 Forum

During the business programme of the VIII Army 2022 International Military and Technical Forum in August 2022, Rosoboronexport JSC (part of Rostec State Corporation) received more than 70 delegations from 50 countries and presented more than 200 products from Russian defence companies in 6 exhibit areas. The total area of the Rosoboronexport's exhibit display was about 1,700 square meters.

T-14 Armata and K-17 Boomerang

Kornet-E ATGM system

"In 2022, Rosoboronexport has organised a rich business programme on the sidelines of the Army Forum. We held more than 70 negotiations, during which we discussed various military-technical issues with representatives of 30 partner countries. We concluded several export contracts and also laid the groundwork for contracts worth more than $14.5 billion," stated Alexander Mikheev, Director General of Rosoboronexport. "The company made presentations of about 350 Russian products to the delegations of partners who came to the forum. They showed particular interest in the Su-57E fifth-generation fighter, T-14 Armata tank, Ka-52E attack helicopter, Tor-E2 SAM system, Kornet-E ATGM system, and the K-17 Boomerang wheeled infantry fighting vehicle", he further stated.

At Army 2022, Rosoboronexport also signed joint programmes with leading Russian defence companies to promote their products and services in the external market as well as a cooperation agreement with VTB Bank.

Rosoboronexport conducted a live demonstration of Russian armoured vehicles and air defence systems at the Alabino Training Ground according to a scenario developed by the company jointly with the Ministry of Defence of the Russian Federation. Nineteen pieces of equipment, including the BMD-4M airborne assault vehicle, K-17 Boomerang IFV and the BTR-82AT APC, demonstrated their running and firing capabilities in nine tactical episodes.

A video announcement of the exhibition, dozens of video reviews on weapons, military and special equipment and a virtual tour of the exhibit display in VR mode are available on Rosoboronexport's digital platforms on the Internet.

Rosoboronexport took part in the X Moscow Conference on International Security, as well as in the work of intergovernmental commissions with five partner countries of the company.

Rosoboronexport was awarded the Main Prize of the VIII Army 2022 International Military and Technical Forum by the Ministry of Defense of the Russian Federation for its great contribution to the development of the Forum.

Su-57E fifth-generation fighter

Ka-52

Updates from Israel Aerospace Industries

IAI unveils STAR-X 3D

Israel Aerospace Industries' (IAI) has unveiled the STAR-X 3D multi-mission naval radar, designed for Offshore Patrol Vessels (OPVs) and other small vessels. The STAR-X 3D naval radar is based on IAI's ELTA AESA (Active Electronic Scanned Array) technology It performs simultaneous air and surface surveillance, and is designed for performing critical missions in Exclusive Economic Zones (EZZ) and beyond. The newest member of IAI family of operationally proven naval radars, which are in service with naval forces worldwide, the STAR-X is a fully digital, 3D, high-performance AESA radar which leverages proven technology from other IAI-ELTA radars.

IAI to provide special mission aircraft

Israel Aerospace Industries (IAI) has signed a contract valued at over $200 million to provide Special Mission Aircraft to a country in Europe, which is a NATO member country. The Special Mission Aircraft will be developed by IAI's Group and subsidiary ELTA Systems Ltd., home to Israel's radar and intelligence technology. IAI's special mission aircraft are active in Israel and in many countries around the world, and provide an important strategic edge.

EASA approval for B737-800SF freighter conversion

Israel Aerospace Industries (IAI) has received the European Aviation Safety Authority (EASA) Supplemental Type Certificate (STC) for its B737-800SF passenger-to-freighter conversions. With the EASA STC approval, IAI will open its B737-800BDSF cargo conversions to European companies and operators, providing a solution to the rising demand for aircraft conversions worldwide. The first two converted aircraft for which this approval will apply have already been delivered to a customer in Spain with an additional aircraft undergoing conversion and joining the European fleet shortly.

IAI selected by Dassault to produce Falcon 10X surfaces

Israel Aerospace Industries (IAI) has been selected by Dassault Aviation to design and produce the all-composite wing movable surfaces for the new, long range Falcon 10X business jet. The Falcon 10X wing movable surfaces programme joins IAI's other aerostructures programmes for other leading aircraft manufacturers.

GSL – Scaling new heights through Indigenous Shipbuilding

ICGS Shaurya

Goa Shipyard Limited (GSL) has, in the last few years established new benchmarks in the Indian Shipbuilding Industry by consistently delivering each and every vessel ahead of contractual delivery schedule. Backed by strong design house and superior 'Quality' ships, it has emerged as the fastest growing shipyard of country, building high technology and sophisticated ships. With an unmatchable track record of timely execution and delivery at 'fixed cost' of over 200 ships and more than 160 Fast Interceptor Boats, GSL stands tall as the success story of the changing face of Indian Defence Shipyards.

Equipped with an in-house design capability and most modern facilities, GSL has excelled in its core competence of design and building a wide range of Patrol Vessels, Missile Boats, Landing Crafts, Training Vessels, Survey Vessels, Sail Training Ships, Fast Patrol Vessels and Yardcrafts for the Defence Sector, besides other types of vessels in the commercial sector. GSL has capability to design and build ships to customer's requirements and its in-house R&D unit is recognised by DSIR, Ministry of Science & Technology, Government of India.

The Shipyard has exhibited unparalleled performance in shipbuilding industry by delivering over 30 ships in last few years, all ahead of schedule, amounting to Gross tonnage of approx. 32,000 tonnes. These deliveries include 11 OPVs, 11 Fast Interceptor Boats, 4 x 1000 Ton fuel barges and 1 Damage Control Simulator. The throughput achieved validates the processes and productivity which has consistently increased year on year.

The Shipyard has excelled in design and construction of OPVs and it's a matter of pride that over 24 designed and built OPVs by GSL are currently in service with Indian Navy, Coast Guard and Sri Lanka Navy. The recently completed Coast Guard Project for five Advanced Offshore Patrol Vessels (AOPV) is the most successful project in Indian shipbuilding industry with over 70 % indigenous content. The project was completed in 5 years from 2016-22 with all five vessels delivered ahead of schedule and build period of 2400 ton AOPVs reduced to 3 years from 5.5 years, taken earlier for last OPVs built by GSL.

Another major proven and trustworthy platform designed and constructed by the Shipyard is the Fast Patrol Vessel (FPV). Driven by waterjets, these vessels can achieve speeds in excess of 37 knots. Known for its excellent manoeuvrability, these ships have proved their mettle at high seas during hostile conditions. Seven of these vessels have been delivered to Coast Guard and two exported in 2015-16. GSL has also won contract for 8 FPVs for Coast Guard wherein the design phase is in advanced stages and construction has also commenced.

With dependable and robust products and committed workforce, the Shipyard has been giving record breaking performance in exports year after year and emerged as the largest exporter of defence ships from Indian sub-continent. In the last three years alone, it has delivered 2 OPV, 11 FIBs and 2 FPVs, and a Damage Control Simulator to friendly foreign countries. These projects again were delivered ahead of schedule and superior build quality led to accolades at the highest levels. With these deliveries, the Shipyard has emerged as the largest exporter of defence ships from India and poised to build upon it further in the coming future. As of now, GSL is executing a prestigious project for a friendly foreign country which is presently in the design stage and will commence physical construction soon.

The last couple of years have been very challenging for the Shipyard owing to the

cascading effects of the pandemic and very recently the changes in the geo political scenario with respect to the Russia-Ukraine Conflict. However the period has also been very encouraging with the Yard transitioning itself to the domain of advanced weapon intensive platforms by commencing the execution of the prestigious contract for construction of two Advanced Missile Frigates for the Indian Navy under design assistance from Russia. This project which has completed the technical design stage and is in the advanced stages of detailed design with physical construction also commenced, will definitely catapult us into a select league of shipyards which can design and construct complex weapon intensive ships.

The other two major projects being executed are the 2 Pollution Control Vessels and 8 Fast Patrol Vessels for the Indian Coast Guard, which are entering into full scale production stage soon. Both there platforms are designed in-house by GSL. GSL has also emerged the least bidder for the 7 New Generation Offshore Patrol Vessel Project for the Indian Navy. The contract for this project is expected to be inked in the near future.

It is also a matter of great pride that the two frigates under construction will be installed with a considerable percentage of indigenous equipment fit, contributing to the Government of India's Make in India and Atma Nirbhar Bharat vision. Critical engineering, hull and weapon systems will be of indigenous origin tapping into the growing capabilities of domestic public and private industry. Close to 8000 items will be of indigenous origin and are presently under various stages of procurement from MSMEs.

Frigate

In order to bring world class technology to India and manufacture equipment/ systems in India with significant indigenous content, GSL has laid considerable thrust on collaboration with leading Indian OEMs and startups and has entered into MoUs with various industry and academic institutions such as BEL, L&T and IIT Goa to further boost indigenisation and reduce dependence on import. GSL is also participating in the IDEX programme and is associated with startups for development of niche technologies in the marine and shipbuilding domain.

While we are aggressively pursuing the 'Make in India' initiative by introducing more and more import substitute products, we are conscious of the fact that MSMEs form a critical fulcrum behind this initiative. Therefore, we are putting in all out efforts in increasing our vendor base. We have a robust Vendor Development programme in place which looks into regular conduct of vendor meets, active participation in vendor meet at regional as well as national level, facilitating yard visit for vendors for interaction with stakeholders at GSL and understand their requirement, imparting training on TReDS to MSEs, rebate in class approval fee for MSEs owned by SC/ST entrepreneurs from Indian Register of Shipping and Handholding local suppliers. GSL has also actively worked towards on boarding majority of its vendors on the India Defence Mart (IDM) which is again another great initiative by the Government.

Constantly building and consolidating its experience gained over half a century and reputation for excellence and consistent track record of timely deliveries, GSL today, confidently looks ahead to successfully meet the challenges of the future requirement of our forces indigenously.

Sri Lanka Navy Ship OPV Sayurala

Courtesy: GSL

Lockheed Martin showcases commitment to a self-reliant India at Defexpo 2022

Lockheed Martin will showcase its diverse portfolio of defence capabilities and solutions at the 12th biennial edition of Defexpo India 2022, taking place in Gandhinagar, Gujarat from 18-22 October 2022. The company's exhibit this year includes a broad span of advanced technologies from the Aeronautics, Rotary and Mission Systems, and Missiles and Fire Control business areas.

"Lockheed Martin is committed to assisting in the growth of India's strategic security capabilities and the advancement of its defence manufacturing ecosystem. Our joint ventures with Tata and industrial relationships with many Indian companies such as Ashok Leyland, Lakshmi Machine Works, MIDHANI, Rossell Techsys and SASMOS among others are a testament to the success of the government of India's mission to create 'Atmanirbhar Bharat' in the defence sector," stated William L. Blair, chief executive, Lockheed Martin India Pvt. Ltd. "Participating at Defexpo 2022 gives us the opportunity to showcase our advanced technologies and innovative capabilities directly to the largest gathering of defence and aerospace partners and our customers in India," Blair said. "We look forward to engaging with our customers and industry partners to discuss their key priorities for advancement of India's national security, indigenous production and human capital development agendas", he further stated.

William L. Blair, chief executive, Lockheed Martin India Pvt. Ltd.

The prime attraction at Lockheed Martin's booth this year will be one of the most technologically advanced complex aerostructures, a "Made in India", fuel-carrying, 9G, 12,000 hour, interchangeable/replaceable fighter wing. This wing was manufactured at the Tata Lockheed Martin Aerostructures Limited (TLMAL) facility in Hyderabad. The TLMAL joint venture exemplifies the government of India's "Make in India" goals and also serves as the single global source of C-130J empennage assemblies installed on all new Super Hercules aircraft. To date, TLMAL has manufactured and exported more than 180 C-130J empennages.

The F-21 fighter aircraft, which is on offer to the Indian Air Force (IAF) will also occupy a prominent place at Lockheed Martin's booth. The company is leveraging both 4th and 5th generation technologies to offer the best solution to meet or exceed the IAF's capability needs, provide Make in India industrial opportunities, and accelerate India-United States cooperation on advanced technologies, including but not limited to fighter aircraft. The F-21 demonstrates Lockheed Martin's

commitment to delivering a technologically advanced, single-engine fighter to the IAF — For India, From India.

The Indian Navy's acquisition of MH-60R "Romeo" multi-mission helicopter is another highlight for Lockheed Martin at the show. The MH-60R is the world's most advanced maritime helicopter and brings vital anti-submarine and anti-surface warfare capabilities to the Indo-Pacific region. The US Navy has already delivered the first three aircraft to the Indian Navy in 2021 and these aircraft are being utilised to train Indian pilots and crew members in California. In July-August 2022, the US Navy transported to India another three helicopters, which will be initially based at Naval Air Station INS Garuda in Kochi. A total of 24 MH-60Rs will be delivered in country over the next few years.

India's workhorse, C-130J Super Hercules airlifter, which represents a strong legacy of partnership between India and the US, will also be on display at the Lockheed Martin booth. The IAF uses its fleet to support a variety of missions, from cargo delivery to providing vital humanitarian aid including in the wake of the COVID-19 pandemic as well as for transportation of relief materials, equipment and personnel in the areas affected by cyclones Yaas and Tauktae.

The S-92 helicopter, best in class for safety and reliability, will also boost Lockheed Martin's presence at the show. The S-92 helicopter recently surpassed 2 million fleet flight hours which is a testament to the reliability of the multi-mission aircraft.

As part of the Javelin Joint Venture, Lockheed Martin also produces the Javelin anti-tank guided missile system. This versatile and effective one-man-portable and platform-employed multi-target precision weapon system provides capability to defeat a broad spectrum of close combat threats on the modern battlefield. Using fire-and-forget technology, the weapon guides itself to the target without external commands, allowing soldiers to take cover or reposition. With a range of 65 meters to 4 kilometers in most operational conditions, as well as the ability to operate through adverse weather and battlefield obscurants, Javelin can be deployed in a variety of environments and conditions.

Lockheed Martin continues to build upon more than seven decades of association and three decades of partnerships with India by nurturing and expanding collaborations with local industry to support the foundation of indigenous defence manufacturing ecosystem. The company's present and future programmes in India range from transport, maritime and fighter aircraft, to sea and land-based air and missile defence projects, as well as capabilities in civil sectors including new and renewable energy.

Lockheed Martin's presence at the show will be in strict accordance with Covid-19 protocols laid down by the Ministry of Defence and state government to ensure the safety of employees and visitors.

Present in India for over three decades, Lockheed Martin is proud of its longstanding relationships and commitment to customers and partners on existing and future programs. These range from transport, maritime and fighter aircraft, to sea and land-based air and missile defence projects, as well as capabilities in civil sectors including new and renewable energy. A strategic partner and developer of sovereign industrial, workforce and enterprise capability, Lockheed Martin India's joint ventures, apprenticeships, and founding membership of the India Innovation Growth Programme underscore its conviction in Indian industry, talent and progress.

