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II/2021

Aerospace & Defence Review



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Printed at Aegean Offset Printers

The opinions expressed in the articles published in the Vayu Aerospace & Defence Review do not necessarily reflect the views or policies of the Publishers.

VAYU

Aerospace & Defence Review

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31 The Aatmanirbhar Bharat Show



In this extensive review of Aero India 2021, readers are (air) transported to AFS Yelahanka for a most comprehensive overview of what was what during the 13th Edition of the event, inaugurated by Defence Minister Rajnath Singh "amidst challenges brought about by Covid-19".

38 HAL at Aero India 2021



Hindustan Aeronautics Limited were dominant at Aero India 2021, right from the very start, with their *Aatmanirbhar Formation Flight*, consisting of the LCA trainer (LIFT), HTT-40, HJT-36, Hawk-i and Civil Dornier 228 flying in a special formation signifying self-sufficiency in the segment.

41 The Tejas – and its Loyal Warriors



The future was also on display (albeit in mock up or model form) with HAL showcasing its CATS (Combat Air Teaming System) which is "a composite amalgamation of manned and unmanned platforms which work together to penetrate heavily defended enemy airspace". Revealed for the first time also were an array of stealthy UCAVs, being developed by DRDO.

44 ALHs for Indian Navy and Coast Guard



HAL's prowess in the area of rotary winged aircraft was well represented even as the Company handed over ALH Mk.IIIs to the Indian Navy as also the Coast Guard variant to that Service. HAL's light utility helicopter (LUH) also received its initial operational clearance (IOC) during the Show.

47 RFP for HTT-40 BTA



HAL received the formal RFP from the IAF during Aero India 2021 for 70 HTT-40 Basic Training Aircraft, ironically at the very place when some years earlier the previous Defence Minister and then CAS had virtually dismissed HAL's such efforts.

53 DRDO achievements during 2020



Responding to the call for *Aatmanirbhar Bharat*, DRDO has taken several initiatives to strengthen the indigenous defence eco systems, with 108 systems identified for D&D by Indian industry.

60 BEML in Defence & Aerospace



BEML signed a slew of MoUs with various entities to explore and enhance business in Defence & Aerospace sector.

69 The MRFA Competition



Even though this has yet to formally begin, some contenders for the IAF's multi-role fighter aircraft (MRFA) competition were omnipresent at Yelahanka: Dassault, Boeing, Saab, MiG and Lockheed Martin.

98 The Battle for Kushtia



2021 marks 50th anniversary of the decisive action in (then) East Pakistan when both history and geography were made. This is the first of a series of articles on battles fought in the words of those who led from the front. In this account, Major General Pramod K Batra (retd) writes about the 'Battle Honour, a Tactical Blunder and Historic Moment' when he was commanding 'A' Squadron 45 Cavalry deployed in West Bengal under 4th Mountain Division.

Also: Desert Knight-21; Exercise Kavach and AMPHEX-21; Exercise Yudh Abhyas; Tropex 21; Arjun Mk.IAs; Dutch helicopters Snowbound!; Tatoi Tecnam in Greece; Portuguese Chipmunks.

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Deepening Ties

The visit of US Defence Secretary General Lloyd Austin to Delhi so early in the tenure of the Biden Administration, and the NDA government's enthusiastic reception, underline the urgency in both capitals to elevate the bilateral defence partnership. Driven by shared threats from a rising China and united by a new geopolitical perspective on the Indo-Pacific, Delhi and Washington appear set to expand the scale and scope of the security partnership. Engagement between the Indian and American military establishments began in the early 1990s, soon after the Cold War came to an end. Security relations got their first political boost in Washington under President George W Bush (2001-09). Since he came to power in 2014, Prime Minister Narendra Modi has shed many of Raisina Hill's entrenched ideological reservations on defence cooperation with the US. As China's aggressive tactics in the Great Himalayas and the Western Pacific began to strain Beijing's ties with both Delhi and Washington, it was inevitable that India and America would tighten their defence embrace.

The focus of talks between Defence Minister Rajnath Singh and Secretary Austin was on intensifying military-to-military engagement, information sharing, cooperation in emerging sectors of defence like artificial intelligence, and mutual logistics support across the Indo-Pacific. While the Indian armed forces want to acquire advanced US weapons, the government is eager to move away from a buyer-seller relationship. Given its current focus on strengthening the national defence-industrial base and reducing arms imports, Delhi is seeking American investment in India's defence production. If India's defence reforms do attract large-scale US private investment, the growing strategic convergence will provide a conducive political environment.

The powerful dynamic in favour of the India-US defence partnership faces some political headwinds. There is the looming prospect of legally mandated US sanctions on India triggered by the purchase of the S-400 advanced air-defence missiles from Russia. Austin said he had not talked about sanctions, since India is yet to acquire the missiles. Delhi will hope that President Joe Biden will waive the sanctions when Delhi begins to receive the S-400 system. But the anti-Russia mood is hardening in Washington and has the potential to harm US-India defence relations. In response to a question on human rights, Austin told the press that he discussed the subject in his talks with the Indian ministers. South Block has clarified that the issue came up only as an affirmation of shared democratic values. What matters, though, is not the specific remarks Austin may have made, but the current negative narrative in Washington about Indian democracy taking an illiberal turn. It may not be a problem today, but could become one later.

From The Indian Express

Quad on track

With the publication of a jointly authored opinion piece in *The Washington Post*, the leaders of the Quad countries—the US, India, Australia and Japan—have attempted to demonstrate that they are literally on the same page. The write-up not only emphasises the takeaways from the first-ever summit of the grouping, held virtually, but also highlights the four nations' pledge to 'recommit

themselves to an Indo-Pacific region that is free, open, secure and prosperous'. There is no mention of China anywhere, but the quartet's assertion that it is striving to ensure that "all countries are able to make their own political choices, free from coercion" makes it easy to guess that the message is intended for Beijing's ears.

On the Quad agenda is a major initiative to help end Covid-19 that has ravaged the US and India in particular. There is unanimity among the four leaders that overcoming the pandemic is the key to economic growth and stability. The plan envisages expanding and accelerating the production of safe, accessible and effective vaccines in India. A central role for New Delhi on this count is a shot in the arm for its Covid diplomacy, which has admirably withstood the Chinese challenge.

The Biden administration's outreach to strengthen India-America ties is another development that seems to have displeased China, which has been insisting on delinking the border dispute from bilateral exchanges. US Secretary of Defence Lloyd Austin visited India and held discussions with his counterpart Rajnath Singh on operationalising major defence partnerships between the two nations, including the Basic Exchange and Cooperation Agreement that was signed days before the 2020 US presidential elections. It is the first trip by a top official of the Biden administration to this country. The Ladakh disengagement might have signalled a thaw, but India will remain wary of China as long as sustainable peace eludes the LAC. In the meantime, New Delhi should make the most of its growing friendship with Washington to further its strategic and economic interests and also keep Beijing on the back foot.

From The Tribune

Peace and Pakistan

Pakistan Army Chief Qamar Javed Bajwa's recent call for "extending the hand of peace" to India needs to be viewed with circumspection. Coming less than a month after both countries' directors general of military operations agreed to honour the 2003 ceasefire along the Line of Control (LoC) and after he and Prime Minister Imran Khan had made similar qualified statements at functions three days apart in February, it is clear that Islamabad's moves stem from urgent internal compulsions. For one, its economy had slowed sharply before the pandemic with gross domestic product growth sliding from a decade-high of 5.8 per cent in 2017-18 to (-) 0.4 per cent in 2019-20. The pandemic year is unlikely to improve this trajectory. Pakistan is surviving on a \$1.4-billion loan from the International Monetary Fund under a Rapid Financing Instrument scheme plus \$2 billion from the US and other G20 multi-lateral institutions (the relaxation of conditions under the Extended Fund Facility Programme - Pakistan's 13th such programme - in March last year also helped).

The flow of all this dollar funding could be in jeopardy if the country is blacklisted by the Financial Action Task Force (FATF). On 2 March, the 39-member Paris-based FATF decided to keep Pakistan on the "grey list" and gave it three more months to meet its commitments. The country has been on the list since June 2018 and has to fulfil a 27-point action plan to avoid blacklisting. These commitments include imposing sanctions on powerful leaders of terrorist outfits. According to one report, Pakistan lost \$38 billion during its time on the grey list (which includes a stint between

2008 and 2015) but a blacklisting could put it on a par with North Korea or Iran. An olive branch to its greatest nuclear-armed enemy, therefore, could send out multiple messages to western donors and financiers of Pakistan's commitment to tackling terror. It is also worth noting that General Bajwa had made similar noises in 2018, when the Trump administration was preparing a strategy of exit from Afghanistan, which Pakistan views as its bulwark for strategic depth. That effort was given short shrift, but a new administration in Washington offers fresh signalling opportunities as the US moves forward with its exit plans.

This latest olive branch also needs to be seen in the context of the deteriorating relations between Pakistan and China. Tensions over the \$60-billion China-Pakistan Economic Corridor have been building since Mr Khan came to power. China has been backing away from its financing commitments owing to delays and militant attacks on Chinese engineers at Gwadar Port and else-where. The fact that India could transfer several Army Divisions from the LoC to the Line of Actual Control to fight Chinese incursions without Pakistan taking advantage could be considered one potent sign of Islamabad's version of realpolitik.