Text and photos courtesy: LM

Good going for Dassault Aviation in 2022

Highlights and excerpts of the first half-year results

"The Rafale chosen by the United Arab Emirates to equip their air forces in December, Dassault CEO, Éric Trappier, signed a contract in Dubai for the supply of 80 Rafale aircraft to the UAE Air Force. The signing took place in presence of the President of the Republic, Emmanuel Macron, and Sheikh Mohamed bin Zayed Al Nahyan, then Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE armed forces. It is the largest contract in Dassault Aviation's history. Its effective date was announced on 19 April 2022. It is the result of more than 45 years of trust between the UAE and our company through The Mirage family, and in particular The Mirage 2009".

"It is yet another demonstration of the excellence of the Rafale and the French aviation industry. The Rafale demonstrates its versatility, efficiency and reliability daily in many theatres of operation. It continuously integrates feedback from the armed forces and the latest innovations to stay at the cutting edge of technology".

Éric Trappier, Chairman and Chief Executive Officer of Dassault Aviation presented the "2022 first half-year results" during a press conference

"The French Ministry of the Armed Forces, Directorate of Aeronautical Maintenance, has awarded the Dassault Aviation a new generation contract, Balzac, to support the French Air and Space Forces' Mirage fleet. This follows from the Ravel contract which guarantees excellent Rafale availability for the armed forces. Covering a period of 14 years, this verticalised contract includes all through life maintenance activities for the French Mirage 2000, excluding the engine and the ejection seat".

"On 19 January, six Rafales flown by the Greek Air Force's crews, took off from an east side to the Tanagra Air Base. Our CEO was a guest at the ceremony, presided over by the Greek Prime Minister. The entry into operational service for these first six Rafales in the Hellenic Air Force 332 Squadron clearly demonstrate the strong partnership between France and Greece, just one year after the signature of the contract for 18 aircraft".

"On 24 March, the CEO and the Greek Defence minister signed a new contract for six additional Rafales in Athens in the presence of the French Minister of the Armed Forces. This will bring the number of Rafales operated by the Hellenic Air Force to 24. This year, two Greek Rafales also took part in the traditional 14th of July parade".

"In late January, Dassault Aviation attended the second edition of La Fabrique Défense trade show in Paris alongside GIFAS and the French aerospace industry. For three days, defence and industry professionals gave a large number of young people the chance to discover the challenges of defence and to find vocations, training opportunities, and professions for their future".

"On 10 February, Éric Trappier and Air Vice Marshal Yusuf Jauhari, Head of Defence Facilities Agency for the Indonesian Defence Ministry, signed a contract in Jakarta for the purchase of 42 latest generation Rafale aircraft in the presence of French Defence Minister, Florence Parly. Once the contract

Rafale

comes into effect, Indonesia will become the eighth country to purchase a Rafale and the seventh international customer and the first country having never had a Dassault aircraft to acquire new Rafales".

"Now we're going to continue the development of work in France on our F4 standard, which is the armed forces standard for the UAE and for France, the launch of the productivity works to allow Batch 5 contracts for 2023; around 42 aircraft".

As for military support, we are delivering the retrofits of Mirage 2000D. The Mirage 2000D will keep flying together with the Rafale aircraft air/air and air/ground improvements. Ravel for Rafale, or ATL 2 for Ocean, and Balzac contract for the Mirage 2000D but also for the other Mirage 2000 that will still be flying in the coming years".

"Future Combat Air System launched in February 2020. Phase 1 work was completed at the beginning of the year. We are waiting for the contractualisation of the Phase 1B after Phase 1A. This contract should have been signed at the end of last year or before the end of 2021, and we encountered a few interpretation difficulties of what 'prime contractor' means between Dassault and Airbus, and we are still at that point right now".

"For the export support for our fleets and all the service platforms that we're setting up to improve the support and be as close as possible to our clients for all the Rafales that were delivered to four countries - Egypt, Qatar, India and Greece. Our training centre in Mérignac is still running, especially now, to train pilots and Greek mechanics who have bought the Rafale".

"The contract for the supply of 20 MALE Eurodrone systems, i.e. 60 aircraft and their support for five years, was signed at the end of February by OCCAR and Airbus Defence and Space, which is the prime contractor for the programme. Dassault Aviation is one of the first three main subcontractors. It is specifically responsible for flight controls and mission communications".

"The Falcon 6X first production has completed a world tour with its team of onboard engineers and technicians. This summer the 6X will be facing the hot Middle East weather. Then it will fly low altitude routes over the desert to test the peak efficiency of the environmental control system. This follows on from the extreme cold tests which were carried out last year in Iqaluit in Canada where the aircraft was tested at minus 37 degrees Celsius. The first customer aircraft are currently being finalised at our Little Rock facility in Arkansas".

Falcon 6X

"Falcon 10X, we are still developing it. So, this is an ultra-long range aircraft. We are developing a new cockpit. We have a technology and innovations centre. All this was presented. The cabin; we are really insisting on that in terms of comfort because these are long flights, because it's an ultra-long range aircraft, and the design has already received a certain number of awards thanks to the mock-ups of size one that we have manufactured and that we're taking around the world so that our future clients might realise how pleasant it is and how efficient this cabin is once this aircraft will be flying. The state of the programme - we finished the wind tunnel test. We have produced the first parts of the Falcon 10X. The development of the Pearl10X engine is taking place well with 1,000 test hours. So therefore we are quite satisfied with this development. But of course, it's a very ambitious plan and the COVID issues have stopped us from working as we usually do, with an integrated platform in Saint Cloud before each one goes back to his company to carry out the ad hoc developments. So all the difficulties in 2020/2021 can be felt on our programme. But we're still ambitious and we are sticking to this schedule for late 2025".

(All photos: Dassault Aviation)


A fully loaded Rafale off on a mission

Brahmos remains at the forefront of 'Make-In-India' and 'Make-for-the-World'

By signing the historic export contract with the Republic of Philippines in January this year to deliver world's fastest and deadliest supersonic cruise missile Brahmos to the Armed Forces of Philippines, BrahMos Aerospace has charted a new frontier to fulfil New Delhi's 'Make-in-India' and 'Make-for-the-World' aspirations.

The Defence Joint Venture (JV) entity involving India's DRDO and Russia's NPOM has been manufacturing the state-of-the-art Brahmos Weapon System for the Indian Army, Navy and Air Force. The highly versatile Brahmos has been widely reckoned as the most powerful precision-guided system of 21st century owing to its supersonic speed, impeccable accuracy, complex manouverability and deadly firepower to completely decimate high-value land and sea-based targets from stand-off ranges in all-weather conditions.

The multi-role, multi-platform Brahmos, since its maiden launch on 12 June 2001, has undergone numerous development trials and user practice trials from ground, sea and air platforms – thus establishing an unbeaten record having highest success rate.

Having been inducted in the Indian Navy as the 'prime strike weapon', Brahmos has immensely bolstered India's maritime might and outreach. Both the anti-ship and land-attack variants of the weapon are operational in the Navy.

Indian Army's artillery arm has raised several Brahmos land-attack cruise missile (LACM) regiments to safeguard India's frontline land border positions. The Indian Air Force (IAF) has also operationalised Brahmos LACM squadron.

On 20 January 2020, the IAF commissioned the formidable Tigersharks Squadron consisting the Sukhoi-30MKI fighter platform armed with the powerful Brahmos air-launched cruise missile (ALCM) system. It became the 'first-in-the-world' weapon-platform combination having a frontline fighter aircraft armed with a highly manouverable supersonic cruise missile which made India the first and only country to complete the "supersonic cruise missile triad".

After charting innumerable milestones since its inception in February 1998, BrahMos Aerospace on 28 January 2022, achieved yet another historic feat when the JV entity signed an export contract with the Philippines to deliver shore-based Brahmos anti-ship weapon systems to the Armed Forces of Philippines.

"With this landmark export contract, the world-class Brahmos brought the first and foremost major breakthrough in India's military exports front and became the first full-scale weapon set for delivery to a responsible, friendly foreign customer nation," according to Mr. Atul Dinkar Rane, CEO & MD of India-Russia JV entity BrahMos.

As India has entered the 76th year of Independence with a strong resolve to build an "Atma Nirbhar Bharat" encompassing modern, high-end defence technology through uninterrupted 'Make-In-India' and 'Make-for-the-World' endeavours, the historic Brahmos export deal has come as a shot in the arm.

"Backed by the Government of India's forward-looking policies to bolster the country's status as a net exporter of weapons in the coming years, the Brahmos export breakthrough has come at a very appropriate time. BrahMos Aerospace, the flagbearer of 'Make In India' in defence production and indigenisation, is now going to 'Make for the World.' This historic export deal has propelled forward India's aspiration to collectively achieve defence exports worth US$5 billion by 2025," says Dr. Sanjeev Kr Joshi, Dy CEO of BrahMos.

The JV entity, meanwhile, has set its sight on the future and has started the work to design and develop more advanced variants of existing Brahmos, including Brahmos-NG. This futuristic next-generation (NG) missile variant with its smaller, lighter and smarter dimensions, promises to redefine the battlefields of tomorrow in a decisive way by being deployed onboard a wider number of modern land, naval and air platforms in higher numbers.

Brahmos-NG promises to emerge as yet another potential weapon of export, thereby further widening India's military exports horizon in the coming years.

Courtesy: Brahmos Aerospace

Germany for 35 F-35's and munitions

Germany has requested to buy thirty-five (35) F-35 Joint Strike Fighter Conventional Take Off and Landing (CTOL) aircraft; thirty-seven (37) Pratt & Whitney F135-PW-100 engines (35 installed, 2 spares); one hundred five (105) AIM-120C-8 Advanced Medium Range Air-to-Air Missiles (AMRAAM); seventy-five (75) AGM-158B/B2 Joint Air-to-Surface Standoff Missiles-Extended Range (JASSM-ER); three hundred forty four (344) GBU-53 Small Diameter Bombs (SDB-II), etc. The estimated total cost is $8.4 billion.

UK for 513 Javelin's

United Kingdom has requested to buy five hundred thirteen (513) Javelin Lightweight Command Launch Units (LWCLUs). Also included are Javelin LWCLU Basic Skills Trainers (BSTs); Javelin Outdoor Trainers (JOTs); Javelin Vehicle Launcher Electronics (JVL-Es); Javelin LWCLU Train the Trainer Package, etc. The total estimated programme cost is $300 million.

Saudi Arabia for 300 Patriot's

Saudi Arabia has requested to buy three hundred Patriot MIM-104E Guidance Enhanced Missile-Tactical Ballistic missiles (GEM-T). Also included are tools and test equipment; range and test programmes; support equipment to include associated publications and technical documentation; training equipment; spare and repair parts etc. The total estimated cost is $3.05 billion.

Oshkosh delivers the 1st upgraded Stryker

Oshkosh Defense has delivered the first Stryker Double-V Hull Infantry Carrier Vehicle (ICVVA1) upgraded with the 30 mm Medium Caliber Weapon System (MCWS) to the US Army's Aberdeen Test Center (ATC) in Aberdeen, Maryland, where the system will undergo Production Verification Testing (PVT).

Kongsberg contract with Australia for NSM

Kongsberg Defence & Aerospace has signed an initial contract valued at MNOK 489 with the Commonwealth of Australia for Naval Strike Missile (NSM) capability. On 5 April 2022, the Federal Government announced the accelerated acquisition of the NSM to replace the Harpoon Anti-Ship Missile on the Royal Australian Navy's ANZAC Class Frigates and HOBART Class Destroyers.

Gulfstream G800 makes 1st international flight

Gulfstream Aerospace Corp. announced that the all-new ultralong-range Gulfstream G800 made its first international flight just weeks after the aircraft's first flight. The G800 made its first flight on 28 June and shortly thereafter, the Gulfstream flight test team completed additional testing requirements, including a long-duration flight of more than eight hours and operations beyond the aircraft's maximum operating speed and cruise altitude of Mach 0.925 and 51,000 feet/15,545 meters, respectively.

CF34 engine line passes 200m FH

The CF34 engine line has surpassed 200 million flight hours and 157 million flight cycles. In the history of GE and CFM, only the CF6 and CFM56 engine lines have accumulated more commercial flight hours. The CF34-1A engine entered service on the Bombardier Challenger 601 Corporate Jet in 1983. There are more than 600 Bombardier Challenger and CRJ 100/200 business jets in service.

Norway for 205 AIM-120 AMRAAM's

Norway has requested to buy up to two hundred five AIM-120 D-series Advanced Medium-Range Air-to-Air Missiles (AMRAAMs); up to sixty (60) AIM-120 C-8 or D-series AMRAAMs; and four (4) AIM-120D AMRAAM Guidance Sections, etc.

GA-ASI MQ-9A for USMC

General Atomics Aeronautical Systems was awarded a contract for eight MQ-9A Extended Range (ER) Unmanned Aircraft Systems as part of the ARES Indefinite-Delivery/Indefinite-Quantity (ID/IQ) contract.

Estonia for 6 M142 HIMARS

Estonia has requested to purchase up to six M142 High Mobility Artillery Rocket System (HIMARS) Launchers; thirty-six (36) M30A2 Guided Multiple Launch Rocket System (GMLRS) Alternative Warhead (AW) Missile Pods with Insensitive Munitions Propulsion System (IMPS) and Frequency Modulated Continuous Wave – Directional Doppler Ranging (FMCW-DDR) Proximity Height-of-Burst (HOB) Sensor Capability, etc. The total estimated cost is $500 million.

Korea for 31 MK 54 torpedoes

Korea has requested to buy thirty-one MK 54 All Up Round Lightweight Torpedoes. Also included is Recoverable Exercise Torpedo (REXTORP); Storage and Issue (S&I) facility; air launch accessories for rotary wing; classified and unclassified torpedo spare parts; torpedo containers; torpedo support equipment to include test equipment and tools etc. The estimated total programme cost is $130 million.

USAF, Raytheon test AMRAAM F3R

The US Air Force and Raytheon successfully conducted the first AMRAAM F3R, an AIM-120D3 missile, live-fire test against a target. The test used production missile hardware developed under the AMRAAM Form, Fit, Function Refresh programme, which updates both the missile's hardware and software. The AIM-120D3 combines System Improvement Programme 3F software updates with F3R hardware.

Raytheon, NGC in 2nd hypersonic test

Raytheon in partnership with Northrop Grumman, successfully completed its second flight test of the scramjet-powered Hypersonic Air-breathing Weapon Concept, or HAWC, for the Defence Advanced Research Projects Agency and the US Air Force.

The Hypersonic Air-breathing Weapon Concept, or HAWC, team completed a second flight test using Northrop Grumman's scramjet engine.

Norway for StormBreakers

Norway has confirmed its intention to procure the Raytheon StormBreaker smart weapon from the US Air Force. Preparations are now underway to integrate the network-enabled weapon into the capabilities of the Royal Norwegian Air Force. StormBreaker is a fielded munition on the US Air Force's F-15E Strike Eagle, and the weapon has performed various live drops and weapons evaluations since.

Australia for 80 JASSM ER's

Australia has requested to buy eighty Joint Air-to-Surface Standoff Missiles - Extended Range (JASSM ER) (AGM-158B with telemetry kits and/or AGM-158B-2 configurations). Also included are missile containers and support equipment; JASSM training missiles; weapon system support; spare parts etc. The estimated total cost is $235 million.

Netherlands for 96 Patriot GEM-T's

Netherlands has requested to buy ninety-six (96) Patriot MIM-104E Guidance Enhanced Missile-Tactical (GEM-T) ballistic missiles. Also included are tools and test equipment; range and test programmes etc. The estimated total cost is $1.2 billion.

NG's AARGM-ER

Northrop Grumman successfully completed the third live fire test of its AGM-88G Advanced Anti-Radiation Guided Missile Extended Range (AARGM-ER). The US Navy launched the missile from an F/A-18 Super Hornet aircraft recently at the Point Mugu Sea Range off the coast of California. Utilising its advanced emitter acquisition system, the missile detected a land-based threat and engaged the threat system.

Airbus tests firefighting kit on A400M

Airbus has successfully tested a removable firefighting demonstrator kit on the A400M during a flight test campaign in Spain. The test campaign took place in daylight conditions with a minimum operating height of 150ft, flight speeds as low as 125 knots and drops involving up to 20 tonnes of water from the current tank in less than 10 seconds. The main objective of the campaign was to validate the drop water quantity and time as well as the ability of the A400M to carry out this new role with the kit.

Moroccan Forces order H135s

The Moroccan Forces Royales Air have ordered a fleet of H135s for military primary training missions. The light twin-engine H135 will be used for training pilots to perform a wide array of demanding missions including utility and search and rescue.

Dassault certifies dual HUD on Falcon 8X

The FAA and EASA have approved use of Dassault's advanced dual head-up display known as FalconEye, on the company's Falcon 8X very long range trijet, adding to the aircraft's low visibility operations capability. The dual HUD configuration will ultimately permit an EFVS-to-land capability in near zero-zero conditions, pending new EASA regulations. The dual HUD option will be certified on the Falcon 6X, due to enter service mid-2023, and on the ultra-long range Falcon 10X, planned for certification in late 2025.

BAE contract for additional M109A7's

BAE Systems has received a $299 million contract from the US Army for the production of 40 sets of M109A7 Self-Propelled Howitzers and their companion, the M992A3 ammunition carriers.

Sikorsky S-92 fleet in 2 million FH

The global fleet of the multi-mission Sikorsky S-92 helicopters is rapidly accumulating flight hours, surpassing 2 million flight hours in a variety of missions including search and rescue, oil and gas transportation and VIP transportation in 28 countries. The S-92 was in service for 12 years when it reached 1 million flight hours. Just six years later, the fleet operates in 28 countries and its flight hours have doubled.

American Airlines for Boom Supersonic Overture

American Airlines and Boom Supersonic announced the airline's agreement to purchase up to 20 Overture aircraft, with an option for an additional 40. American has paid a non-refundable deposit on the initial 20 aircraft. Overture is expected to carry passengers at twice the speed of today's fastest commercial aircraft.

LM delivers HELIOS

Lockheed Martin delivered to the US Navy a 60+ kW-class high energy laser with integrated optical-dazzler and surveillance (HELIOS), the first tactical laser weapon system to be integrated into existing ships and provide directed energy capability to the fleet. Integrated and scalable by design, the multi-mission HELIOS system will provide tactically relevant laser weapon system warfighting capability as a key element of a layered defence architecture.

Preparing for speed

Italian fast jet pilot training at Lecce

Coming from Lecce city over the Strada Provinciale 362, you finally turn right on to the Viale dell' Aeronautica, the road that leads you straight to the main entrance of Italian Air Force base Lecce-Galatina. The road, which gives access to the air base, is the route which every Italian fighter pilot has taken in the early days of their career when following the jet aircraft training course of 61 Stormo (Wing).

The air base, which was established in 1931, is located in a rural area of the most southern part of the Italian country, close by the sea where the Mediterranean connects with the Adriatic Sea. It is an ideal area for the daily ongoing training flights and although the area attracts lots of tourists, the aircraft have enough airspace over sea to avoid the popular landscape and cultural attractions.

61 Stormo

When we arrived at Lecce, being welcomed by our 61 Stormo hosts, the flying sequence of that day had already started. The flight training activities normally starts around 7 AM and continue into the evening for scheduled night flying. 61 Stormo operates several types of jet aircraft, like the Alenia Aermacchi MB-339, which is present with the earlier A and the improved CD models. Furthermore you can find at the base Leonardo T-346A trainers, while the wing awaits further deliveries of another Leonardo built asset, the T-345A which will replace the aging MB-339's in the years to come. 18 of these new jets have been ordered by the Aeronautica Militare Italiana (Italian Air Force), while a future overall requirement of 45 aircraft is considered. Lecce's 61 Stormo includes 3 active training squadrons, namely 212 Gruppo, 213 Gruppo and 214 Gruppo. The wing also houses 10 Reparto Manutenzione Velivoli (Aircraft Maintenance Unit), a maintenance and overhaul unit for the MB-339 and T-346 aircraft and also taking care of the multi coloured MB-339's of Italian demonstration team "Frecce Tricolori".

Jet training

When the new student fighter pilots arrive at 61 Stormo, they join 214 Gruppo where Phase II training of the Italian Air Force training syllabus is executed, which is basic for all pilots who can be appointed for helicopters, fighter jets, transport aircraft and Remotely Piloted Aerial Systems (RPAS) or so called drones. Here you learn to handle the aircraft, with basic elements how to take-off and land. 214 Gruppo uses the MB-339A aircraft, which is in fact re-named as an AT-339A for military use in Italy. Student pilots

who are selected to continue for fighter aircraft or RPAS training will continue for Phase III in 213 Gruppo making use of FT-339C (Italian military name for MB-339CD), which differs from the AT-339A by improved and modernised flight controls and avionics. Passing the Phase III course with a positive result, will deliver the students their wanted military pilot license. Jet fighter pilots will then join 212 Gruppo for the pre-operational Phase IV, which is focussing at various tactical aspects like formation flying, low-level flying, Ground Controlled Approach (GCA), Night Vision Goggles (NVG) flying, weapon training and aerial refuelling and is called Lead In Fighter Training (LIFT). For this training, 212 Gruppo is equipped with M-346 jet aircraft which In Italian service becomes T-346A and are in use since 2014. The T-346 is powered by two Honeywell F124-GA-200 turbofan engines and achieves a maximum speed of almost 1100 kmph or 1.2 Mach, it can reach an operational ceiling at 45.000ft and stay airborne for more than 2.5 hours. This Leonardo built aircraft is rather successful, when currently also in favour for operational pilot training in Poland, Israel, Singapore and Qatar and on order for Greece, Egypt, Azerbaijan, Turkmenistan and Nigeria. Next to pilot training, the M-346 can be selected as a Light Combat Aircraft (LCA) with a total of 7 pylon stations beneath the aircraft, capable to carry multiple types of weapons or fuel tanks to extend the flight range.

212 Gruppo

In the offices of 212 Gruppo, we meet one of the squadrons instructor pilots, Major Giuliano G., who accumulated 1000 flying hours on the Tornado at Ghedi Air Base

Badge 61 Stormo/Wing

Badge 212 Gruppo/Squadron

Badge 213 Gruppo/Squadron

Badge 214 Gruppo/Squadron

and now telling us more about the LIFT (Lead – In To Fighter Training) at Lecce. The Phase IV training is a mix of actual flying in the T-346 and virtually in a flight simulator, together composing the advanced Integrated Training System. The system consists out of various flight and mission simulation systems, as well as multi-media and classroom courses, mission planning and training management systems, and furthermore an Integrated Logistic Support (ILS) service which manages the squadrons aircraft and simulators for optimal use. The sophisticated Full Mission Simulators (FMS) of this Leonardo system in use by 212 Gruppo, which have a 360 degree view and a cockpit lay-out which is 100% identical to the real jet, are capable to train all kinds of procedures and flight scenarios. One of the features of these virtual simulators include the ability to conduct real-time formation flying with actual T-346 aircraft in flight. Although joining virtually an actual flight, the pilot in the simulator sees no difference with the real aircraft in formation which are projected in the simulator and they can carry out their planned mission as if they are all flying together. To prepare such a mission, the pilot of the simulator joins all pre-flight briefings, like weather and ATC, together with the flight crew of the real T-346. The IFTS further makes use of several Flight Training Devices (FDS) simulators which are less advanced than the FMS and for example include a cockpit view of 180 degrees.

The technology of the Embedded Tactical Training System (ETTS) in the M-346, but also in the FMS simulators, offers tactical training while integrating the aircrafts' sensors and (virtual) weapons against the enemy forces, generated by the GBTS computers. According the instructor pilot, the total of about 130 flights hours to be accumulated in approximately 10 months by the students in Phase IV, is more or less equally divided over flightsim and aircraft. Major Giuliano mentions that the knowledge level of pilots, about the aircraft and all its modern systems, who now pass Phase IV is very high and making the integration of the pilot into an operational jet squadron more smooth. Major Giuliano recalls his transition into

the Tornado squadron when the Phase IV training was executed on the MB-339. Without specific knowledge on things like ECM (Electronic Counter Measures), laser bombs, hostile environments, missiles and FOX-3 (term for using air-to-air munition), bogey's (enemy aircraft) or how to perform GCA, you can notice a knowledge gap as you are on a medium knowledge level when entering a front line unit. This will make it more demanding for a new pilot to catch up when already in a squadron.

Gruppo 213 and 214 are also making use of flight simulators for their training purposes, however these are more basic equipped, necessary for the squadrons general focus at (basic) flight manoeuvres.

The modern T-346's of 212 Gruppo, with fully digital flight controls plus avionics and both cockpits equipped with Head-Up Displays (HUD) and Multi-Function Displays (MFD) and Hands On Throttle And Stick (HOTAS) controls, the aircraft is ideal to prepare the new fighter pilots for their transition to the Operational Conversion Units (OCU) flying the Tornado, the more modern Eurofighter or, the 5th gen, F-35 state of the art aircraft of the Italian Air Force.

The 3 squadrons of the 61 Stormo are not limited for Italian pilot training only. Other nations can make (commercial) agreements to outsource, their pilot training partially or as a whole at Lecce. Moreover,

the Phase IV training activities of 212 Gruppo have now been installed in the International Flying Training School (IFTS) together with Leonardo offering dedicated pilot training to other interested nations besides main client Italy. During the visit to Lecce, student pilots from Qatar, Germany, Saudi Arabia, Austria, Greece, Argentina and Singapore could be found at the base. The pilot trainings courses for other nations follow in general the Italian course syllabus, but in practice the elements can be adapted according the clients desires. The same will count for students from Japan who will join the IFTS for a specific Phase IV training in the course of 2022. To high light the new IFTS initiatives, 212 Gruppo has one of its T-346A's applied with some special additional markings including a large IFTS badge on the tail. The squadron also has a 212 Gruppo special decorated T-346, named "I Bianchi. The other Lecce squadrons also have their own a special decorated "Gruppo" jet, like the "I Verdi" FT-339C of 213 Gruppo and the "I Rossi" AT-339A of 214 Gruppo.

Decimomanu

Earlier, the Italian Air Force staff announced its decision to change the structure of 61 Stormo at Lecce. The plan foresaw that 213 and 214 Gruppo will remain at Lecce while the IFTS of 212 Gruppo will move with their T-346 aircraft to Decimomanu air base at the Italian island of Sardegna, where an entire building will be dedicated to the Ground Based Training System. In the past Decimomanu Air Base and its Air Combat Manoeuvring Instrumentation (ACMI) range saw regular aircraft detachments of several NATO members using the Air Weapons Training Installations (AWTI) facilities.

In 2016, Germany terminated as last NATO nation its participation in the facilities due to the high involved costs, leaving home country Italy as the only user. During the past few years the air base had several Air Force and Coast Guard helicopters continuously based for SAR and CSAR duties. The move of 212 Gruppo with its T-346A's to Decimomanu will bring back daily jet aircraft activity to the base and will take place in this years (2022) summer, when construction work for the new facilities is finished. The construction activities include a new IFTS campus which will hosts students, instructors, technical staff and includes recreational areas such as a restaurant and sports facilities, together with maintenance infrastructures for the M-346A fleet.

The transfer of this joint venture of the Italian AF together with Leonardo for the Phase IV pilot training to Decimomanu, will provide sufficient capacity and allows a more efficient use of available Italian air space. According Leonardo, a fully operational IFTS will have 22 T-346 aircraft, 2 Full Mission Simulators, 3 Flight Training Devices and together with 40 international instructors an annual capacity of 70 Lead-In Flight Training courses can be scheduled, amounting approximately 8000 flying hours. Although the majority of the instructors are Italian military pilots, the team is completed with civilian instructors and international exchange pilots, for example an F-16 pilot from the USAFE. All instructors, whether military or civilian, have completed the same instructors course to get them qualified at an equal level.

Lecce will continue with the Phase II and III syllabus pilot training activities of 213 and 214 Gruppo and, in the period to come, it will welcome the deliveries of the new T-345 trainer. With the arrival of the new aircraft, the Italian Air Force will also gradually phase out the AT-339A and FT-339C platforms from training operations until a final goodbye after an active career of decades.

Text and photos by Peter ten Berg

Preparing for Italy's future Light Utility Helicopter

All the way down South in Italy, Calabria occupies the "toe" of the country's boot-shaped peninsula. It's a sun-baked region of rugged mountains, old-fashioned villages and dramatic coastline. Since October 1996 the region hosts the 2° Reggimento Aviazione dell'Esercito "Sirio" (2nd Aviation Regiment), which is based at the international airport of Lamezia Terme. This rather new army base and unit consists of two flying groups. The 30° Gruppo Squadroni "Pegaso" and 21° Distaccamento Permanente AVES "Orsa Maggiore" which both fly the Agusta Bell AB-212 (local designation UH-212) and Agusta Bell AB-412 (local designation HH-412A). The 21st permanent detachment is at Cagliari on the island of Sardinia. The

Hovering over the main runway at Lamezia Terme are the three types currently used by the 2nd Aviation Regiment (photo: Erik Bruijns)

Italian Army Aviation has been present in Lebanon since 3 July 1979 under the name ITALAIR helicopter squadron. Since 2006 this detachment has been reorganised, according to United Nations Resolution 1701, and named as Task Force Italair. The 2nd Aviation Regiment has been involved in the "Leonte 2" peacekeeping mission in Naqoura, in southern Lebanon, taking care of the preparation and training of the personnel commanded in service at the Task Force Italair of the UN multinational contingent called United Nations Interim Force In Lebanon (UNIFIL). Italian Army led, the Task Force consists of pilots from the army, air force and navy and is making use of six UH-212's, all supporting an overall white colour scheme with UN markings. During these 43 years, the helicopters flew more than 53.000 flight hours, completed 1.300 medical evacuation, transported more than 180.000 passengers and 4.000 tons of cargo.