Any Indian response so far has come via a riposte from Punjab Chief Minister Amarinder Singh suggesting that Pakistan should control the ISI and stem cross-border infiltration. But wary from the negative outcomes of earlier peace feelers, New Delhi has refrained from an official response. Certainly, the ceasefire offers a much-needed respite for populations along the border, where villages and livelihoods have been all but destroyed from military operations. Equally, India is spared a two-front crisis as long as the stand-off with China in Ladakh continues. High alert, however, should remain the watchwords.

From Business Standard

Avoid turbulence

The lockdown announced last March to combat the pandemic led to substantial collateral damage. Among the worst hit was the aviation industry which was forced to shut down. Therefore, when flying resumed two months later with restrictions, the government stepped in to help by fixing different price bands depending on the duration of flights. In other words, the minimum and maximum fares were fixed. It was an imperfect arrangement but the context justified government intervention in the most fundamental aspect of a market economy.

In a market transaction, the price is the most essential feature. It is the signal which affects the present and also future allocation of resources. Therefore, direct government intervention in a market economy through restrictions on price movement is a gross distortion. Yet, almost nine months after domestic aviation resumed, the government has decided to continue with price bands. Not just that, it has also increased the minimum and maximum tariffs, presumably to account for higher fuel prices. In terms of optics, this is similar to the MSP mechanism. The extension of price bands is an unwise move. We are at a stage when the pandemic-related controls by the government have to end.

The price bands are seen to be helping out companies with weak financials, but they bring no efficiency gains and are at the cost of the consumer. The experience in many countries, including India,

shows that minimum support prices are addictive. Consequently, there is always lobbying to persist with them. But fast-paced return to normalcy needs to be accompanied by a withdrawal of the extraordinary government interventions, whose Covid-related justification does not hold any longer. Withdraw the price bands in aviation and let market competition take its course. This is what minimum government, maximum governance is about.

From The Times of India

Is China too big to tame?

The United States and three of its critical allies in the Asia-Pacific – Japan, Australia, and India – have decided to breathe new life into the long defunct Quadrilateral Security Dialogue, commonly known as the Quad. The Quad was founded in 2007 to signal to Beijing that the US and its allies would act assertively to counter behaviour seen as a threat to regional security. Tellingly, it went dormant after Australia and India concluded that the organisation risked alienating their most significant economic partner.

But President Donald Trump restarted the Quad in 2017, and in November 2020, after a hiatus of 13 years, it held its largest joint military exercise to date. More than that, President Joe Biden just wrapped up the first summit of his term speaking with his counterparts in Japan, Australia, and India. This week, following the summit, Biden's Secretaries of State and Defense are due to make their first international trips not to the Middle East or Europe, but to Japan, South Korea, and India.

That the Quad is back – and that the new US administration is prioritising its relationships in Asia – is surely the clearest sign yet that many major countries in Asia are fearful of China's expanding influence. America and its Asia-Pacific allies have long seen China as both a threat and an opportunity, but Beijing's expanding assertiveness has added new urgency to discussions about how to manage its rise.

The problem is that these discussions inevitably brush up against a profound dilemma at the heart of the Quad's policy towards China: How do you simultaneously nurture a critical economic relationship while deterring behaviour perceived as unfair and indeed threatening? Is China too big to tame? Over the past two decades, America and its allies have failed to address this dilemma in a coherent fashion. This failure has led to a schizophrenic policy response towards China.

In just the last few months, each of the Quad countries has found itself in a major confrontation with China. For India, it was last year's border dispute in remote Ladakh, where Indian and Chinese soldiers skirmished in remote mountain passages. For Japan, it was China's adoption of a new coast guard law that allows Chinese ships to fire upon vessels in disputed waters. For Australia, it was a trade dispute with China that cost the country at least US\$3 billion in exports.

And for the United States, of course, it was the extended Trump trade war, meant to punish China for the full suite of its perceived economic sins, from a failure to protect intellectual property, to currency manipulation and domestic subsidies. To these perceived sins, the new administration can add a massive cyberattack against Microsoft, a major American company.

From Channel News Asia

Admiral Arun Prakash on

“What Delhi must do to make sure it isn’t caught off-guard by China again”

The nation heaved a collective sigh of relief as the Indian and Chinese armies commenced a process of “synchronised and verifiable disengagement” on banks of the Pangong Tso in eastern Ladakh. This mutual climbdown came after 10 months of a tense and sanguinary armed confrontation, punctuated by talks between respective military commanders. It marks the beginning of a process that should lead to disengagement at other “friction points” along the line of actual control (LAC) in Hot Springs, Gogra and Depsang and eventually, to a state of “de-escalation”, wherein, both armies will revert to pre-April 2020 force-levels and deployments.

Even as political analysts rack their brains about the motivation underlying China’s blatant territorial incursions, and its equally perplexing withdrawal, this traumatic event calls for deep reflection in South Block. Clearly, India’s swift military response, backed by firm political resolve, came as an unpleasant surprise to China,

and influenced its eventual decision to disengage. Possible “loss of face” in Beijing may see some in the Party and/or the People’s Liberation Army (PLA) pay the price for miscalculation. But even in the (unlikely) event that the status-quo ante is restored, China’s periodic transgressions have imposed costs on India which cannot be ignored. While the political consequences of these intrusions are being managed through legerdemain, it is the price being paid in terms of economic and security penalties, which calls for attention.

The expenditure demanded by an unanticipated redeployment of 50,000-60,000 soldiers and their sustenance in the high-altitude, arctic conditions of Ladakh would be substantial. While the rapid troop build-up is testimony of India’s newly acquired, strategic airlift capability, it will extract a price in terms of wear and tear on the IAF’s transport and helicopter fleets. The cumulative costs of this military confrontation could, therefore, impose a

significant burden on an already stressed defence budget and will impact on force modernisation plans. Relief at the ongoing disengagement must be tempered by the fact that this is just the latest act in the ongoing drama being played out by China along the LAC.

The notional LAC was described by the then Chinese Prime Minister Zhou Enlai in 1959, as conforming to “the so-called McMahon Line in the east and the line, up to which each side exercises actual control in the west”. In 1962, the PLA advanced to this claim line, before withdrawing, unilaterally, 20 km behind it. This left China in occupation of 38,000 sq km of the Aksai Chin plateau. In the east, China now claims, as part of ‘Southern Tibet’, 84,000 sq km of Arunachal Pradesh, which is well to the south of the McMahon Line.

Having neglected for 59 years post-bellum to negotiate conversion of the 3,500 km disputed Sino-Indian boundary into an international border, India continues to





pay a heavy price for this glaring omission. The mere existence of an undefined and un-demarcated LAC has provided an instrumentality for China to periodically intimidate and distract New Delhi—and damage India’s image internationally. History will judge the culpability of statesmen and diplomats, who allowed this situation to persist, but the Indian state must take note of other, equally egregious, lapses that have encouraged adventurism on the part of our neighbours.

Prime amongst these is the indifference of India’s politicians, bordering on neglect, towards defence preparedness. The 1962

military-debacle that resulted from Prime Minister Nehru’s order to “throw out the Chinese” from NEFA was a direct consequence of his total ignorance about the dismal state of the Indian army vis-à-vis the PLA and the adverse terrain that our poorly-armed and ill-clad troops were to fight in. In March 1971, PM Indira Gandhi, eager to march into (then) East Pakistan, was, fortunately, restrained by General Manekshaw’s firm but principled dissent. The consequent six-month respite enabled our military to make up for drastic weapon and equipment shortages through imports.



A manifestation of this political syndrome is the oft-heard statement in Parliament: “When the time comes, all resources will be made available to our gallant armed forces.” The absurdity of such statements seems lost on our political elite, because “when-the-time-comes” is too late to hand out guns to soldiers. Consequently, every crisis sees a panic rush abroad, for “emergency purchases” of items ranging from rifles to fighters.

Another cause for India being repeatedly caught flat-footed in crises situations is the strange and ostrich-like reticence which prevents self-assessment as well as policy-articulation. Thus, no government has, so far, defined national aims, objectives, vital interests and ‘red lines’ in the form of a security doctrine or strategy. One also wonders if the 60-year experience has helped the Ministry of External Affairs to evolve a ‘China-specific’ strategy.

The MoD steadfastly refuses to undertake strategic defence reviews, which would clearly show up the yawning gaps that exist between the budget and military resources available, on the one hand, and the capabilities required to meet extant threats, on the other. This has created a dilemma for the Indian armed forces, wherein they are expected to discharge roles, for which the government has neither funded nor equipped them; two examples being “fighting a two-and-a-half front war” and becoming a “net-security provider for the Indian Ocean region”.

Finally, the term heard consistently in India’s national security discourse is “surprise”, used in the context of the 1947, 1962, 1965 and Kargil conflicts, as well as episodes like the IC-814 hijacking and the 26/11 terror strike. The phrase implies intelligence failures on account of flaws in collection, collation and analysis, as well as timely dissemination of information. The 1999 Kargil Review Committee in its public report had stated: “There are no checks and balances in the Indian intelligence system to ensure that the consumer gets all the intelligence that is available and is his due... each intelligence agency is diligent in preserving its own turf.”

The two decades since Kargil have seen reconnaissance and surveillance operations transformed by the induction of drones, aircraft and satellites and the inception of a dedicated “tech-int” agency. And yet, in April 2020, the PLA blatantly managed to sneak up on us. 🦋

[All images from Indian MoD]

Air Marshal Brijesh Jayal cautions on

The human resource challenges

(that integration of single service commands will involve)

Ever since the surprise announcement of the much-awaited CDS post by the Prime Minister, events appear to be moving at a pace that may be in the right spirit in terms of lost time, but may not be in the best interest of long-term good of this much needed reform. Perhaps this apparent contradiction needs explaining.

Amongst other responsibilities, the CDS is mandated to bringing about jointness in operations, logistics, transport, training, support services and repair and maintenance involving the three services. In furtherance of this, priority has been accorded for integrating single service commands into tri-service theatre commands or functional commands which in turn are expected to ensure optimal use of military resources, both human and material, to fight future battles. Indeed, it was the previous Raksha Mantri who had stated that the issue of jointness was very dear to the PM's heart although her prescription of "We want a bottom-up approach, create the base and then add layers to it", appeared somewhat problematic and had some commentators wondering if experimenting with the sharp end of the fighting chain was indeed a wise move?

Soon after the CDS took charge, a reported briefing by the defence secretary had indicated that the former was expected to hit the ground running and show tangible outcomes in "one hundred days". In pursuance of this, a defence ministry statement later stated that the CDS has directed HQ IDS to submit a proposal to create an Air Defence Command by 30 June 2020. Reports now indicate that a Joint Air Defence Command and a Maritime Theatre Command are targeted to be operational within the next few months. To better appreciate the

challenges, such far-reaching changes entail to the very conservative military domain, perhaps the US example can be a guide.

The Goldwater-Nichols Department of Defense Reorganisation Act of 1986 in the US made the most sweeping changes since the department was established in 1946. Essentially, it was triggered to fix problems caused by inter-service rivalry, which had emerged during the Vietnam War and during later joint operations. Amongst other issues, the Act laid down in detail a personnel policy relating to joint specialty officers.

Recognising that resolving challenges was a long-term exercise, the US defence department's Joint Vision 2010 (of 1996) and Joint Vision 2020 (of 2000) flowing from this Act, accepted that for the US military forces to be fully joint intellectually, operationally, organisationally, doctrinally and technically, was a progressive and on-going task.

Towards this, officers that are selected for specialisation in 'joint specialty' duties achieve the necessary knowledge and skill through mandated courses at designated professional military education schools that come under the umbrella of the National Defence University (NDU). Such courses are conducted at three levels of career progression of a 'joint specialty' officer, between seven years to thirty years of service. Post training, assignment and associated experience at different seniority levels is a pre-requisite for higher level joint assignments.

This writer was a member of the team constituted by the government in 2001 to study and make proposals towards setting up of a NDU as recommended by the group of ministers, post the Kargil 1999 conflict. During the team's visit and interaction in USA, importance of jointmanship and the deliberate process

of educating and skilling staff towards 'joint specialty' skills and experience, was highlighted at every level of US senior military leadership.

In our present discussion of reorganisation and integrating of single service commands into tri-service ones, however, one finds little reference to any plans towards educating and skilling those uniformed men and women who will make this joint command and control war-fighting system work as efficiently and effectively as any other military organisation is expected to do. Indeed, to one's knowledge, a professional category of 'joint specialty officers' does not even exist. This is not a qualification that can be mandated by mere reorganisation and placings and like every other aspect of professional military functioning, requires dedicated training and application in the task assigned, which we know from the US experience calls for joint-specialty officers.

When viewed from this perspective, it is worth reflecting on whether in our enthusiasm to implement integration of single service commands and converting them into joint theatre ones, in a compressed time frame, we are not underestimating the human resource challenges that this major and much desired reform will entail.

Whilst this may also be an opportunity to reflect on why our own NDU, the foundation stone of which was laid by the then PM in 2013, still remains a distant dream, there is every reason for national security managers to reflect on the undue haste to embark on joint operational commands with the human resource that is not equipped for 'joint specialty' duties through training and experience as is the basic norm for other military assignments.

Perhaps thus there is a need to make haste slowly! 

Indian Defence Budget 2021-22

Union Budget for the Financial Year 2021-22, presented by the Finance Minister Nirmala Sitharaman in the Parliament on 1 February 2021 includes “defence modernisation”, increasing defence capital outlay by 18.75 per cent. Defence allocation in the budget has been increased to Rs 4,78,195.62 crore for the FY 2021-22. Excluding Defence pensions, the total allocations for Defence Services and other organisations/Departments under Ministry of Defence for the FY is Rs 3,62,345.62 crore, an increase of Rs 24,792.62 crore over FY 2020-21.

The allocation under capital expenditure which relates to modernisation and infrastructure development of Armed Forces has been “significantly increased”. The allocation under Capital of Rs 1,35,060.72 crore for FY 2021-22 represents an increase of 18.75 per cent over FY 2020-21 and 30.62 per cent over FY 2019-20, “the highest ever increase in capital outlay for Defence in the last 15 years.”

IAF's capital budget increased



In the country's budget 2021-22, there is only a modest increase of 1.4% over the past FY but within this, the Air Force has been allocated the largest capital amount. This reflects the IAF's increasing commitment to pay for its new Rafale fighters, manufacture of additional Su-30MKIs and Tejas LCAs by HAL as also continued modernisation of the Mirage 2000 fleet. According to defence analysts, major expenditure is also anticipated in the pending case for 114 multirole fighter aircraft (MRFA) for which the IAF has issued a global RFI some years back.

Combined Commanders' Conference at Kevadia

The Combined Commanders' Conference (CCC) of the Indian Defence Forces took place this year at Kevadia in Gujarat, under the imposing statue of Sardar Patel. This joint Services apex level conference “reviewed the security situation and defence preparedness of the Armed Forces, and deliberated on pertinent organisational issues for evolving a joint military vision for the future”. The Valedictory Session on the final day was chaired by Prime Minister Narendra Modi with the NSA in attendance. Scope of this year's



conference was expanded “to make it a multi-layered, interactive, informal and informed event with the added participation of about 30 officers and soldiers of various ranks from the three Services”.

Second IAF Rafale squadron



As earlier reported, the Indian Air Force's second squadron to be equipped with the Dassault Rafale will be No.101 ('Falcons of Chhamb') at Hasimara in northern Bengal. The first Rafale squadron is steadily building up to unit establishment and the first of Rafales for No.101 squadron will arrive in the months ahead. According to Air Marshal Anil Chopra (Director General CAPS) “located in the crucial Siliguri corridor, the Hasimara air base will cover both central and eastern Tibet. The Rafale will augment and add a bigger punch along with the IAF's Su-30 MKIs which are already based in the Brahmaputra valley”.

Seen above in flight test in France on 16 March 2021 is IAF Rafale (BS 014) with MICAs and Meteor AAMs (courtesy: Phoenix Aviation Photography/Vincent Vannier)

Three more Rafales arrive in India

A third batch of Rafale aircraft were ferried to India from France, arriving at Ambala, via Jamnagar on 27 January 2021. Their nonstop flight of 7000km was supported with in-flight refueling by tankers of the UAE Air Force. With this addition, the number of Rafales in the IAF's inventory has gone up to 11, all operated by No.17 Squadron.



Exercise Desert Flag 2021



The Indian Air Force took part in Exercise *Desert Flag* based at Al Dhafra airbase in the UAE, deploying six Sukhoi Su-30MKIs of No.30 Squadron, two Boeing C-17 Globemaster IIIs along with some 125 personnel. The three week exercise began in early March and had participation of Air Forces from the US, France, South Korea, Saudi Arabia, Bahrain and the UAE. The IAF Su-30MKIs ‘mixed it’ with F-15s, F-16s, Rafales and Mirage 2000s apart from support aircraft (*detailed report in next Issue*).

Indo-Uzbekistan Field Training Exercise *Dustlik II*



An Indian–Uzbekistan joint military exercise *Dustlik II* took place at the Foreign Training Node Chaubatia, Ranikhet. 45 soldiers each from Uzbekistan and the Indian Armies participated in this exercise, the second edition of such an annual bilateral joint exercise in the field of counter terrorist operations in mountainous/rural/urban scenario “under UN mandate”.

Indian and Chinese forces disengage in Pangong Tso sector



More than 9 months after the military standoff began in the spring of 2020, after Chinese forces had occupied forward positions in Eastern Ladakh including the Pangong Tso area, the two Army’s began disengagement from the LAC in mid-February 2021. According to the Chinese Defence Ministry website “Chinese and Indian front-line troops at the southern and northern banks of the Pangong Tso started synchronised and organised disengagement from 10 February”. According to sources, tanks and mechanised equipment of both sides have been pulled back from locations south of the Pangong Tso.

Apaches in Eastern India



Air Marshal Amit Dev, AOC-in-C EAC visited forward locations in Sikkim during mid-February 2021 for interaction with Indian Army Commanders “to further synergise support efforts”. During the visit, he also met with aircrew of an Apache helicopter unit, deployed in the Eastern sector.

US supports India in 'face off' with China

According to Admiral Philips Davidson, heading the US Indo-Pacific Command, "China's recent activities along the Line of Actual Control (LAC) have opened India's eyes to what cooperative effort with others might mean for their own defensive needs" as he observed that India, in the very near term, would deepen its Quad engagement. "We have been deepening our maritime cooperation". It is also learnt that the US provided information, cold weather clothing and other equipment to India during the border crisis with China.



and manufactured". The approvals include 118 Arjun Mk.1A MBTs (for Rs 8380 crore), protection systems for the Army's approximately 3000 tanks and AFVs (for 5300 crore), 293 DRDO-developed anti-tank missiles, 13 modified IFVs (NAMICA), 8 *Arudra* medium powered radars and practice ammo for the T-90 and T-72 MBTs.