Light Utility Helicopter

The Aviazione Dell'Esercito, AVES (Italian Army Aviation), has been looking for a replacement of a number of its aging helicopters. Most of these were put in service between the 1970's and 1990's and are in need of replacement. With older flight controls and aging airframes, the Italian Army started to look for a general replacement of its Elicotteri da Supporto al Combattimento, ESC (Combat Support Helicopters) which consists of the Agusta A-109 and Agusta Bell AB-205, AB-206, AB-212 and AB-412. Next to the giant leap forward in technology, the optimization of the logistics with a single-platform fleet, instead of the current one based on five different helicopters helped in making the decision. Col. F. Bianchi, 2nd Aviation Regiment commander explains, "The LUH programme, beyond the objective

A HH-412 approaches a valley for a low level mission

Freshly painted UH-212 waiting to be ferried to Lebanon for another tour in the ItalAir mission

of progressively replacing all the assets currently in use in the light transport role, has the ambition to make the fleet more modern and rational. Our intention is to finetune the operational requirements for a more efficient logistics chain and also making possible a reorganisation of the Regiments of Support and Maintenance Squadrons. We do this while making the entire operation more homogeneous, streamlined and functional being based on a single type of set-up. With the A-109 having made its last flight on 14 October 2021, the UH-212 is set to be the next up in line for replacement, which is currently scheduled for 2024".

A couple of years left for the legacy 212 and 412. The Italian army has been using them for many years but is now eager to move to the new UH-169

The executive phase of the project started back in 2019, with Leonardo Helicopter Division having delivered the first of two AW169 Light Utility Helicopters on July 10, 2020. These were delivered in training configuration after parliamentary approval for the purchase of 15 to 21 AW169M's was granted in November 2019. The new helicopters, designated UH-169B by the Army, are formally configured as "Addestratore Basico Commerciale" (Basic Commercial Trainer) and will be used to start the training of the crews that will fly the final configuration of the helicopter, called "Multiruolo Avanzato" (Advanced Multirole). Gian Piero Cutillo, Managing Director of Leonardo Helicopters, said during the delivery ceremony: "It gives us great pleasure to celebrate with the Italian Army the delivery of its first AW169 in basic training configuration as an essential enabler ahead of the implementation of the new, broader LUH programme. The LUH will definitely represent the start of a new era in terms of capabilities, technical support, mission flexibility and interoperability in the lightweight segment. The new programme takes advantage of many decades of a successful partnership and continued exchange of information, intended to fully

The UH-169 is more nimble compared to its older cousins. The tail boom as can be seen here is one part that is smaller on the new helicopter

The first milestone reached is the completion of the training of 35 pilots and 31 flight engineers so far up to July 2022

understand the changing operational needs and how to address them through the possibilities offered by new technologies. We're committed to supporting the Italian Army to maximise the benefits of these new helicopters."

The UH-169B is based on the AW169M, the military variant of the AW169 light intermediate twin-engine helicopter, designed to carry out a wide range of tasks, including utility, surveillance, special operations, maritime patrol, land reconnaissance, training, rescue and firefighting. The requirements set for the program by the Ministry of Defence requested a helicopter that was already in service in other Italian armed forces or law enforcement agencies. It would require having Command and Control (C2) systems already in service or in the acquisition phase. A service life of 10.000 flight hours or no less than 30 years and the capability to communicate and transmit images and videos to the troops on the ground, both with Italian assets and in a joint/NATO environment, following the Army's Forza NEC (Network Enabled Capability) program. The helicopter should also be able to perform in a "dual use" role for civilian Search and Rescue (SAR), MEDical EVAcuation (MEDEVAC), surveillance, firefighting and support in the event of natural calamities.

The 4 bladed rotor of the HH-412 was already more efficient compared to the 2 bladed UH-212

Text and photos:
Erik Bruijns and Mark de Greeuw

Vega – The force of stars

A perfect man-machine integration, made possible thanks to the integrated helmet and display sighting system [IHADSS] that is built into the helmet (Photo: Erik Bruijns)

Along the Adriatic coast, in Italy's Emilia-Romagna region, close to the microstate of San Marino lies the city of Rimini. Known for being Italy's biggest beach resort, its beachside nightclubs and shallow waters, it is also the home of the 7th Reggimento Aviazione dell'Esercito "Vega" (7th Aviation Regiment), an Aviazione dell'Esercito Italiano (AvEs, Italian Army Aviation) flying unit, made up of about 800 soldiers. The regiment was established on 5 July 1996 at Casarsa della Delizia in the North of Italy, with the name of 7th Attack Helicopter Regiment "Vega". On 23 October 1998, as part of the reorganisation of the Army Aviation, it relocated to the Miramare di Rimini Air Base and after some further renaming the unit received its current name on 1 December 2003. Sharing the base with the Federico Fellini International Airport, the military side of the base changed its responsibility from the Italian Air Force (flying the F-104) to Italian Army in the late 1990s. The regiment is made up of two Flight Groups, the 25° Gruppo Squadroni "Cigno" with the NH Industries UH-90A and the 48° Gruppo Squadroni "Pavone" with the Agusta AH-129D "Mangusta", as well as the Support Group that deals with technical support and maintenance of the helicopters.

Operations

The 7th Aviation Regiment is a very particular aviation regiment within the Italian Army, because with two separate flight lines, it is able to perform all the tasks that can be assigned to an Army Aviation unit. This includes a variety of tasks in different configurations, defined, over time, by the careful evaluation of the operational scenario of use. This is done both within Italy, for homeland security, as well as in its deployments abroad. Specifically, the assets of the regiment can be called upon to conduct transport, firefighting support or escort and reconnaissance missions. In addition to these general missions, there

The UH-90A is perfectly suited to infiltrate behind enemy lines and deliver troops fast and efficient

The Spike ER missiles have different targeting and target tracking modes

are a number of specific and specialized tasks, such as recovery missions for injured personnel through CASEVAC (Casualty Evacuation) or MEDEVAC (Medical Evacuation) or isolated in a non-permissive environment (Personnel Recovery). In addition to these there are also missions like exploration and surveillance within the area of operations. There are also a number of normal tasks for homeland security, which consist of providing support to public institutions, upon specific activation of the Italian provinces, which require particular assistance and the use of means and skills during an emergency.

Since its reconfiguration, the 7th Aviation Regiment has participated with its crews and helicopters in various operations at home and abroad. Lt. Col. Giorgi, 25th Group Commander explains, "At home, in support of the homeland security, we have

The range of the Spike-ER missile allows to intervene at greater distances and in a more selective and accurate manner than the previous versions

been involved in different operations, some of which in cooperation with other Italian forces. One such operation is the "Strade Sicure" (operation Safe Streets), where the Italian Army has been working together with the Carabinieri and Polizia since 2008. It is perceived by many to be a counter-terrorist deterrence operation but, although it does fulfil this role to some extent in the capital and Italy's major cities, it was originally established primarily to provide additional personnel to the Prefects of Italy's Provinces and Metropolitan Cities in order to maintain public order. The aim has been to try to prevent petty crime and to supervise sensitive sites and visitor attractions. The missions and deployments abroad have included the countries of Albania, Kosovo, Somalia, Afghanistan and Iraq".

Lt. Col. Giorgi continues, "Twenty years of duty abroad, in which the crews of the 7th Aviation Regiment, operating in difficult and hostile scenarios, even in extreme climatic conditions, have shown high skills. Operating in Iraq and Afghanistan we have shown these skills in the most extreme environments. The experience gained during these deployments are extremely valuable for ourselves as well as the other units in the Italian Army. Not only to broaden the skillset of the crews involved, but also to develop the helicopters used in these conditions. Flying at high altitude in hot climates requires adoption of men and machine. Because of our continuous efforts, the men and women of the 7th Aviation Regiment have been awarded an important honour directly by the Head of State, on the 4th of November 2017. The Knight's Cross of the Military Order of Italy, the highest military reward".

Flying a mix between an older model attack helicopter and a brand-new transport helicopter, the assigned tasks are clearly different in nature. The Italian Army has however found a perfect integration of use for both helicopters in the Reconnaissance Surveillance Team (RST) or more commonly known as Purple Team missions. The Purple Team is a flight formation consisting of an escort helicopter (AH-129) and a tactical transport helicopter (UH-90), used flexibly, in operational support and logistical support missions, adapting to the possible evolutions of the current operating scenario. The Purple Team can have different configurations, which are defined by the careful evaluation of some factors. These factors can be such as, the assigned task, the presence of hostile personnel, the time available, the terrain, the threat and the presence or absence of personnel and civilians on the ground. In the recent current operating scenarios abroad, the Purple Team was used for the transport of personnel/material, logistical support, medical evacuation, exploration, escort and reconnaissance. The peculiarity of this team lies in the possibility of having a deterrence capacity of the AH-129 and the versatility of the UH-90 in an integrated manner, through the standardization of the various employment procedures, primary objective and crew training.

The new OTSWS (Observation, Targeting and Spike Weapon System) to control the new Spike-ER missile is one of the new features on the AH-129D

Acknowledgement: The authors would like to thank Lt. Col. Giorgi, Maj. Ceravolo and Cpt. Magrini as well as all the men and women of the 7th Aviation Regiment for their hospitality and help in making this article possible.

Text and photos:
Erik Bruijns and Mark de Greeuw

The 20 mm Oto Melara 197B machine gun is directly linked to the movements of the pilots head

An UH-90A hanging in front of a rocky cliff during a training mission. The UH-90A is used to operated in all sorts of environments

The Italian Army has found a perfect integration of use for both helicopters in the Reconnaissance Surveillance Team (RST) aka purple team.

Exercise centre Konya

Where Asian and European arms train together

For many military fighter pilots, the name Konya is a synonym for exercises that excel in intense training in a multinational setting. With such "train as you fight" exercises, the younger fighter crews are introduced to large scale multinational operations, where the more experienced pilots are enabled to deepen their tactics further and can share their knowledge with the whole community.

Essential for the success of such an exercise is a combination of several factors. The best results can be reached when an exercise can provide important elements like sufficient free air space, offer realistic, complex and various scenarios, include a variety of other (than only air force) defensive and offensive units and assets and have participants with aircraft that can contribute to a wide variety of mission roles and be complementary to the others.

Konya

3rd Main Jet Base Konya, with its annual Anatolian Eagle exercises, is considered to be a rather successful provider in realising such a challenging exercise environment and not only by its long career as an organiser. The Anatolian Eagle exercise can look back

at long track record which started back in 2001. Earlier, per 1998, two "Anatolian Flag" exercises had been initiated at Incirlik Air Base to gain further experience, after having successfully participated in the USAF Red Flag exercise at Nellis AFB in 1997. With the lessons learned and the ambition to enhance the flying combat training for Turkish air crews and to increase the inter-operability with other air forces, the Turkish exercise was renamed into Anatolian Eagle and moved to Konya in 2001. In that years early summer exercise edition, USA and Israel were the first participants to train with their fighter aircraft together with the Turkish Air Force. From that moment on Anatolian Eagle returned each year, more or less as a standard event on the annual international exercise calendar. Through the years the Turkish Air Force invested further in Konya air base in its facilities and provisions to maintain a perfect execution of the exercise and its missions into the future. Originally, the exercise was organised by the Turkish Air Force Command, but with the ambitious goals and improving the ability to develop the exercise further and adapting to new demands, a dedicated Anatolian Eagle Training Centre Command was erected

at Konya. In this perspective also a new international helicopter exercise was born, namely Anatolian Phoenix, and added to the "menu" in 2009. This exercise, which is in basic smaller than Anatolian Eagle, is focussing at Combat Search And Rescue (CSAR) training.

Being a member of NATO, Turkey was already joining regularly multinational exercises. Although they participated a few times in USA based flag exercises, the majority was done in Europe during exercises like "Tactical Air Meet", "Brilliant Arrow", "Joint Warrior", "Frisian Flag" etc. seeing mostly other NATO participants. Now that Turkey has its own exercise initiative, you see the interesting fact that the Anatolian Eagle exercise is not limited to NATO members only. Due to the

country's location in south east Europe, the Turkish exercise also attracts nations from the Middle East and Asian regions. The fact that you can see countries like Saudi Arabia, Qatar, Israel, Pakistan, Jordan and Azerbaijan next to all European air arms, makes the exercise for all involved very valuable.

The large exercise area in the direct vicinity of the 3rd Main Jet Base at Konya is also an important element of the success of nowadays Anatolian Eagle. Just north of the base an area, with a spanning of 215 nm from west to east and 180 nm from north to south, containing an exercise airspace from ground level up to 50,000 feet, the air crews are given an almost unrestricted

playground for the various mission scenarios between the blue and, opposing, red forces. Additional exercise aids include an "Air Combat Manoeuvring Installation" (ACMI) system and a variety of Surface-to-Air-Missiles (SAM) systems, which provide realistic mission threats to the complex flight scenarios that have to be executed. Another off-coast exercise area can be found over the Mediterranean and is used for maritime mission scenarios.

2022 edition

After two years without an Anatolian Eagle or Phoenix exercise in 2019 and 2020 due to the Covid-19 pandemic, the training returned again in operations in 2021. And now, although the pandemic is still not over, the improved situation to monitor

and control the virus, contributed also to conduct an edition in this year (2022). In the second half of June fighter aircraft of Jordan (F-16), Pakistan (F-16), United Kingdom (Typhoon) and Azerbaijan (Su-25) had gathered at the air base of Konya. Exercise days included 2 mission of which the morning wave concentrated on a Combined Air Operation (COMAO). The afternoon mission window was used for the participants to fly in a smaller set up.

The Turkish Air Force type for the exercise, concentrated on the F-16 Fighting Falcon and almost every unit that operates that type, had several fighters deployed to Konya. Furthermore an E-7T Wedgetail, from home base Konya, giving Airborne

Warning and Control System (AWACS) or so called Command & Control (C2) supported the exercise as well as tanker aircraft. Interesting element to AE2022 was the inclusion of Turkish UAV's. Although the ANKA-S operations remained out of sight, the other new UAV system from Baykar for the Turkish Air Force was a twin propeller driven Akinci flying its missions from Konya. The Akinci is a High-Altitude Long-Endurance (HALE) Unmanned Combat Aerial Vehicle (UCAV) and the first deliveries to the Turkish Air force took place mid last year (2021). The UCAV is specified with a cruise speed of 240 kmph, can fly up to 45.000ft, stay airborne for more than 24 hours and the 8 hardpoints can carry a variety of missiles and/or bombs. During AE2022 the Akinci was extensively displayed to the media in flight over Konya as well while slowly moving over the taxi tracks of the air base. The Akinci is equipped with an EASE radar for navigation together with actual and synthetic meteorological estimation, an Aselsan Common Aperture Targeting-System for reconnaissance-surveillance-targeting duties, an Electronic Warfare (EW) pod and a Signals Intelligence (SIGINT) module.

Although the Anatolian Eagle exercise focusses at the training of the fighter pilot, the supportive element of UAV's and more over UCAV's, will likely grow in the years to come.

Text and photos by Peter ten Berg


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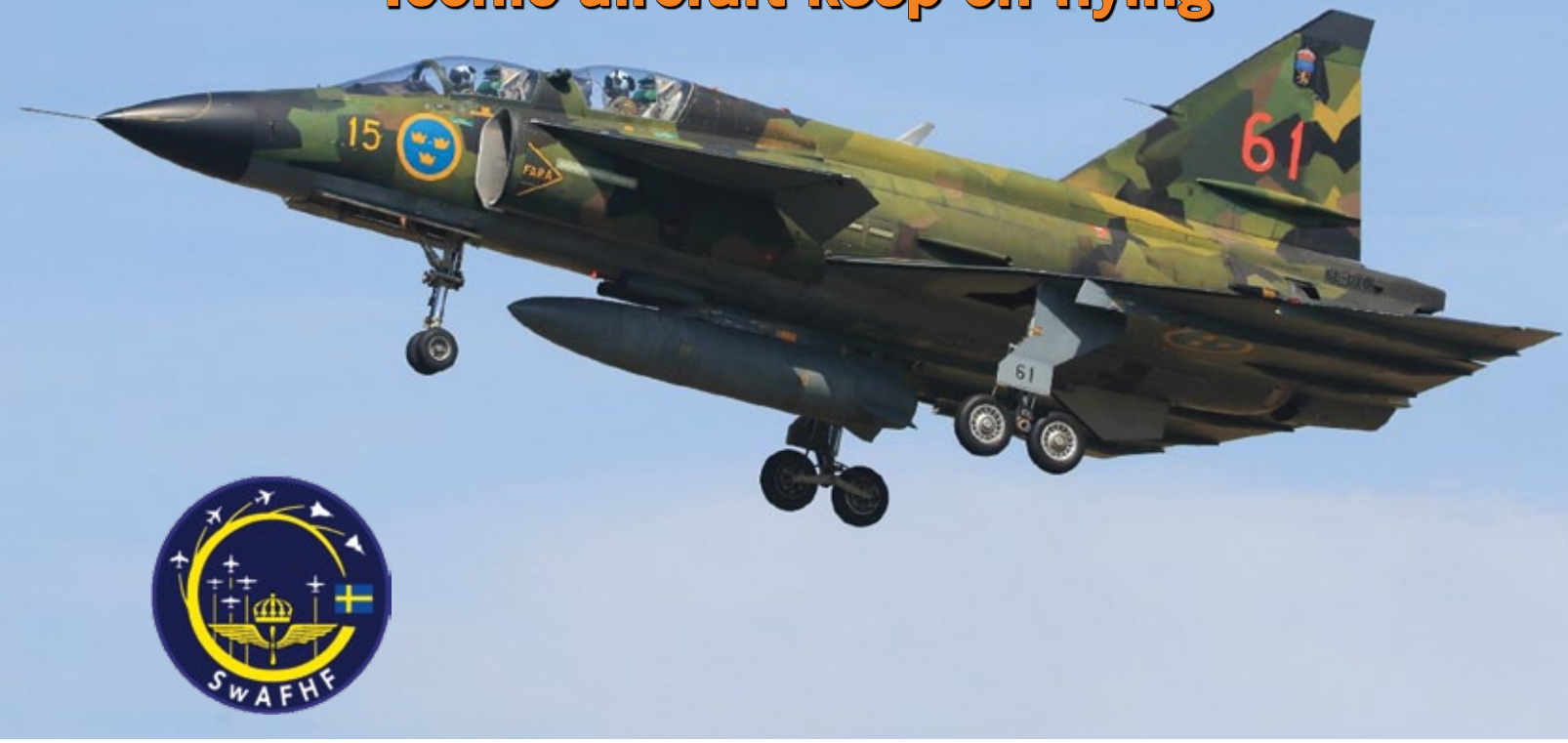
Swedish Air Force Historical Flight

Iconic aircraft keep on flying



There are numerous places in countries where you can find former operational aircraft, preserved in parks, resting on poles in public areas or military domains and even on display in all kinds of aviation museums. Here they serve the people who has keen interest in exploring history and provide an overview in the developments of a countries' military aviation, or even can attract youngsters to pursue his career as pilot.

Swedish AF Historical Flight

Sweden is one of the countries which has went a step further in maintaining a variety of former operational aircraft in fly worthy condition. The prime focus is on Sweden's domestic aviation industry around aerospace and defence asset producer, Saab AB. Throughout the year, a variety of aircraft out of their fleet do make regularly public performances during national events and in more rare occasions, they can be seen on display on international events.

The organisation who is responsible to keep Sweden's aircraft heritage in the air, is the Swedish Air Force Historical Flight (SwAFHF) based at Linköping Air Base, located some 200 km south-east of capitol Stockholm. Established in 1998, the SwAFHF is a private organisation of volunteers, often with a military career in the Swedish AF, with the ambition to preserve and fly aircraft types that were operational in the Swedish Air Force. Meanwhile, the fleet of the SwAFHF has grown to an impressive number of mainly Saab manufactured fighter aircraft. Although the aircraft are nowadays civil registered, the SwAFHF applies original colour schemes, camouflage patterns and unit marks to the aircraft, identical to the time when they were operational in the Svenska Flygvapnet, or Swedish AF. The Saab manufactured

flying jet-fighter inventory of the SwAFHF currently includes a single seat (AJS37) and twin seated (Sk37) Viggen, a variety that can also be found with a J35J and a Sk35C Draken, a J32B Lansen and the line-up is completed with a J29F Tunnan. Although the Sk60 is still operational as the Swedish AF basic jet trainer, international known as the Saab-105 where pilot instructor and student sit next to each other, the SwAFHF has already secured this type for their fleet with a specie in bare metal look.

International

Basically, the Swedish Air Force Historical Flight is organised for the national interest and events however, the SwAFHF also occasionally serves international audiences when its few appearances a year are scheduled outside Sweden. According the organisations website, 2022 international representation was planned for Denmark, Austria and the UK. For the later, the destination was shifted to RAF Fairford where it participated in the static display of the Royal International Air Tattoo, more known as RIAT. This time, a firm SWAFHF delegation displayed at RAF Fairford and included a Lansen, a Draken and a Viggen. The flightplan of the three historic aircraft from Sweden to the UK foresaw an extra stop enroute for refuelling. For this occasion, the Royal Netherlands Air Force Base of Volkel was chosen and apparently not without reason.

Volkel

On 15 July 2022, the Swedish aircraft showed up in the airspace over Volkel around noon and within a 10 minutes of interval, they touched down to stay here for a couple of hours. Volkel air base which is located in the south of the country, is host

for active 2 squadrons. 312 squadron is equipped with the last Dutch operational F-16's, until the type will be taken out of service in the course of 2024, meanwhile, the base is in transit to the F-35. The transit to the new 5th generation fighter became "visible", as by late June this year the other unit, 313 squadron, received its first four F-35 Lighting II aircraft. From now on and in a gradual pattern, follow-on deliveries of new F-35's will take place, while in the same time the number of F-16's will slowly decline. The F-16's have become a part of a contract with USA headquartered Draken International for a future aggressor or red forces training missions for various international clients. Next to the operational flying activities at Volkel, the air base is also hosting Historical Aircraft Volkel, or local called Historische Vliegtuigen Volkel (HVV), a group of volunteers working on aircraft types with a historic bond to Volkel. Part of the HVV is the Dutch Starfighter Foundation which concentrates it activities around the restoration of former Dutch AF F-104G # D-8114 towards a so called 200 hours phase inspection status. The Starfighter which was recently presented in an excellent status during the 70 years celebrations of 312 squadron, is now awaiting funds to procure the inspection aim essential General Electric J79-GE11A engine.

The connections between the Swedish and Dutch historical aviation collegial organisations, brought both of them together during the planned Swedish stop-over at Volkel, providing the opportunity to view each other's aircraft and exchange information and knowledge.

On 18 July 2022, the Viggen, Lansen and Draken aircraft made one more stop at the Volkel while returning back from the RIAT. This time, the visit was only for refueling of the three aircraft and were again airborne within 45 minutes towards their Swedish homebase.

Text and photos by Peter ten Berg

French Revolution celebrated

Bastille Day 2022: The annual air defile over Paris

The 2022 edition of the Bastille Day celebration in France, generally known as '14 Juillet', again witnessed a large parade in and over the capital Paris. The national event commemorates in basic the French revolution of 1789 by annually honouring all those who daily serve to protect the country's national and international territories and its citizens. The organisation of the national Bastille Day event framed the slogan 'share the flame' to this year's parade. Since World War I, the flame is not only a symbol of the personal offers given for freedom but also of hope and doing efforts for a better future.

The 2022 parade, brought 6300 participants together, including 5000

Fixed wing formations 2022

Formation	Theme	Type	Country
1	Opening "Big 9"	Alpha Jet	Patrouille de France
2	Protection French citizens and power force display	A330 MRTT; Rafale B & C	France
3	Evacuation operation "Apagan" (Afghanistan)	A330 MRTT; A-400 Atlas	France
4	Operation "Barkhane" and "Chammal"	C-135; Mirage 2000C and D; Rafale B and C	France
5	Deterrents	A330 MRTT; Rafale B and C	France
6	Air Defence	E-3F AWACS; Mirage 2000-5 and C; Rafale B	France
7	Air Police	Rafale B and C; Mirage 2000-5	France; Greece
8	Multi mission transport	A-400 Atlas; C-130 and C-130J	France; Germany; Belgium; Spain; Italy
9	Naval aviation	Rafale M; E-2 Hawkeye	France
10	Patsimar OPEX Narcops	Atlantic2; Falcon 50M	France
11	Navigation training	PC-21; Xingu	France
12	Counter Incident and civil protection	B-200; CL-415; Dash-8	France
13	25 years information, surveillance and reconnaissance operations	Reaper	France

soldiers on foot, 62 aircraft, 26 helicopters, 1 drone and numerous military vehicles and machines, completed with 200 horses of the French Republican Garde. The route of the parade always follows Paris' main street, the Champs-Élysées from the Arc de Triomphe towards Concorde square.

The parade in front of President Macron started with the traditional air defile, led by the French air force demonstration team Patrouille de France. The 8 Alpha Jets of the aerobatic team made a salute to the audience by deploying their smoke trails in the national colours in the air over Paris. Patrouille de France was followed by 12 separate fixed wing formation elements, each representing a specific theme. The formations were built up by a variety of combinations of fighter, surveillance, transport and tanker aircraft. Apart from familiar theme elements such as naval aviation, air defence etc, this year's parade included other themes like the Air Police missions. France is one of the regular contributors to the NATO Air Police missions in the Baltic region, where they provide rotational Quick Reaction Alert (QRA) services due to no or insufficient Baltic air defences. Operation Apagan, the French evacuation effort out of Afghanistan in 2021, received special attention with an A330 MRTT and an Atlas in formation. Other operations brought forward were operation Barkhane, the anti-insurgent operation against Islamic groups in Africa's Sahel region and operation Chammal in Syria and Iraq against Islamic State since 2014. The French Naval Aviation finally showed aircraft which are active in Patrol, Surveillance and Intervention Maritime (PATSIMAR) missions like against illegal drugs trafficking (NarCops).

Due to the nature of this national event, the aerial assets on display in this parade were all French. However, with all the international contacts throughout the year with military partners in combined missions, operations and exercise, the Bastille Day organising committee always

invites other nations to join the parade. As a new Rafale fighter customer, Greece was invited to join with two of their new aircraft in the parade. For the "Multi Mission Transport" formation, Germany, Belgium, Spain and Italy participated with Atlas or Hercules aircraft. Worth mentioning was the first participation of the new C-130J aircraft of the French-German Binational Air Transport Squadron (BATS) from Evreux Air Base. The same base plays a major role for the air defile, as the majority of fixed wing aircraft gathers at Evreux and perform a mass take-off in the hour prior to the parade over Paris.

Interesting participants in between the long rows of gathered aircraft at Evreux, were 5 Dassault Mirage 2000C's, also often referred to as RDI (to its "Radar Doppler Interception" upgrade), that conducted their farewell flight for the French Air Force earlier this year. A few weeks earlier, the final French unit "Escadron de Chase 2/5 - Ile de France" operating the 2000C had a closing ceremony at home base Orange, which also marked the final operational service day of the type in the French AF. Especially for Bastille Day, the delta winged Mirage 2000C's did a last flight to say goodbye to the large audience in Paris.

Photos and text: Peter ten Berg


115-YT

Arrival of T-059 and T-060 at Vlb Eindhoven

Within 2 days, 2 Airbus A330 MRTT tankers aircraft were delivered to Vlb Eindhoven.

On 27 July 2022, A330 MRTT T-059 was delivered by Airbus from Getafe Airport in Spain. And on 29 July 2022, A330 MRTT T-060 was delivered. Seven Airbus A330 MRTT have already been delivered, with two more to go.

Of the nine A330s, five have Eindhoven as their home base, the other four go to Cologne. The aircraft are owned by six countries: Belgium, Germany, Luxembourg, the Netherlands, Norway and the Czech Republic. They should all be delivered by 2024.

The A330 MRTT can accommodate 267 passengers and 45 tons of cargo. In addition, the aircraft can be converted in a short time into a flying infirmary with 6 intensive care units and 16 stretchers for the transport of wounded from a war or mission area. One of the 8 devices always remains available as a medical device, so that there is no delay in converting the device.

The Netherlands is allowed to use the A330s for a total of 2,000 hours per year. Germany is a major user with 5,500 hours, Belgium has 1,000 hours available. The A330 will replace the outdated KDC-10 fleet of the Dutch Air Force. The latest aircraft that landed on Tuesday bears the registration T-060.

On 29 July 2022, there were no fewer than five A330 MRTT aircraft at vlb Eindhoven. T-054, T-057, T-058 were lined up on the eastern platform; while on the western platform were the new A330 MRTTs T-059 and T-060.

Text and photos:
Joris van Boven and Alex van Noije

New Spanish A330 MRTT at Eindhoven

In June 2021, the 'Ejército del Aire' (Spanish Air Force) agreed with the Spanish flag carrier Iberia to take over three Airbus A330-200 aircraft. During the Corona crises, many passenger aircraft were stored and it was not clear if these aircraft would be needed in the future.