India requests procurement of 30 MQ-9B Predators



According to authoritative sources, the Government of India have requested procurement of 30 MQ 9-B Predators drones manufactured by San Diego-based General Atomics. This would be a major strategic boost to India's military capabilities as these armed drones would supplement the earlier drones used for surveillance and reconnaissance.

DAC approves Rs 13,700 crore capital proposes

Defence Acquisition Council (DAC), under chairmanship of the Raksha Mantri has approved capital acquisition proposals of various weapons/platforms/equipment/systems required by the Indian Army, Indian Navy and Indian Air Force. Three *Acceptance of Necessities* (AoNs) for an overall cost of Rs 13,700 crore were accorded, all these AoNs being in the highest priority category of Defence Acquisition and will be "indigenously designed, developed

Privatisation of PSUs

The Union Cabinet has reportedly cleared privatisation of public sector undertakings (PSUs) with details to be announced later. Although Defence PSUs may be included, it is learnt that the policy would begin with non-strategic sectors which will be part of *Atmanirbhar Bharat* objectives and it is anticipated that the Government will first limit the presence of PSUs to some half dozen strategic sectors while privatising, perhaps merging or clubbing remaining entities under a holding company.

Brahmos missiles for the Philippines



On 2 March 2021, the Governments of India and the Philippines formalised a key agreement to facilitate government-to-government deals on military hardware, including the potential supply of Brahmos cruise missiles. The pact was signed by under-secretary Raymundo Elefante of the Philippines' department of national defence and Indian ambassador Shambu Kumaran at Camp Aguinaldo, headquarters of the Philippines armed forces. The Indian-origin supersonic missiles will be operated by the Philippine Army's 1st Land Based Missile System Battery with the Philippine Marines also being a potential operator.

DRDO tests VL-SAM

Two successful launches were conducted on 22 February 2021 of the indigenously designed and developed Vertical Launch Short Range Surface to Air Missile (VL-SRSAM) for the Indian Navy underwent.



and developed by DRDO, the Helina and Dhruvastra are third generation, Lock on Before Launch (LOBL) fire and forget anti-tank guided missiles to engage targets both in direct hit mode as well as top attack mode.

Flight test of Solid Fuel Ducted Ramjet



Flight test of a vehicle powered by Solid Fuel Ducted Ramjet (SFDR) was carried out at the Integrated Test Range Chandipur on 5 March, 2021. "All subsystems, including the booster motor and nozzle-less motor, performed as expected, while many new

technologies were proven, including solid fuel-based Ducted Ramjet technology. The technological advantage will enable development of long range air-to-air missiles".

Maiden test launch of Akash-NG

The concerned DRDO laboratory carried out a successful maiden launch of the Akash-NG (New Generation) Missile from Integrated Test Range on 25 January 2021. The Akash-NG is a new generation Surface to Air Missile is for use by Indian Air Force for intercepting high maneuvering low RCS aerial threats.



User trials of 'Helina' and 'Dhruvastra'

Joint User Trials of the Helina (Army version) and Dhruvastra (Air Force version) anti-tank missiles have recently been carried out, launched from Dhruv ALHs at desert ranges. Designed



First delivery of MRSAM missile kits



Kalyani Rafael Advanced Systems Pvt Ltd. (KRAS), a joint venture between the Kalyani Group and Rafael Advanced Defense Systems of Israel rolled out their first batch of Medium Range Surface to Air Missiles (MRSAM) for the Indian Army and the Air Force, with KRAS committed to deliver more than 1000 MRSAM 'missile kits' over the coming years. These missile sections will then be forwarded to Bharat Dynamics Limited (BDL) for further integration.

Final production batch of LRSAMs



Final production batch of the Long Range Surface to Air Missiles (LRSAM), designed and developed by DRDO in collaboration with various industry partners and integrated by BDL, was "flagged off" on 14 February 2021 at DRDL, Hyderabad. The LRSAM is jointly developed by DRDO and IAI of Israel to equip ships of the Indian Navy for providing point and area defence against various aerial threats including aircraft, subsonic and supersonic cruise missiles.

Indian Army demonstrates drone swarms



During the Army Day Parade held at Delhi Cantonment on 15 January 2021, the Indian Army carried out a live demonstration of Drone Swarming capability using 75 indigenously designed and developed drones which executed an array of Artificial Intelligence (AI) enabled simulated offensive missions and close quarter attack. This demonstration was ‘recognition of the Indian Army’s steady embrace of emerging and disruptive technologies to transform itself from a manpower intensive to a technology enabled force to meet future security challenges’.

100th L&T-made K9 Vajra



On 18 February 2021, Chief of the Army Staff General MM Naravane flagged-off the 100th K9 *Vajra* 155mm/52 calibre tracked self-propelled howitzer from L&T’s Armoured System Complex (ASC) located at Hazira, near Surat.

Milan-2T for Indian Army

The Ministry of Defence has contracted with Bharat Dynamics Limited (BDL) for supply of 4,960 Milan-2T Anti-Tank Guided Missiles for the Indian Army at a cost of Rs 1,188 crore. The Milan-2T is a tandem warhead ATGM with the range of 1,850 metres, produced



by BDL under license from MBDA Missile Systems, France and can be deployed in anti-tank role for both offensive and defensive tasks.

Training of Turkmenistan Special Forces



A detachment of Turkmenistan Special Forces have been carrying out training at the Indian Army’s Special Forces Training School (SFTS) on combat free falls as a precursor to further ‘customised’ professional courses.

Affiliation of Assam Regiment with No.106 Squadron, IAF



The Assam Regiment and Arunachal Scouts have been formally affiliated with No.106 Squadron, IAF with a formal ceremony taking place at Tezpur (Assam) on 15 February 2021. The ceremony commenced with inspection of the Guard of Honour by Maj Gen PS Behl, Colonel of The Assam Regiment & Arunachal Scouts. The ‘Charter of Affiliation’ was later signed by him and Gp Capt Varun Slaria, CO No.106 Squadron.

CAS visits Bangladesh

Air Chief Marshal RKS Bhadauria made an official goodwill visit to Bangladesh on 22 February 2021 on an invitation from his counterpart Air Chief Marshal Masihuzzaman Serniabat, CAS Bangladesh Air Force. It is learnt that an ex-PAF Sabre, later operated by the Bangladesh AF has been presented to the IAF Museum at Palam.

First LSP LCH in ground run



Coinciding with rollout of the 300th ALH, 'ground runs' of the first Limited Series Production (LSP) Light Combat Helicopter have taken place. This project has been taken up by the Company proactively even as an order on HAL is in process. The LCH was piloted by Gp Capt (retd) Hari Krishnan Nair S, Chief Test Pilot and Gp Capt (retd) C G Narasimha Prasad, Senior Flight Test Engineer of Flight Operations, Rotary Wing.

HAL's Hawk-i test fires 'Smart Anti Airfield Weapon'



In a major boost to the indigenous Hawk-i programme, HAL has successfully test fired a *Smart Anti Airfield Weapon* (SAAW) from the Hawk-i off the coast of Odisha. The indigenous stand-off weapon developed by the Research Centre Imarat (RCI), DRDO is the first smart weapon fired from an Indian Hawk Mk.132. The aircraft flown by HAL test pilots Wg Cdr P. Awasthi (retd) and Wg Cdr M. Patel (retd) executed the weapon release in textbook manner. The telemetry and tracking systems captured all the mission events confirming the success of the trials.

IndiGo announces 22 new flights



IndiGo, has just launched 22 new flights for connecting key regional cities in India. IndiGo will operate new flights between Agartala - Aizawl under the RCS scheme and exclusive flights between Bhubaneswar-Patna, Jaipur-Vadodara, Chennai-Vadodara, Bengaluru-Shirdi, Patna-Kochi, and Rajahmundry-Tirupati. IndiGo will also be commencing flights between Kolkata-Gaya, Cochin-Trivandrum, Jaipur-Surat, Chennai-Surat. Meanwhile, BOC Aviation Limited has announced its purchase-and-leaseback agreements with InterGlobe Aviation Ltd. for eight new Airbus A320neos. The aircraft will be powered by CFM Leap engines and are scheduled to be delivered in the second half of 2021.

SpiceJet introduces 24 new domestic flights



SpiceJet has launched 24 new domestic flights and will be the first (and only) airline to connect Ajmer with Mumbai and Ahmedabad with Amritsar, "enhancing connectivity between metro and non-metro cities". Meanwhile, SpiceJet has inducted two more wide-body aircraft (a Boeing 767 and Airbus A330) to its cargo fleet and will now have a dedicated fleet of 19 cargo aircraft, including five wide-body jets. Other than the wide-body aircraft, SpiceJet's cargo fleet includes five Boeing 737 freighters and nine Q-400s.

SpiceJet tie up with WheelTug



SpiceJet has tied-up with WheelTug PLC for reserving 400 production slots for the electric taxi system which enables “the airline in saving fuel, reducing CO2 emissions as well as noise levels, improves its fleet utilisation thereby directly improving the company’s bottom line”. The innovative WheelTug system places high-torque motors in the nose wheels of the aircraft. Pilots control the aircraft themselves, performing ground operations without requiring tugs for manoeuvres. By keeping jet engines off in closed areas, the airline will lower its emissions and additionally, SpiceJet gate and stand operations will be faster and more dependable helping the airline eliminate unexpected long delays affecting the schedule on any given day.