As the Spanish Air Force needed additional tanker capacity, the three A330-200 would be transferred; and in November 2021 the contract was signed for the formal transfer.

The first Airbus A330 was transferred at the end of 2021, receiving the temporary registration T.24-01 and code 452-01. Early 2022, the second A330 was transferred registration T.24-02 and code 452-02. And number three with registration T.24-03 and code 452-03, is expected to arrive in 2023. These aircraft will initially fly in the passenger role and between 2023 and 2025, the aircraft will be converted by Airbus at Getafe Air Base (ICAO:LEGT), into the MRTT tanker role. Whereby a hose and drogue refueling system and a specific Medical Evacuation (MEDEVAC) kit will be added. After the conversion, the registrations will be altered to TK.24-01, TK.24-02 and TK.24-03. The three aircraft will be based at Torrejón Air Base (ICAO:LETO), where they will fly with the 542 Escuadrón (452 squadron) of the 45 Grupo (45 Wing).

"With the addition of A330 MRTT to its fleet, the Spanish Air Force acquires a key and proven new capability, that will enhance and support overseas operations, as well as medevac missions, on which the aircraft played a key role during the Covid-19 pandemic crisis worldwide", stated Jean-Brice Dumont, Executive Vice President Military Aircraft at Airbus.

The A330 MRTT is the only next generation strategic tanker and transport aircraft flying and available today. The large 111 tonnes/245,000 lb basic fuel capacity of the successful A330-200 airliner, from which it is derived, enables the A330 MRTT to excel in Air-to-Air Refuelling missions without the need for additional fuel tanks. Thanks to its wide-body fuselage, the A330 MRTT can also be used as a dedicated transport aircraft able to carry up to 300 troops, or a payload of up to 45 tonnes/99,000 lb. It can also easily be converted to accommodate light and intensive care stations for Medical Evacuation (MEDEVAC).

Visit to Eindhoven AB:_On 22 July 2022 and on 8 August 2022, the A330 with registration T.24-02 and code 452-02 visited Eindhoven Air Base in the Netherlands (ICAO:EHEH), under EATC supervision.

EATC:_The European Air Transport Command is a single multinational command. Its headquarters is located at Eindhoven air base in the Netherlands. The fleet is composed of over 150 assets

located at the national air bases of the seven member nations. The EATC is a unique organisation for military air mobility, including transport, air-to-air refueling and aeromedical evacuation within Europe. The overall objective is to improve the effectiveness and efficiency of the member nations' military air transport efforts. The idea of EATC was born in 1999. The driving parties were France and Germany, who looked back at a strong bilateral cooperation in the field of air transport. As NATO and the EU identified shortfalls in the domain of strategic transportation, initiatives were developed over the years, aiming at the highest degree of cooperation in a multinational command structure with an operational and a functional authority. The ground rules for EATC were set in September 2010 and EATC was inaugurated at Eindhoven air base by the four founding members, The Netherlands, Belgium, France and Germany. Later Luxembourg, Spain and Italy joined the ETAC.

Text and photos:
Alex van Noije and Joris van Boven
(As reference, a genuine MMU A330-MRTT photo, the T-060 that arrived in August)

Air Marshal (R) Harish Masand says...

I learnt More than Flying from Them: "BABA" KATRE

Writing this down on Teachers' Day, my thoughts went back to this great professional and personality who set an example for me on how to live one's life and conduct oneself. Even if Lakshman Madhav Katre, popularly known as "Baba" Katre had not risen to be the Chief of the Air Staff, we would always remember him as someone to emulate and inspire us. That is when I decided to pen this down as an overdue tribute to someone who taught me so much, silently by example.

I first had the honour of meeting Baba Katre when I reported to my very first operational squadron, 37 Squadron or The Black Panthers operating Hunters in Hasimara. Reporting there on the 4 December 1968 from OTU, AF in Jamnagar and attending my very first Meteorological and Operations briefing in the Base Ops Room, I was immediately taken by Baba's personality and the way he spoke. Baba was then commanding the base at Hasimara as a Group Captain and after the meteorological and ATC briefing was over, he stood up and addressed the whole lot of us on conducting ourselves with dignity and in an officer-like manner with the large number of tea planters in the area. I think some folks had had some sort of altercation with the planters over the preceding weekend in one of the planters' clubs. If I remember correctly it was Kalchini club. Baba then looked like a double of Gregory Peck and even spoke a lot like him in that deep bass, masculine voice reminding me of Peck as the bomber commander in the movie "Twelve O'Clock High". Many thought of him as another Cary Grant. All in all, Baba was a very personable figure.

While we lowly Pilot Officers sitting in the back rows never got to meet him then or immediately thereafter, we slowly came across him in the Officers' Mess once in a while since he was staying single in the Mess in the so-called VIP room of Hasimara since Mrs Srilata "Sheila" Katre was in Delhi due to children's schools and education. Groupie "Baba" Katre would sometimes join us in the bar in the evenings for a couple of drinks with some younger company and though we hesitated a bit initially, his demeanour soon made us comfortable and we never felt that we were speaking to or mingling with a very senior officer. Baba also had a reputation of being a very knowledgeable and professional officer which we soon saw for ourselves whenever he spoke on various matters at the briefings. On weekdays at the bar whenever he came across, he would generally start a conversation on some military matter or a topic of general knowledge. That got most of us to visit the library more often to pick up books on military history or current events so that we could talk to him without making a fool of ourselves. That habit, initiated for me by Cecil Parker earlier in Jamnagar, stood me in great stead later in my professional and personal life. While he was very proper and correct in his behaviour at the bar or the dining hall of the Mess, following the laid-down timings for the bar on weekdays, he did let his hair down a

Hasimara (Photo: Samir Chopra/www.bharat-rakshak.com)

bit on weekends when he would suddenly ask, "anyone for —- club?" depending on which club he intended to visit that evening. Many of us would then jump in to his Jeep and he would take us to those places and introduce us to his planter friends to get us going socially, both in terms of improving our social graces as also to make friends with whom we could spend some good times, particularly on weekends since there was no other social activity outside of the base in that back of the beyond place like Hasimara. In such outings, we also saw how well he was received by the tea planters. On the way back, he even let me drive him back in his Jeep one time when he found out that I could drive well and at the same time did not overdo the drinking. Mrs Shiela Katre visited Hasimara briefly in the few months that Baba Katre stayed in Hasimara after I arrived and we only met her very briefly and formally in a Mess Party. Even Mrs Katre came across as a warm and friendly person while, at the same time, being very sophisticated and polished. Unfortunately, Baba left Hasimara soon after in the summer of 1969 and I got a very short stint under him.

Destiny, however, had plans of its own and I soon served under the Katres again in 1974 in the Air Force Academy at Dindigul, just outside Secunderabad. This time, I was surprised with his memory and the ability to remember names and faces of people who had served under or with him many years ago. Having freshly graduated from the Flying Instructors' School in Tambaram, I reported to AFA in June 1974. Reporting to Baba, the Commandant of AFA then as an Air Commodore, on the very first day, he called me by my first name while welcoming me to the Academy and said that "he had high hopes from me" in my tenure as an instructor under him. That initial remark made me work even harder to ensure that I performed to his expectations.

Baba's reputation had spread further in the intervening years with his handling of operations in Pathankot, a front-line base, during the 1971 War. While I did not personally serve under him there, I did hear a few snippets about how he had turned the base around during the War due to his foresight and ability to motivate the people around and under him as a leader. These snippets came from some of my friends in 20 Squadron which was in Pathankot during the war but was operating from Srinagar in May 1972 when I did the survival course there. Admiral Arun Prakash, serving in 20 Sqn during the 1971 War as a Lieutenant has this to say of Baba, "By the morning of 5 December, it had become quite obvious that 18 Wing, located just 12 miles from the international border, and home to some valuable IAF assets (including two squadrons of Hunters Mk. 56-A), was going to be an attractive target for PAF Mirage IIIs (by day) and B-57s (by night). Since much of the IAF's "counter-air offensive" task, in the West, had been assigned to these two Hunter squadrons, it was vital that the Wing not only remained at peak of functional efficiency, for operations, but that its flying-effort was astutely directed and targets selected for maximum impact on the enemy. Thus, all of us, junior aircrew, were surprised and mystified to see an Air Commodore in the Base Ops briefing, that morning. But things began to fall into place, when the whispered name "Baba Katre" began to go around. Although we were not clear about A/C Katre's role and designation, it soon became apparent that much of the day-to-day ops planning for 18 Wing, was being undertaken by him and our Boss, Wingco Parker, who were meeting frequently. For us, 'junior-joes' it was most reassuring to know that operational decision-making was in the capable hands of two most professional IAF officers of that era". The second person Admiral Prakash is obviously referring to is then Wg Cdr Cecil "Nosey" Parker who was commanding 20 Sqn at that time. Air Vice Marshal Cecil Parker, now settled in Secunderabad and a prolific contributor to the Vayu Aerospace Review journal, adds, "despite differences in age/seniority we had a close personal relationship dating back to 1951 when as a (thoughtless) flight cadet I got the better of Baba on the tennis court in the Sirhind Club in Ambala. As the operational commander he left me and my squadron completely alone and would not even come and have a drink unless I also invited the Stn Cdr (which I did the day my MVC was announced. Baba was a professional and a diplomat who handled air operations hands-off with finesse".

In AFA itself, he gave me a glimpse of his thinking and preparations for operations by training well during peace time. While I could narrate many instances of this, let me narrate just a few to highlight Baba's methods. I had landed up in AFA with very little flying and little cloud flying to get an instrument rating. On the Su-7, that I had flown prior to the Instructors' Course, I had barely managed the four hours of cloud flying needed to get a "White" rating. In AFA and, particularly in Hakimpet where I was initially attached for a few months to fly lead sorties for trainees and a lot of Vampires were idling on the ground, I managed to collect the cloud flying or 'actual' hours and got my "Green" rating on the HJT-16 Kiran. Soon after that, there was a really bad weather day with lot of clouds and pouring rain and we were not flying. Like everyone else, I was sitting in the crew room, having the most

At Hasimara

suitable snacks for that kind of weather, "hot pakoras" with "chai". The crew room phone rang and the Flight Commander, then senior Flt Lt Vinod Bhatia, picked up the phone. After a few mumblings which we couldn't hear, he called me and said the Commandant wanted to speak to me. After I wished Baba Sir, he immediately asked me what I was doing. When I told him, he curtly said, "Is this why we gave you a Green rating? You should be out in this weather training other people so that in war, this kind of weather doesn't prevent you from operating." I told Vinod what the Commandant had said and he promptly authorised a cloud flying sortie for me with Flt Lt Mohan "Dixie" Dikshit, my course mate and a co-instructor with us. I still recall that we were in cloud and rain through the sortie from soon after take-off at about 300 feet AGL all the way till we recovered on an NDB approach. That was the only navigational aid available at AFA those days. Thereafter, I kept doing these kind of sorties with full encouragement from my Flt Cdr and ACFI, then Sqn Ldr HS Riar. As a matter of fact, a stage came when we would do the complete air test or even an aerobatics sortie completely on instruments while the other instructor pilot acted as a safety pilot if ever something went wrong. Fortunately, that "if ever" never happened and we got tremendous self-confidence to fly in the most adverse weather or night and still perform the mission at hand which came in very handy, for me at least, later in operational squadrons.

Baba also used to take me along for the air tests sorties that he personally flew, particularly when the aircraft had a peculiar snag which he felt he needed to assess for himself. While totally a task master when it came to professional aspects, Baba and Mrs Katre were also very hospitable and socially friendly even with the most junior of instructors, like us. While demanding professional standards, he also showed a lot of empathy and compassion for the juniors, even for the flight cadets who may be struggling in some phase of flying so as not to ruin their career without a detailed review and a second chance, if required. So, he flew at random with different cadets and also meticulously went through the reports put up to him. Once, he called me and asked me if I could take Flt Cadet VS Ashok for a few sorties and teach him close formation since Ashok had been put up for suspension for being weak in formation flying. I found Ashok responded and performed when he was explained the theoretical aspects of formation flying and treated gently. Ashok went on to become a good Comm Sqn pilot later in his career. If it wasn't for Baba's detailed scrutiny of Ashok's documents and his compassion for cadets, the latter would have been just another another statistic in the list of those who didn't make it. At the same time, Baba did not accept any compromise in moral values and ethics in his subordinates. Much later when I was in Staff College as a DS, we had a case of some nine student officers in early 1985 who had obviously copied from each other in an exercise out of sheer laziness even though it meant little in their assessment. Baba was then the Chief and directed that the officers should be suspended and removed from the course. The case went to the High Court of Madras and though Baba had passed away in the meantime, the Staff College authorities persisted and finally got the judgment accepting their removal just before the course graduated.

Baba was also displayed his caring nature when it came to personal matters. I still recall when my future in-laws, Brigadier and Mrs Mitra, fixed a date for my wedding with their daughter, Malini, through their family pandit and found the most auspicious date as 25 November 1974 when we were in the last stages of the 113 Pilots' Course with the deadline of the passing out parade fast approaching. Both Flt Lt Nitin "Goofy" Gupte and I had got the same date for the wedding bells somehow. While I didn't want to leave my pupils till the course passed out and wanted to delay the wedding by a couple of months, Baba called us and said that this was also a very important event in our lives and we need to go and not disappoint our families who had made all preparations. However, the task and mission accomplishment being the most important, all he would give us is a week off in which to get married and get back. In that one week, I still recall the rush to Binaguri and Indore to make it back just in time. Before going, we were also to make sure that we had done all the dual sorties required for our pupils so that they could continue for that one week with just solo sorties to the extent possible. As soon as we got back, we are back to 5-6 sorties a day/night to make up and I still remember how tired Goofy and I used to be when we got back to the house we initially shared to quickly grab whatever Sunilla, Goofy's wife, and Malini had mustered up for dinner and fall asleep, sometimes even while having dinner. Even for the new year's eve in December 1974, Baba and Mrs Katre had organised a party in their house for many of us but we, the ones who were flying, were only allowed to come back around midnight to have one dance with our wives, kiss them happy new year and get back to night flying.

7 Squadron formation team

Mrs Katre, on the other side, would regularly organise events and dances like the "Kiran Night" and other social events where she encouragingly inducted all the newly-wed and young wives for various dances and plays and thus help build up their confidence in such and other welfare activities. On normal days, she also kept them occupied in the AFWWA shops so that the wives didn't sit at home waiting and worrying about their husbands. I found Malini benefitted from such activities and grooming from Mrs Katre tremendously. All in all, we were one big happy family in AFA with lot of work but also lot of play in the time that we had to spare. That is where I coined the phrase, "Work hard, Play hard" which I used later in my operational squadrons and other tenures. Malini got so good at organising such activities and leading the girls into having fun that when we were in senior appointments later, the young folks, both officers and wives, initially reluctant due to their own commitments or outlook, would later join in on their own since the events were full of fun and without compulsion. Even the airmen's wives joined her willingly in many such activities and outings that she organised regularly with and for them.