Vistara B-787 services to Frankfurt



Vistara (Tata-Singapore Airlines) have inaugurated their non-stop flights between Delhi and Frankfurt, under the ‘travel bubble’ agreement between India and Germany. The inaugural flight, operated by Vistara’s brand-new Boeing 787-9 Dreamliner, took place on 18 February 2021. The airline will operate services between the two cities twice a week.

Vistara services to Malé

Vistara has begun non-stop flights between Mumbai and Malé in the Maldives, the only airline to offer choice of Premium Economy class of travel on the route, in addition to Business class



and Economy classes. The inaugural flight, operated by Vistara’s Airbus A320neo aircraft, took place on 3 March 2021, the airline to fly three times a week on the route under India’s ‘transport bubble’ agreement with the Republic of Maldives.

Flybig adopts ARMS software suite



Flybig, India’s newest airline has selected LAMINAAR Aviation Infotech’s ARMS application software. The ATR -72 operator chose the ARMS V2.5 unified platform for network planning, crew management, flight operations, flight dispatch, maintenance and engineering and safety management. On its inaugural flight in December 2020, Flybig operated from Delhi to Shillong and later started from its Indore hub. Currently operating two ATR 72-500s, the airline plans to add more ATR 72s as well as Dornier 228s.

Inflatable hangar at Hyderabad airport



An inflatable hangar, first of its kind in India, was commissioned at GMR Aero Technik’s MRO facility at Hyderabad on 12 February, 2021. The H-45 hangar can accommodate two narrow body aircraft such as the A320neo or B737-900. The hangar has been manufactured by Buildair Inflatable Structural Solution of Spain.

UP Government support for Noida International Airport



A State support agreement was signed between Noida International Airport (NIA) and the Government of UP in Lucknow on 1 March 2021 which confirms the State Government's support to establish and continuously improve surface access to the airport, establish and expand utilities required to run the airport (water, electricity, waste water), maintain law and order, including monitoring at the airport and grant the necessary clearances to build and operate the airport.

U-UAP train Indian Mi-171A2 pilots



The Ulan-Ude Aviation Plant Training Centre under the Russian Helicopters holding company (part of the Rostec State Corporation) has recently carried out training of a second group of foreign specialists to operate and maintain Mi-171A2 helicopters. The pilots and engineering staff were from Indian company Sky One Airways.

1 Fast Patrol Vessel (FPV) for the Seychelles



Contract for a Fast Patrol Vessel (FPV) has been signed between Garden Reach Shipbuilders and Engineers Ltd and the Government of Seychelles. The SCG Ship *Zoroaster*, a Fast Patrol Vessel, will perform multipurpose operations, including patrolling, anti-smuggling, anti-poaching, and search and rescue (SAR).

INS *Karanj* commissioned

The Indian Navy's third stealth *Scorpene*-class Submarine INS *Karanj* was commissioned on 10 March 2021, at the Naval Dockyard Mumbai during a formal commissioning ceremony. Admiral VS Shekhawat former CNS



who was part of the commissioning crew of the original *Karanj* and later commanded it during the 1971 Indo-Pak war, was Chief Guest at the ceremony. Six *Scorpene*-class submarines are being built in India by the Mazagon Dock Shipbuilders Limited (MDL) Mumbai under collaboration with Naval Group, France.

GSL delivers new class OPV



Third in the class of 5 Coast Guard Offshore Patrol Vessel (OPV), built as per Goa Shipyard Limited's 'in-house' design, was delivered to the Indian Coast Guard on 15 March 2021.

Commissioning of ICGS C-453



Indian Coast Guard Ship C-453, 17th of the 18 Interceptor Boat (IBs) project constructed by Larsen & Toubro Ltd., was commissioned at Chennai on 19 February 2021.

Indian Navy's Il-38SD test launches Kh35E ASM



An Ilyushin Il-38SD of INAS 315 has test fired the Kh35E Anti-ship missile during *Theatre level Readiness and Operational Exercise 2021* (TROPEX-21).

IN ships port call at Mongla



INS Sumedha, an OPV and INS Kulish, guided missile corvette, made port calls at the port town of Mongla in Bangladesh to commemorate the ongoing Swarnim Vijay Varsh....



.... and BN ship to Mumbai

.... while the Bangladesh Navy Ship *Prottoy* made a two-day visit to Mumbai in February 2021.



INS Shardul at Port Louis



INS *Shardul*, a ship of the First Training Squadron of the Indian Navy visited Port Louis, Mauritius as part of an overseas deployment to Southern Indian Ocean nations. The ship also participated in the National Day celebrations of Mauritius.

SECON to construct 8 missile-cum-ammunition barges...



Contract for construction of eight missile-cum-ammunition barges (MCA) was concluded with SECON of Visakhapatnam on 19 February 2021. These will be inducted in the Indian Navy for embarking/disembarking missile, gunnery and ASW ordnance.

...and Suryadipta for ACTCM barges



On 5 March 2021, a contract for construction 11 ammunition cum torpedo cum missile (ACTCM) barges was concluded with Suryadipta Projects Private Limited, Thane. The ammunition cum-torpedo-cum-missile barges will be used by the Indian Navy for embarking/ disembarking ammunition, torpedo, missiles and other stores.

3rd ship of Project 17A

Garden Reach Shipbuilders and Engineers Limited (GRSE) has laid the keel of an Advanced Stealth Frigate Project, P17A at Yard 3024. The shipyard had earlier launched the first P17A Stealth Frigate INS *Himgiri* ahead of schedule on 14 December 2020, the Keel laying of Yard 3024 also having been achieved ahead of schedule.

INLCU L58 commissioned



IN LCU L-58, the eighth and last ship under Project LCU Mark IV, was delivered by GRSE end of December and commissioned on 18 March 2021. Entire design of the eight Landing Craft Utility (LCU) Mark IV ships was developed in-house by GRSE, its primary role being transportation and deployment of armoured fighting vehicles, troops and equipment from ship to shore. The ships are equipped with bow ramps to enable loading/unloading of combat equipment and vehicles upon beaching. These ships, based with the Andaman & Nicobar Command, can be deployed for multirole activities like beaching operations, search and rescue, disaster relief operations, supply and replenishment and evacuation from distant islands.

Two ALH Mk.IIIs for Coast Guard

The Indian Coast Guard has received two ALH Mk.III helicopters as part of a contract for 18 such helicopters from HAL. "These will enhance operational preparedness for maritime missions of the Service".



APPOINTMENTS

Air Marshal Vijay Pal Singh Rana is AOA

Air Marshal Vijay Pal Singh Rana took over as Air Officer-in-charge Administration (AOA) on 1 February 2021. Earlier, he was Principal Director Air Force Works, Commandant Air Force Administrative College, Senior Officer-in-charge Administration at Training Command and Assistant Chief of the Air Staff (Air Force Works) and Director General (Administration) at Air Headquarters, New Delhi.



Air Marshal GS Bedi appointed DG (Inspection & Safety)

Air Marshal GS Bedi has been Appointed Director General (Inspection & Safety). The Air Marshal has flown a wide variety of fighters and trainer aircraft, with over 3700 hours of flying, is a Qualified Flying Instructor and a Fighter Combat Leader with vast instructional experience.

As Air Vice Marshal, he was AOC Jammu & Kashmir, ACAS Operations (Offensive) ACAS (Personnel Officers) SASO Southern Air Command and SASO Eastern Air Command.



Rear Adm Atul Anand is FOC Maharashtra Naval Area

Rear Admiral Atul Anand assumed the office of Flag Officer Commanding Maharashtra Naval Area (FOMA) on 22 February 2021. The Admiral has held several key command appointments in his naval career including the command of Torpedo Recovery Vessel IN TRV A72, Missile Boat INS *Chatak*, Corvette INS



Khukri and the Destroyer INS *Mumbai*. He has also served as Navigating Officer of IN Ships *Sharda*, *Ranvijay* and *Jyoti*. In addition, he was Direction Officer of the Sea Harrier squadron and Executive Officer of the destroyer INS *Delhi*.

Rear Adm Tarun Sobti is FOC Eastern Fleet



Rear Admiral Tarun Sobti took over Command of the Eastern Fleet on 23 February 2021 at Naval Base, Visakhapatnam. During his career spanning 32 years, he has served as Navigating Officer of INS *Kirpan*, commissioning Navigating Officer of INS *Mysore*, Direction Officer on INS *Viraat* and Executive Officer of missile destroyer INS *Delhi*. His sea commands include those of missile vessel INS *Nishank*, missile corvette INS *Kora* and missile destroyer INS *Kolkata* of which he was the commissioning Commanding Officer.

His staff and operational appointments include those as Joint Director of Staff Requirements and Joint Director of Personnel at Naval Headquarters. Prior assuming command of the Eastern Fleet, he was Deputy Commandant and Chief Instructor of Indian Navy's premier officer training establishment Indian Naval Academy at Ezhimala.

Rear Adm Ajay Kochhar is FOCWF

Rear Admiral Ajay Kochhar took over as Flag Officer Commanding Western Fleet (FOCWF) from Rear Admiral Krishna Swaminathan, at a ceremony onboard the aircraft



carrier INS *Vikramaditya* on 24 February 2021. A specialist in Gunnery and Missile Warfare, he has commanded five warships on both the Western and Eastern seaboard including the aircraft carrier INS *Vikramaditya*. He was Assistant Controller of Carrier Projects & Assistant Controller of Warships Production & Acquisition overseeing all aspects related to construction and acquisition of warships for the Indian Navy both from Indian as well as foreign shipyards including the indigenous aircraft carrier (IAC-1).

Vice Adm R Hari Kumar takes over as FOC-in-C, WNC

Vice Admiral R Hari Kumar has taken over as FOC-in-C of the Western Naval Command. He is a specialist in gunnery and has commanded five ships including a destroyer and the aircraft carrier INS *Viraat*. On promotion to flag rank he held the appointments of Commandant of Naval War College at Goa, Flag Officer Sea Training, Flag Officer Commanding Western Fleet, Chief of Staff at Western Naval Command, Controller Personnel Services and Chief of Personnel at NHQ and earlier was CISC/ VCDS (Vice Chief of Defence Staff) at HQ IDS.



Vice Adm Ajendra Bahadur Singh is FOC-in-C ENC

Vice Admiral Ajendra Bahadur Singh, has taken over as the Flag Officer Commanding-in-Chief (FOC-in-C), Eastern Naval Command (ENC). A Navigation and Direction Specialist, Vice Admiral AB Singh has held various Operational Staff and Command appointments in his career spanning over 38 years. He has commanded INS *Veer*, INS *Vindhyagiri*, INS *Trishul* and INS *Viraat*. The officer has commanded the Eastern Fleet and was closely associated with the response to Super Cyclone *Hudhud* in 2014. As Principal Director and ACNS (Policy & Plans) at Naval HQ, he was closely associated with promulgation of the Maritime Strategy, Transformation & Long Term capability development plan as also *Atmanirbhar* shipbuilding roadmap of the Indian Navy.



Vice Adm Atul Kumar Jain is CIDS

Vice Admiral Atul Kumar Jain has taken over as Chief of Integrated Defence Staff to Chairman Chiefs of Staff Committee (CISC) on 2 March 2021. Prior to this appointment, Vice Admiral Atul Jain has held various Operational, Staff and Command Appointments in the course of his career spanning over 38 years, has commanded four ships including INS *Mysore*. His appointments ashore include Director, Naval Intelligence (Protocol), Director, Foreign Liaison and Principal Director Staff Requirement at Integrated Headquarters, Ministry of Defence (Navy).



New Army Appointments



Lt Gen BS Raju (photo above) is the new Director General of Military Operations (DGMO), Indian Army while Lt Gen DP Pandey, currently DG of the Territorial Army, has succeeded him as GOC XV Corps in the Kashmir Valley. Lt Gen Paramjit Singh has taken charge as Deputy Chief of the Army Staff (Strategy), this new post created to look after military operations, military intelligence, strategic planning and operational logistics.

Ravi Nirgudkar is BAE Systems Managing Director India

Ravi Nirgudkar has been appointed as Managing Director for BAE Systems in India and will "spearhead BAE Systems' operations and build on the Company's proud track-record of partnering with the Indian defence industry". He succeeds Nik Khanna who takes up a new role with BAE Systems' Air Sector in the United Kingdom.



Indo-French Air Exercise

‘Desert Knight-21’



in the exercise included the Mirage 2000, Su-30MKI, Rafale, II-78 FRA, A.50 AWACS and AEW&C aircraft.

This exercise was part of a series of engagements between the two Air Forces, having held six editions of the *Garuda*, the last being in 2019 at French AF Base Mont-de-Marsan. “As measures to further the existing cooperation, the two forces have been gainfully utilising available opportunities to conduct hop-exercises.” The French deployment while ferrying to Australia for *Ex Pitchblack* in 2018 was hosted at Air Force Stations Agra and Gwalior for the exercise with fighters and MRTT aircraft. The French detachment for *Ex Desert Knight-21* was earlier deployed in Asia as part of their ‘Skyros Deployment’ and ferried to Air Force Station Jodhpur.

This exercise was also unique as it included fielding of Rafale aircraft by both AFs, which was “indicative of the growing interaction between the two premier Air Forces”.

The Indian Air Force and French Air and Space Force (*Armée de l’Air et de l’Espace*) conducted their bilateral air exercise, *Ex Desert Knight-21* operating from Air Force Station Jodhpur 20 to 24 January 2021.

The French contingent comprised Rafales, Airbus A330 Multi-Role Tanker Transport (MRTT), A-400M Tactical Transport aircraft and some 175 personnel. Indian Air Force aircraft types participating

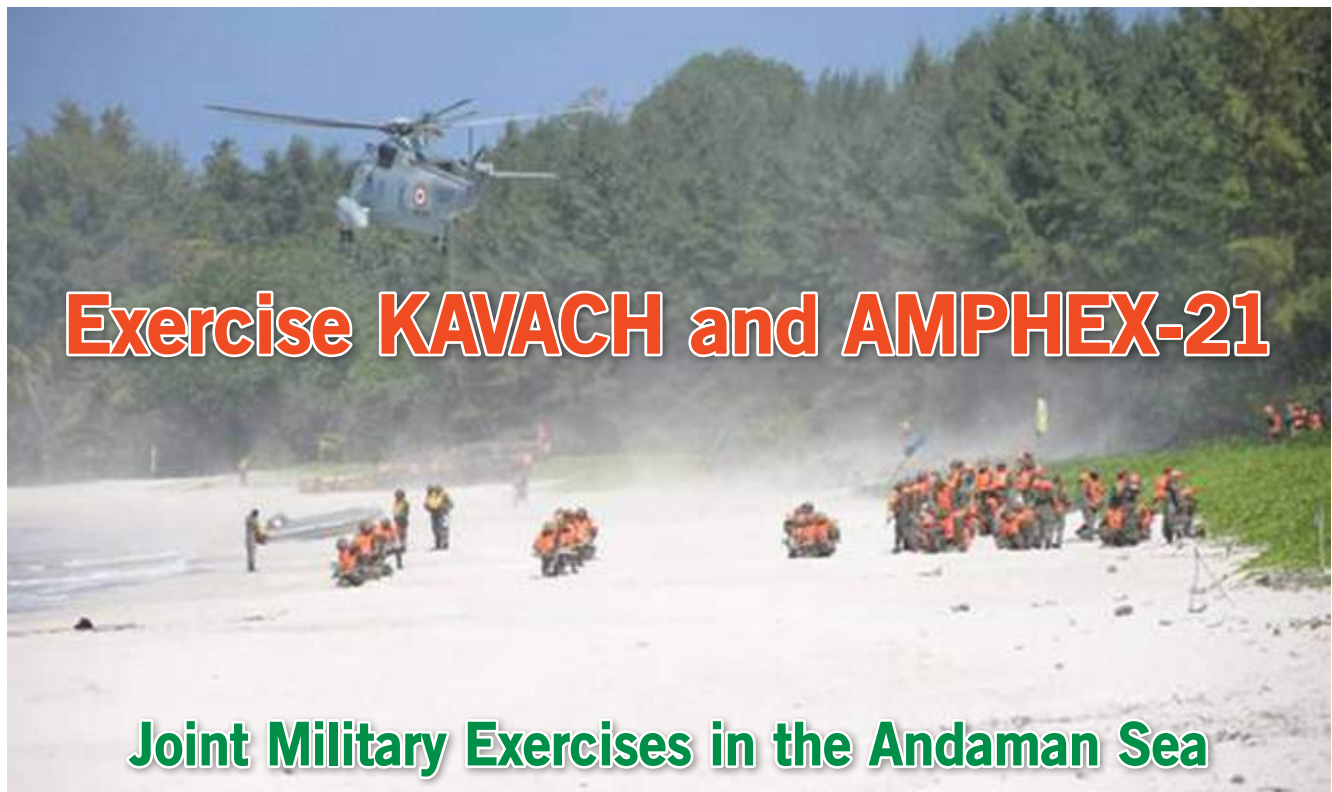




General Bipin Rawat, the CDS visited AFS Jodhpur on 21 January 2021 and also flew on-board the MRTT along with Maj Gen Laurent Lherbette, the FASF contingent leader. The CAS Air Chief Marshal RKS Bhaduria visited Air Force Station Jodhpur on 23 January 2021 and interacted with members of IAF and FASF contingents. He commended the planning, operational and maintenance staff from both sides for smooth and safe conduct of the exercise. ✈️



[All images from Indian and French MoD]



Towards enhancing joint operational readiness, the Indian Armed Forces conducted large-scale conjoint military training exercises KAVACH alongwith AMPHEX-21 in the Andaman Sea and Bay of Bengal in January 2021, the exercise conducted under aegis of the Andaman & Nicobar Command (ANC) with participation of Eastern Naval Command (ENC) and the Army's

Southern Command (SC) and involving assets of the Army, Navy, Air Force and Coast Guard, including elements of an Amphibious Brigade of the Army along with corvettes, submarines and amphibious landing ships of Navy's Eastern Fleet and MARCOS Marine Commandos. IAF Jaguar maritime strike and transport aircraft and assets of the Coast Guard also participated.

The exercise commenced with maritime strikes by Jaguar aircraft, followed by Para Commandos and Marine Commandos carrying out Combat Free Fall paratroops over Car Nicobar to validate air dominance and maritime strike capability within the area of interest in Indian Ocean Region (IOR).

The MARCOS, along with combat loads and Air Droppable Rigid Hull Inflatable Boats (ADR), were dropped over the Andaman Sea, enabling them to reach targets with stealth and speed. Mi-17 V5 armed helicopters undertook precision targeting against designated enemy assets at sea and on land. The training exercise culminated with beach landing operations by elements of the Amphibious Brigade from INS *Jalashwa*, *Airavat*, *Guldar* and LCU MK-4-class of ships involving 600 troops along with tanks, troop carrier and other heavy weapons. The logistic team demonstrated and validated the joint logistic



system and its capabilities to respond to dynamic changes in operational situations and combat missions.