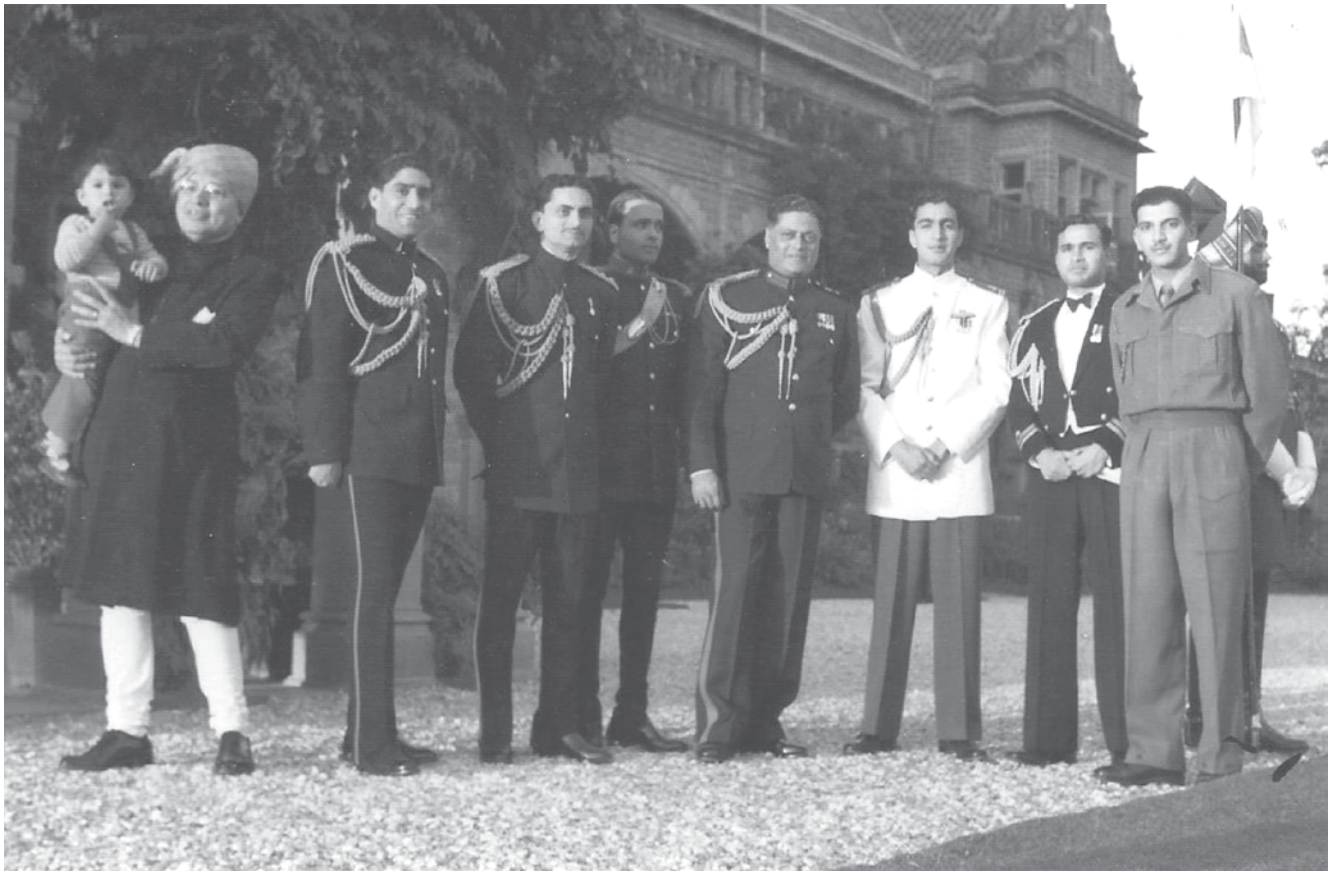
Unfortunately, my stint in AFA was also cut short soon after I got my Instructor's Category B, and while I was still working on accumulating 300 instructional hours to be able to upgrade to A2, with a posting

to 17 Sqn on MiG-21s. By then, I had just finished a year in AFA and did voice my concerns to the Commandant. Baba called me to the office and spoke to me at length patiently explaining why I needed to get onto MiG-21s as soon as possible since all I had before, as experience on operational aircraft, were the Hunter and the Su-7. Baba also said that A2 was just a symbol which I could later work for on the MiG-21, if I wanted though I didn't need it, but that I had more of a future as a combat pilot and unless I converted to the MiG-21 fast, I may just miss the bus since the Air Force was going in for a large number of MiG squadrons. He was so right in his assessment, as I realised later.

After a short stint in 17 Sqn, by the time, I reached 101 Sqn on MiG-21s in Adampur as an instructor in the end of 1976, Baba had returned from RCDS in the UK and had taken over as SASO in Western Air Command in Delhi. We kept calling on the Katres whenever we passed through Delhi and they were in town. Every time, when we left them after a very pleasant evening, Baba Sir would come to the gate and see us off even when he became AOC-in-C. Initially, I tried dissuading him from doing this since we could see ourselves out but he always came out saying that if we had taken the trouble to come and see them by driving through the traffic of Delhi, surely he could see us off. Needless to say, Baba remained humble despite the higher ranks he richly deserved and reached. In 1981, I was in DASI for a brief while before proceeding to Staff College and was staying with my elder brother, "Sonny" who happened to be in Communication Squadron at Palam at that time since Malini was with her parents expecting our first and only child. I particularly remember one occasion when I called on them at 25 Safdarjung Road which was then the WAC C-in-C's house, I think. Baba asked me why I had never mentioned my brother earlier. I told him that the topic had never come up before and since Sonny was in transports, I was not certain Baba would even know about him. Baba surprised me by saying that he had always thought that I was the best but Sonny had recently flown him somewhere in the Tu-124 and he thought Sonny was better than me. I told him that I was glad he felt that particularly since it was a Masand he was talking about. I passed this compliment to Sonny when I got home and found that even Sonny had come under Baba's spell when, in the kind of weather that they had flown in, Baba had sat in the cockpit all the while just watching how Sonny handled the situation without interfering or telling Sonny what to do.

We met again in Gorakhpur in 1983 during 1 Squadron's Golden Jubilee when I heard of Baba's feats as a young Adjutant of the squadron in 1947 when he saved the silver of 1 Sqn for the IAF even though 1 Sqn had been given to Pakistan during the division of assets. The greatest compliment I received later in my career, even though I do not think I deserved it, came for Air Mshl Dhatigara who had settled down in Poona after retirement. I had taken over command of the base in Poona in January 1997 and we met a few times. I used to have a delegation of senior retired officers of all three services come to the base every couple of months to spend the morning at the base and interact, particularly with the younger lot in the base. There was also the induction of the Su-30 in June 1997. After the Air Force Day in October, Air Marshal Dhatigara was very generous to write a letter to my C-in-C, then Air Marshal SR Deshpande, saying that I reminded him of Baba Katre. He then sent a copy of this letter to me. Even though I cannot ever compare myself to this great man, I still cherish that letter since that made me feel, right or wrong, that I didn't let Baba Katre down, at least to some extent.

Once again, unfortunately, our association with Baba Sir was cut short due to his untimely passing in June 1985



while he was the Chief. We kept in touch with Mrs Katre though and kept seeing her and calling on her whenever we got the opportunity. As a matter of fact, we became even closer to the Katre family since now there could be no suspicions or talk about seeking any favours from a senior officer. Mrs Katre mentioned later that she considered Malini and me as the seventh and eighth in their household after Vijay "Gujoo" and Sharmila "Khuku", Sameer "Sam" and Anez and Naveena and Ranjit. That was also a proud moment for us and I still keep in touch with the Katres, who are still like family to me, even though Mrs Katre and Malini also passed a few years ago. After all, the memory of such mentors can never leave one.

Chief of the Air Staff, Lakshman Madhav Katre ("Baba" Katre) and Mrs Srilata ("Sheila") Katre

Am I claiming that Baba didn't have any fears and concerns of his own or was a superhuman? Not at all. What I am trying to convey is that he never showed or shared his problems or fears with us so as not to demoralise a junior. All he did once while I was leaving AFA is to ask if I played Golf. I had told him that I was just hitting a few balls when I had the opportunity but didn't really play the game due to lack of time and opportunity in field units. He then said that life in the Air Force was like golf. When one picks up the game, one would find it difficult to reduce one's handicap, particularly when one had reached a single-figure handicap. Thereafter, even a reduction of one stroke was like climbing a hill with many (jealous) people trying to find a fault and pull one back. So, one had to make sure that one didn't ever give such an opportunity to others by being way ahead. Certainly, a tough challenge worth taking up. I don't know if he was hinting at his own life in the Air Force or whether that was just a piece of advice for me but I certainly found that to be truly helpful later. Thank you Baba Sir and Mrs Sheila Katre for all your guidance with affection.

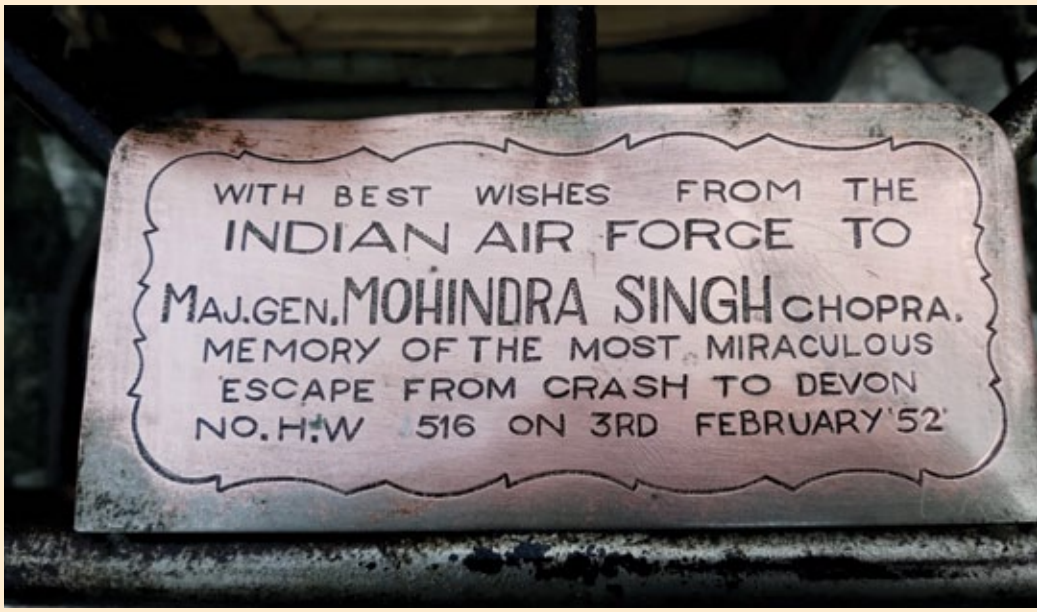
Story of the 'seat'
in the New Towers Library, Kasauli, India

Maj Gen Mohindar Singh Chopra is 2nd from the left

On the 3rd of February 1952, the U. P. Area command of the Indian Army was holding a tactical Exercise in Lucknow. To witness this Exercise, high ranking Army officials decided to fly down to the Exercise to observe. The then GOC-in-C Western Command Lt Gen S. M Shrinagesh (Later COAS), the Quarter Master General Maj-Gen K. S. Thimayya (later COAS), the Chief of General Staff Maj Gen S. P. P. Thorat (later GOC-in-C East), the Military Secretary Maj Gen Sarda Nand, Maj Gen Mohindar Singh Chopra and Brig Ajaib Singh boarded the IAF HQ and Communications Flight De Havilland Devon (HW 516) which was being flown by Flt Lt Suhas Biswas. The Devon reached Lucknow and after the exercises were completed, the Officers returned for the return flight to Delhi. The Devon took off at 1800 hrs and moments after the aircraft took off, the crew observed the port engine was spewing smoke and soon a fire broke out. The Devon became difficult to control and as the fire kept creeping towards the main fuselage, Biswas, the pilot put the Devon in a dive in an attempt to reduce altitude and attempt a crash landing before the aircraft fuel reserves caught fire and blew up. As the Devon was put into the dive, the aircraft shuddered in

3rd February 1952

Aircraft type: De Havilland Devon (HW 516)

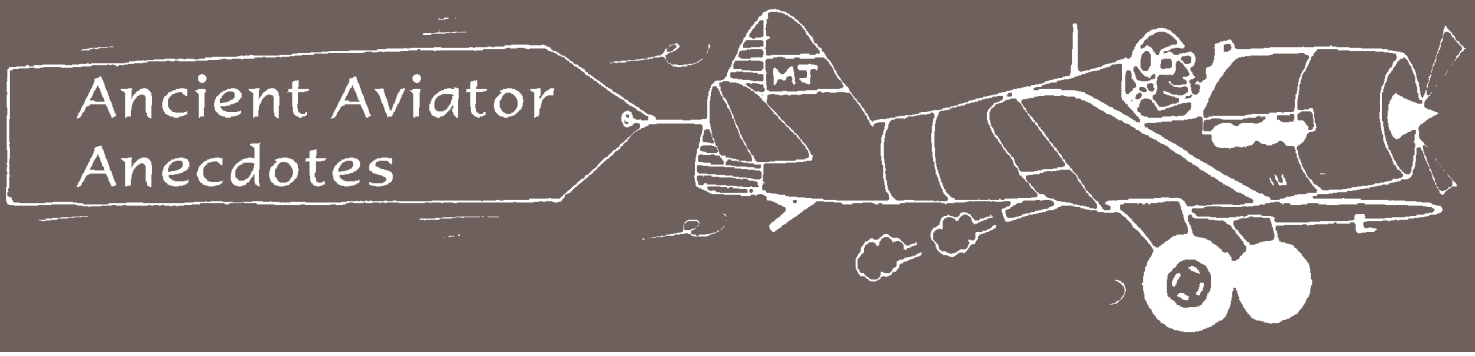


the airflow and the engine mounting broke away, resulting in the burning engine separating from the wing and falling off. Biswas levelled the aircraft and belly landed successfully at a village near the Sandilla Railway Station. All the occupants walked out of the crashed aircraft unhurt with the pilot being the last to leave.

Flt Lt Suhas Biswas awarded the first Ashoka Chakra to the Indian Air Force for the presence of mind, skill and cool courage in maintaining the stricken aircraft and saving the lives of many Senior Army Officers which included two future Army Chiefs and an Army Commander.

The Air Force Chief, Air Marshal Subroto Mukerjee, had the passenger chairs removed from the wrecked Devon and presented it individually to each of the survivors of the crash with a Brass Plate mentioning the circumstances of the crash.