The exercise also validated joint capabilities of intelligence gathering from space, air, land and sea based assets, their synthesis, analysis and near real time sharing to achieve battle field transparency for quick decision making. “The joint force executed multi-domain, high intensity offensive and defensive manoeuvres in the Andaman Sea and Bay of Bengal”.

Amphex-21

The large-scale tri-service joint amphibious exercise AMPHEX-21 was conducted in Andaman & Nicobar chain of islands during 21–25 January 2021 and included naval ships, amphibious troops of the Army and different types of IAF aircraft.

“The exercise was aimed at validating India’s capabilities to safeguard the territorial integrity of its island territories and it also sought to enhance operational synergy and joint warfighting capabilities

amongst the three Services”, according to the MoD briefing.

The exercise involved multi-faceted maritime operations by synergised employment of amphibious assault ships, surveillance platforms, execution of maritime air strikes and complex manoeuvres at sea. Airborne insertion of Marine Commandos of the Navy and Special Forces of the Army, naval gunfire support, amphibious landing of forces and follow-on operations also formed part of the exercise.



Ex KAVACH, for the defence of Andaman & Nicobar Islands, formed part of AMPHEX-21. A joint intelligence, surveillance and reconnaissance exercise under the aegis of HQ Integrated Defence Staff was also conducted concurrently to achieve Maritime Domain Awareness with employment of a multitude of sensors. 🦋



[All images from the Indian Navy]

US and Indian Armies in Exercise Yudh Abhyas

Soldiers from the US and Indian Armies participated in exercise *Yudh Abhyas* during 8-21 February 2021, at the Mahajan Field Firing Range (MFFR) in Rajasthan.

The tough, realistic field training, including small-unit infantry tactics, were carried out by troops of the 11th J&K Rifles and the US Army's 2-3 Infantry Patriots Battalion, 1-2



Stryker Brigade Combat Team. This US Army Pacific-sponsored exercise involves some 250 US and Indian army soldiers each, this annual training exercise “to enhance combined interoperability capabilities through training and cultural exchange, which foster enduring partnerships in the Indo-Pacific region through common defence objectives”, including training at the Corps-level and below; combat against conventional, unconventional and hybrid threats; humanitarian assistance and disaster relief.

The command post exercise (CPX) focused on UN peacekeeping operation staff tasks in a combined military setting, while the field training exercise (FTX) involved company-strength elements from each nation exercising combined, fundamental war-fighting skills to enhance combined operational capacity. the CPX and FTX running concurrently. 🦋



[All images from the MoD]

Tropex 21

Indian Navy's Largest War Game

The Indian Navy's largest war game – the biennial Theatre Level Operational Readiness Exercise (TROPEX 21) - from early January, had participation of all operational units of Indian Navy including ships, submarines, aircraft as well as units of the Indian Army, Indian Air Force and Coast Guard, the exercise culminating in the third week of February.

The exercise was conducted over a vast geographical expanse of the Indian Ocean Region including adjunct waters and aimed at “testing combat readiness of the Navy in a complex multi-dimensional scenario set in the context of the current geo strategic environment”. The Theatre Level exercise also aimed to validate the Navy's “offensive-defence capabilities, to safeguard national interests in the maritime domain and promote

stability and peace in the Indian Ocean Region”. Conduct of TROPEX was overseen by Naval Headquarters with participation from all three Commands of the Indian Navy and the Tri-Services Command at Port Blair.

TROPEX was progressed over distinct phases that also tested the Navy's transition from peacetime to hostilities. In the first phase, the Indian Navy conducted coastal defence exercise *Sea Vigil* along the entire





coastline and Island territories of India on 12-13 January 2021, aimed to validate coastal defences of the country, which was entirely revamped after the 26/11 Terror attacks at Mumbai.

Exercise *Sea Vigil* was followed by a large-scale Tri-Service joint amphibious exercise AMPHEX-21, conducted in the Andaman & Nicobar group of Islands from 21-25 January, the exercise aimed at “validating India’s capabilities to safeguard the territorial integrity of its Island territories

and enhance operational synergy and joint warfighting capabilities amongst the three Services”.

The Weapon Workup Phase of TROPEX, witnessed multiple ‘on-target’ ordnance deliveries including firing of missiles, torpedoes and rockets from frontline warships, aircraft and submarines “to reaffirm the Navy’s capability to carry out long range maritime strikes in the Indian Ocean Region, a capability that is central to meeting operational

challenges and ensuring safe seas and secure coasts”.

This large-scale Theatre Level Exercise put to test and validate the Navy’s Concept of Operations in various conflict scenarios, hone its warfighting skills, bolster its role towards maritime security in the wider Indian Ocean Region, in keeping with the objective of being a ‘Combat Ready, Credible and Cohesive force’. 🦋

[All images from the Indian Navy]



Operational demonstration by A&N Command at Swaraj Dweep

The President of India Mr. Ram Nath Kovind witnessed a Joint Services Operational Demonstration at Radhanagar beach, Swaraj Dweep in the Andamans on 28 February 2021. Integral combat platforms and forces of the Andaman and Nicobar Command (ANC) demonstrated multi-dimensional operational capabilities of the Command, including an amphibious landing.

The President was earlier briefed by Lt. Gen. Manoj Pande (CINCAN) on “operational capabilities and state of readiness of the Command”. Fourteen ships of the Indian Navy, two Fast Attack Craft of the Coast Guard, a number of Indian Air Force aircraft and over 300 troops of the Indian Army with six BMPs, showcased integrated application of combat power of the only Tri-Service Command of the nation. “The demonstration highlighted the synergy, cooperation and interoperability between the Services towards achieving desired outcomes”.

Naval Gun Fire Support (NGFS), Counter Surface Force Operations (CSFO), Search and Rescue (SAR) operations and vertical replenishment at sea were also demonstrated. The amphibious landing of Infantry troops on the beach was executed by Landing Ship Tank (Medium) and Landing Craft Utility. The demonstration culminated with fly past of Dornier 228 MPAs, Mi-17 V5s and Chetak helicopters depicting “Tri-Service synergy and combat potential of the Andaman & Nicobar Command”. 🦋



The Uttarakhand disaster - and the immediate response



The disaster at Uttarakhand in the Garhwal Himalayas on 7 February 2021 is believed to have been caused by a landslide, an avalanche or a glacial lake outburst flood. This caused catastrophic flooding in the Chamoli district, most notably in the Rishiganga river valley and the Dhauliganga river which, in turn, impacted on the river Alaknanda, the major headstream of the river Ganges, with hundreds then tragically killed or missing.

The Government scrambled to deploy various forces in search, salvage, and rescue operations in Uttarakhand. Teams of the State Disaster Response Force (SDRF) were deployed in the Joshimath area. According to SN Pradhan, Director General of NDRF, teams were moved from Dehra Dun to Joshimath as also the airlift of 3-4 more teams from Delhi to Dehra Dun and onwards to Joshimath.

Six columns - around 600 personnel - of the Indian Army were deployed as well as Army and IAF helicopters to support

the government's operations. Two medical teams joined the operations while one engineering task force was sent to Ringi village. The military station near Rishikesh was actively involved in coordination of rescue and relief operations with the local administration even as the situation was monitored from Army Headquarters.

Three helicopters, including two Mi-17s and one Dhruv ALH of the Indian Air Force were stationed at Dehra Dun and nearby locations for rescue operations, while more aircraft were deployed as rescue efforts continued. The IAF also had its new Chinooks deployed for relief operations in Uttarakhand.

Indo-Tibetan Border Police (ITBP) personnel arrived in Tapovan and Reni areas shortly after the flash floods occurred, these columns deployed at village Ringi near Joshimath, two columns from Joshimath and two from Auli, an engineering task force with two JCBs and medical column with two ambulances. Dedicated were two Cheetah helicopters of Army Aviation with a control room at Joshimath. The NDRF moved five tonnes of load from AFS Hindon to Jolly Grant Airport in the Doon Valley while additional C-130s and An-32s were on standby for additional NDRF teams. Three Mi-17s of the IAF were positioned at Jolly Grant to airlift NDRF teams to Joshimath, while MARCOS teams of the Navy were also deployed in the Himalayan region. 🦋



‘A’ is for Aatmanirbhar



(Photo: Vayu)

The Arjun Mk.1A ordered

Although in military history, the French had first begun working on armoured fighting vehicles, it was the British who actually built what was called a ‘tank’. When this debuted on the battlefield of Flers-Courcelette in World War I, it shocked the Germans. Tanks have thereafter dominated the battlefield through World War II, the Korean War, the 1965 and 1971 India-Pakistan Wars, the Six Day War of 1967 and Yom Kippur War of 1973, the Iraq-Iran War, the Gulf War and other battles.

Since independence in 1947, the Indian Army has operated British, French and Soviet-origin tanks. After the 1971 war, the Government of India took a decision to develop an indigenous main battle tank. India had already been producing UK-designed *Vijayanta* tanks at the Heavy Vehicles Factory, Avadi which was a customised variant of the Vickers Mk.1A.

For the next generation of MBTs, an entirely in-house design was then envisaged to meet the Army’s requirements. This was to be a contemporary of the German Leopard 2, American M1 Abrams and British Challenger 1 main battle tanks as also the Russian T-90s which were being inducted by their respective armies during the 1980-90s.