(All black & white photos from Maj Gen Mohindar Singh Chopra's personal collection)



Post the wonderful series on Ancient Aviator Anecdotes, Wg. Cdr. (Retd.) Shiv Kumar Sharma shares his impressions on Air Vice Marshal Cecil Vivian Parker

What and how do I write about Air Vice Marshal Cecil Vivian Parker, a legend with whom I have had very little association but admired greatly from a distance. My first association with him was for a week almost a month before the 1971 war with Pakistan when I was attached to No. 20 Squadron IAF commanded by him; and the next was when I was doing the course at Defence Services Staff College, Wellington where he was the Directing Staff. Therefore, what I am about to write is partly from impressions formed at a distance and partly hearsay. For the presumption of forming my impressions on somewhat limited knowledge, I ask to be excused. For views bordering on idolatry you would express no reservations if you knew the man. Although I am now 84 years old and writing about events that took place 50 years ago, my memory is clear.

In March 1971, the Awami League led by Shiekh Mujibur Rehman was victorious in the Pakistan general election. For the Military Dictatorship and for Zulfikar Ali Bhutto this was not acceptable. There was a military crackdown in the east resulting in a huge influx of East Bengali refugees into India. The figure went into the millions, imposing a huge burden on India's economy. War with Pakistan became imminent but Indian policy makers decided to delay hostilities till after the monsoon for very important tactical and strategic reasons.

The war began with a pre-emptive strike by Pakistan. There were two Hunter squadrons at Pathankot airfield, just 9 nautical miles from the Indo-Pak border. The Hunter squadrons had been classified as Ground Attack Air Defence (GAAD) squadrons. However, on account of the induction of more modern aircraft in the

Air Vice Marshal Cecil Vivian Parker looking relaxed at home busy typing his column "Ancient Aviator Anecdotes" which the Vayu Aerospace Review magazine has had the honour of carrying all 100 episodes!

Air Forces of both India and Pakistan, the role of Hunters was restricted to counter air (involving strikes on airfields and signals units like radar units deep inside enemy territory), interdiction strikes to deny men and material to and from the battle zone and also close support of our troops in the battle zone.

In preparation for war, trained pilots on various aircraft were called up and attached to their respective units. Consequently, I was attached to No. 20 Sqn Air Force commanded by then Wg. Cdr. CV Parker. When I reported to him, I was very apprehensive, having heard about his reputation as a perfectionist. His first question was "Have you brought your log book?" which I hadn't, and I thought I have started on the wrong foot but he quickly put me at ease saying it didn't matter. He then asked me if I had any reservations to which I said yes, I hadn't flown Hunters after the 1965 war. His answer was "SK, this is not 65 we have learnt our lessons." Which on hind sight I don't agree with, the correct statement would have been "I have learnt my lessons"! He made sure I commenced my flying from the 3rd day onwards. After a few familiarisation sorties over a week or 10 days I was moved to 27 Squadron, on the same station, the antithesis of 20 Squadron. Here nobody gave a damn about my being out of touch with Hunter flying and I literally had to familiarise myself flying mission sorties.

The professionalism that I saw in those 10 days will remain etched in my memory till the end of my time on this planet. I was staying in the bachelor's accommodation, with other squadron pilots. On many days I was surprised to hear hectic activity at about 2 AM although the normal working hours were from 0730 AM onwards. The pilots would leave at 2.30 AM for work and return by 0630 or 0700 AM. They would again report for work at 9.30 AM. On enquiring, I was informed that they were training to cross borders (simulating) at night, flying and navigating at 500 feet above ground level (AGL), striking the target at first light and making a getaway thereafter. Easier said than done!

The Hawker Hunter aircraft was not designed for night flying. It did not even have a landing light and in those days there were no navigation aids, inertial or otherwise. By the way, after the war when I was posted to a

Hunter Squadron, I tried to do low flying at night at 1500 feet AGL, and I must confess I was scared stiff. I can't imagine how pilots were trained for this, but I could very well imagine the risk taken by the Squadron Commander. One accident would have put paid to his command and further career. The pilots also trained for surprise strikes at dusk and get away and recovery by night.

Preparation for War

Units were assigned their targets as soon as the war became imminent. Squadrons were provided with photographs of targets that they had to attack e.g. airfields, Signals Units, Oil storage dumps, Radar Units etc. For each strike formations were assigned - including the standbys - and each pilot was told individually what specific part of the target he would engage and, in case he was unable to spot his target, what he would alternatively engage. During such times there is an immense work load on the engineers and technicians who, apart from routine daily servicing and maintenance, have to undertake heavy repairs and maintenance to ensure the highest availability of aircraft. This involves round the clock work in long shifts. The pilots cannot be seen to be working only during flying hours, so they have to come to flight offices as long as the men are working. What was most impressive at 20 Squadron was the gainful and productive utilisation of time. Every day a formation was nominated to conduct a detailed briefing as if they were actually going on the mission. To make the atmosphere real, all of us had to come in the flying overalls/g-suits, and the mission members with their maps, water bottles, currency and weapons. Each pilot had to have memorised the route by heart with turning points, the magnetic course for each leg, the time from Initial Point to Pull Up Point, the description of the target as he expected to see it and finally the alternative target. Mission members were cross-examined by the Sqn CO or the Flight Commanders ad nauseam. I suspect that if you asked any member in his sleep about his target and role he would be able recite it. I am not aware if this was done by any other unit of the Air Force. I wonder why this method of training has not been made a standard operating procedure for the Air Force even during peace time.

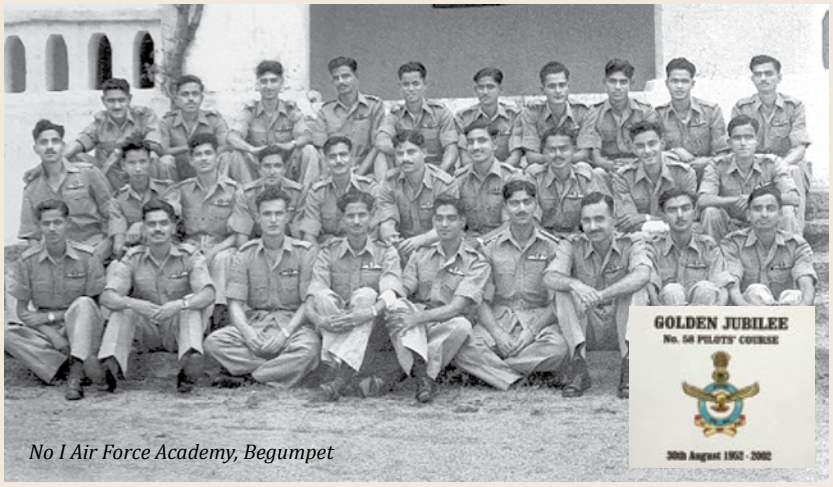
Apart from this, Wg. Cdr. Parker's administration and paper work was as near perfection as possible. He kept the bar charts of the progress made by each pilot and how much training had been accomplished meticulously.

Now this is pure hearsay - someone mentioned that he had a draft ready for the citation for pilots of each mission well before the start of the war! If it is true, it speaks volumes of his confidence in his preparations for the war. I have known a lot of cases where gallantry awards have been bestowed on totally undeserving and not so deserving pilots but in the case of Wg. Cdr. CV Parker, I can say with certainty that if anybody deserved the Mahavir Chakra he was awarded, it was him. He would have deserved it even if he had not flown a single mission in the war. But he was not just the ideal training head. When the shooting war came to 20 Squadron it performed excellently, and leading from the front was its Commanding Officer.

In the end I can say that I feel sorry for the Indian Air Force that a man of his calibre didn't not go beyond AVM, whereas people much less deserving made it to the rank of Air Marshal. It is the dream of every pilot to have participated in a war; and doing well career-wise would be the icing on the cake. But to have led a fighter squadron in war and achieved such phenomenal success is what makes a legend. I am sure, Parker sir, you are enjoying your retirement somewhere and sleeping well and contented.

By Shiv Kumar Sharma
Wg. Cdr. (Retd.) IAF

From the Vayu Aerospace Review archives



No I Air Force Academy, Begumpet

R : * YP Mehta * VBR Misra * S Bhat * SC Saxena * DE Satur * OP Gupta * TK De * JP Gupta * VK Singh * RL Badhwar

C : * HN Koul * RC Mariano * MW Tilak * KD Hoon * R Vasisht * RN Kaul * KK Malik * Jaggi Rao * S Sen * PK Chitnavis

F : * CV Parker * MS Rane * AJ Maitland * MK Rudra * GS Iyer * SL Tandan * MK Khanna * BK Dhiman * Hari Singh

Not in Picture : * MN Singh * Lt Jayachandran, IN

Fifty years have flown in myriad ways
From our 'Forty-Bucks-a-Nlonth' days
Golden greetings to each of you
on 30th. August, two thousand and two

25 Vayupuri, AFOCHS Ltd
Secunderabad 500 094
Tel / Fax + 91 40 7112957

Shirley & Cecil Parker

25 Years Back

From Vayu Aerospace Review Issue V/1997

"India And Russia Deepen Defence Ties"

Six months after India and Russia at a bilateral summit meeting in Moscow resolved to upgrade their relationship to the level of strategic partnership, the two sides took a major step towards putting the concept in flesh and blood, when the Defence Minister, Mr Mulayam Singh Yadav, visited Moscow in early October.

65th Anniversary of The IAF

While a spectacular fly-past by some forty front-line fighter and transport aircraft of the IAF was the highlight marking the 65th Anniversary of the country's air arm, the traditional address by the Chief of the Air Staff, Air Chief Marshal S.K. Sareen, on 8 October 1997 spelt out "the new and challenging role" that Indian airmen will have to play in the 21st century.

HAL Designs Replacement for Kiran

According to aviation sources in Bangalore, Hindustan Aeronautics Limited has undertaken a million-dollar project to initiate development of a basic jet trainer aircraft to replace the HJT-16 Kiran in a phased manner. Analysts estimate that the IAF's basic jet trainer requirement would be around 150 to 200 aircraft in the next 15 years, by which time the Kiran would be obsolescent.

Alliance Air to Phase Out B-737s

Alliance Air, the fully owned subsidiary of Indian Airlines, is to phase out six (out of its 12) Boeings 737s next year and replace them with one of the three airliner-types under evaluation. The airliners being considered for evaluation according to Vinoo Kashyap, Managing Director of Alliance Air, are the 100-seater Boeing 737-600, the 120-seater A319 of Airbus Industrie and the 100-seater MD-95. The new aircraft are to cost approximately $20-25 million each, and a committee for evaluation was set up in August this year under Captain JRD Rao, Deputy Managing Director, Indian Airlines, which would submit the final evaluation within 10 months.

DGCA To Be Split

According to civil aviation sources, plans are afoot to split the Directorate General of Civil Aviation (DGCA) into two and set up a Civil Aviation Authority and an Air Safety Board instead. Both the proposed entities would be multi-member bodies, vested with the authority to take decisions by a majority rule unlike the current set-up where a single person is "the judge, jury and the prosecutor".

Lufthansa Boeings Returned

All the three Boeing 737-200s of Lufthansa, leased earlier to its erstwhile partner ModiLuft, have been flown back to Germany. This follows the recent negotiated settlement between Lufthansa and ModiLuft and the concurrence of the Supreme Court. All the three aircraft left in September 1997 after necessary approvals from the Director General of Civil Aviation (DGCA) and other Government authorities.

Chandigarh - Graduate As An Astronaut

Dr Kalpana Chawla is slated to become the first woman of Indian-origin to go into space as part of the 6-member astronaut crew of the space shuttle Columbia, planned for 19 November 1997.

Kalpana Chawla graduated in Aeronautical Engineering from the Punjab Engineering College, Chandigarh in 1982. Having won a scholarship, she went to the USA and obtained a Master of Science degree in aerospace engineering from the University of Texas in 1984, and a Ph.D in the same subject from the University of Colarado in 1988.

Additional Harrier Trainers For Indian Navy

British Aerospace has signed a £16.5 million contract with the Indian Navy for the supply of two refurbished Sea Harrier T.Mk4 aircraft. Work on the ex-Royal Navy T.Mk4s will start immediately at British Aerospace's Dunsfold site in Surrey and the aircraft are scheduled for delivery in 1999.

PSLV-CI Launches IRS-ID

On 29 September 1997 the indigenously developed and built Polar Satellite Launch Vehicle (PSLV-CI) lifted off from the Sriharikota Space Centre (SHAR) in Southern India to place into orbit the Indian Remote Sensing Satellite (IRS-ID) of 1200 kg. The 44.4 metre tall, 294 tone Polar Satellite Launch Vehicle soared into the sky at 10:17 hrs. The dark brown-and-white-painted rocket sported the national Tricolour and the Indian golden jubilee log, with a payload containing the IRS-ID, nearly 300 kg heavier than the previous IRS-IC.

Jet Airways Fleet Augmented

Jet Airways, the only private scheduled airline competing with Indian Airlines with its vast flight network has added two new Boeing 737-400s to its existing fleet of 12 aircraft. With this addition, the airlines 14-aircraft fleet (all variants of the Boeings 737), will operate to 24 destinations within India with 97 daily flights.

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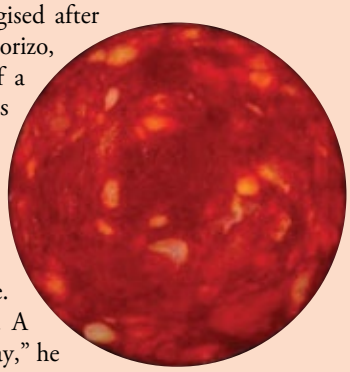
Creating history

A father/daughter duo created history on 30 May 2022 when they flew in same formation of Hawk-132's at AFS Bidar where Flying Officer Ananya Sharma is undergoing training before graduating onto faster aircraft. There has not been any previous instance in the IAF where the combination has been part of same fighter formation in a mission. As heard by all, "Air Cmde Sanjay and Fg Offr Ananya were more than just father and daughter. They were comrades who had full faith in each other as a fellow wingmen would".

Very true and we wish them all the best!

Chorizo or Proxima Centauri?



A French scientist has apologised after tweeting a photo of a slice of chorizo, claiming it was an image of a distant star taken by the James Webb Space Telescope. "Picture of Proxima Centauri, the nearest star to the Sun, located 4.2 light years away from us. It was taken by the James Webb Space Telescope. This level of detail is unreal. A new world is unveiled every day," he told his 91,000 followers on social media. Klein admitted later and apologised in a series of follow-up tweets that the image was, in fact, a close-up of a slice of chorizo taken against a black background. It was a prank and was having fun. (Courtesy: CNN)

Hysterical! And now we're hungry as well.

Yes, let's not bother anymore correcting one and all.

A meal without turbulence

Not too far from New Delhi and on the highway to Chandigarh are a series of scrapped aircraft converted to restaurants. You can choose your pick- Airbus or Boeings. The food is great and atmosphere unreal!

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