However, the Indian MBT programme faced several hurdles but the first significant success was achieved by the Defence Metallurgical Research Laboratory which had developed the *Kanchan* armour, an advanced composite armour equivalent of Burlington armour (a variant of Chobham armour) developed by Army Research Laboratory, UK. Like the Chobham, *Kanchan* too saw new variants over the decades. Meanwhile, the Armament Research and Development Establishment (ARDE) developed an indigenous gun,

firstly a 105 mm rifled-gun but later the bigger and powerful 120 mm rifled-gun. However, the failure to develop an indigenous engine led to procurement of MTU engines to power the tank, called the Arjun. Although the prototypes were ready by the late 80s, it was not until 2010 when, after extensive trials, the Indian Army placed an initial order, the 43rd Armoured Regiment receiving the first Arjun tanks in limited numbers in the late 90s. It was in 2012 when an improved variant, the Arjun Mk.2 was conceived.

The Arjun Mk.2 has since been renamed as the ‘Mk.1A’, and after extensive trials it was ‘cleared’ for induction, the Prime Minister Narendra Modi handing over the first Arjun Mk.1A to the Indian Army at Chennai on 14 February 2021. According to reports, the Mk.1A has 54.3 per cent indigenous content and features 93 improvements over its predecessor.



(Photo: MoD)

super velocity ammunition, can defeat any contemporary armour. The electro slag refined gun steel tube is autofrettaged to withstand higher gas pressures. A thermal jacket prevents irregular temperature distribution onto the tube due to weather influences. The Arjun Mk.1A also has an improved commander's panoramic sight (Mk.II) which is integrated with the thermal imager. Be it night, fog or any kind of difficult weather conditions, the commander can effectively observe the battlefield, the laser range finder and panoramic sight enabling advanced hunter killer capability. It has an Advanced Land Navigation System as well as is equipped with INS or GPS or both. The Arjun Mk.1A has an advanced running gear system as well as hydro-pneumatic suspension which given excellent mobility. The tank is

Protection, fire power, mobility

The Arjun Mk.1A has an improved Kanchan armour and is covered with layers of indigenously developed Explosive Reactive Armour to protect the platform against HEAT rounds and anti-tank guided missiles. It has a containerised ammunition bin with individual shutter (CABIS), which an effective protection against burning ammunition stored in the ready round bin. CABIS protects by venting the gas out by blow-off panels from roof of the turret. The Mk.1A has a roof-mounted driver's seat to protect him from shocks. Its chemical sensor is active in the event of chemical warfare, the tank also equipped with a laser warning and counter measure system with activation of smoke grenades. For operations in dangerous mine fields, the Mk.1A is equipped with a track width mine plough (TWMP).

The Arjun Mk.1A is equipped with an indigenously-developed 120 mm rifled gun which can fire several advanced ammunition including Fin Stabilised Armour Piercing Discarding Sabot (FSAPDS), High Explosive Squash Head (HESH), ThermoBaric (TB) and Penetration Cum Blast (PCB) rounds, apart from indigenous cannon launched guided missile (CLGM). It has new Remote Controlled Weapon Station (NSV 12.7 mm) for engaging both land and aerial targets. Besides there is a 7.62 mm co-axial machine gun, its hatch closed firing capability being useful during close quarter urban engagements. The Mk.1A has highly integrated optics for better



(Photo: MoD)

battlefield awareness, an improved gunner's main sight integrated with automatic target tracking for efficiently targeting the enemy. A computer controlled integrated fire control system incorporating day-cum-night stabilised sighting system, ensures very high first round hit probability and reduced reaction time. The stabilisation system for the main armament is slaved to the sighting equipment in elevation and azimuth, with high and accurate laying speed and allowing fire on the move.

It is claimed that the rifled 120 mm gun together with the newly developed

powered by a MTU-1400 hp liquid-cooled turbocharged diesel engine.

However, a major disadvantage of the Arjun Mk.1A, remains its very heavy weight, being a 68.5 tonne behemoth which decreases the geographical sphere where it can be deployed and the army has ordered 118 Arjun Mk.1As to equip only two regiments. The Arjun Mk.1/Mk.1A could conceivably best be deployed in the western desert where its advantages would be obvious. 🦋

Sankalan Chattopadhyay
(Twitter @VinodDX9)

The Aatmanirbhar Bharat Show



A review of Aero India 2021

HAL's Aatmanirbhar Formation Flight

Photo: Angad Singh

The 3rd edition of the Aero India Show was formally inaugurated by Defence Minister Rajnath Singh at AFS Yelahanka on the morning of 3 February 2021. During his speech, the Minister commended the organisation of this biennial event “amidst challenges brought about by Covid-19” and

added that owing to restrictions, Aero India 2021 “would be a purely business event and there would be no public days”.

Present at the Aero India 2021 Show were Chief of Defence Staff General Bipin Rawat, CAS Air Chief Marshal Rakesh Kumar Singh Bhadauria, COAS General

MM Naravane, CNS Admiral Karambir Singh, Defence Secretary Dr Ajay Kumar, Secretary, Department of Defence R&D and Chairman, DRDO Dr G Satheesh Reddy and the Civil Aviation Secretary Mr. Pradeep Singh Kharola. (seen on the dias in the photo below).





HAL ALHs during the flypast



Pair of LCA Mk.1 of No.45 Squadron in formation flight over Yelahanka

The Minister continued in that, “Aero India 2021 will display the vast potential of India, and the multifarious opportunities that our country offers in the field of defence and aerospace sector. It also promises to be the world’s first-ever hybrid aero and defence exhibition”. The Minister also spoke about the threats and challenges to India emanating from multiple fronts, urging that India remains “vigilant and prepared to counter and defeat any misadventure to defend its people and the territorial integrity at all costs”.

The traditional flypast which followed was heralded this time by an *Aatmanirbhar*

Formation Flight, led by the Tejas LCA and including a pair of HTT-40s and single examples of HJT-36 *Sitara* and Hawk-i. The aircraft static display was overwhelmingly of HAL-built aircraft including the Jaguar, Sukhoi Su-30MKI, Dornier 228 as also IAF fighters such as the Rafale, Mirage 2000 and MiG-29UPG, apart from helicopter types including the Chinook, Apache and HAL Dhruvs.

Mr Rajnath Singh repeatedly referred to the very recent formal order for 83 LCA Mk.1As which he described as the “biggest” *Make in India* defence contract yet and also mentioned overseas interest in the Indian-fighter, specifically mentioning the Maldives, Malaysia and Sri Lanka. “India is steadily marching from *Make in India* towards *Make for the World*”, he further stated.

The Minister conveyed that India was gearing itself to project power and influence across the Indian Ocean Region (IOR). “India has a vast coastline, but our interests also lie beyond our shores. It includes our people who reside and work across continents, especially in the IOC. It is our bounden duty to remain capable and willing to assist them in times of natural calamities and security challenges”. Mention of the Maldives however raised some eyebrows as this tiny archipelago in the Southern Arabian Sea has a very tiny air wing with two HAL Dhruv ALHs for SAR and utility tasks.

Continuing, he appreciated the participation of over 540 exhibitors including 80 foreign companies with defence ministers, delegates, service chiefs and officials from more than 55 nations. He highlighted *Sangam* of rising demand, greater innovation, conducive policies and maturing ecosystem in the sector.



HAL HTT-40 (photo Angad Singh)

Global Chiefs' of Air Staff Conclave



The Indian Air Force hosted a two-day Global Chiefs' of Air Staff Conclave on 3 and 4 February 2021, themed '*Leveraging Aerospace Power for Security and Stability*'.

Welcoming all the Chiefs, Indian Air Force CAS Air Chief Marshal RKS Bhadauria outlined significance of the CAS Conclave in enabling exchange of ideas and enhancement of multilateral cooperation between the participating Air Forces. He reiterated the role of Air Power as a crucial enabler for ensuring peace, stability & security in the region. The three sessions were on the themes of *Disruptive Technologies and Innovations*, *Air Power in the Indo-Pacific Region* and *Air Power and Aerospace Strategy*.

The Conclave was organised in hybrid format in wake of the Covid-19 pandemic but was attended by some 50 representatives from 28 countries including the Americas, Europe, Middle East, West Asia, Central Asian Republics, South East Asia, Africa, Indian Ocean region and the Indo-Pacific.



In his speech, Secretary (Defence Production) Raj Kumar said that India had taken "a leap in organising a completely COVID-compliant exhibition in hybrid mode" and expressed his gratitude to ambassadors and delegates from more than 55 nations who were in attendance, which "reflects positive temperament of people across the world and renewed global interest in the capabilities of India". He said that Aero India 2021 provided a platform for the exchange of ideas and forge partnerships in the aerospace and defence sectors.



Alliance Air and HAL personalities pose with HAL-Dornier 228 light transport aircraft

On second day of Aero India 2021, the MoD officially issued the Request for Proposal (RFP) to HAL for the HTT-40. The RFP is for 70 aircraft with a clause for an additional 38 aircraft which will be delivered to the IAF for meeting the Stage I flying training syllabus. These will supplement the present PC-7 Mk.IIs being operated of the Air Force Academy, Dundigal. The HTT-40s will be built at two sites, HAL's Bangalore Complex and at Nasik.

In the course of next days, formal contract documents to produce Tejas Light Combat Aircraft were handed over by the Ministry of Defence to Hindustan Aeronautics Limited (HAL). Defence Minister Rajnath Singh said "the exhibition would display the vast potential and the multifarious opportunities that India offers in the aerospace sector and that was the world's first ever hybrid Show with a concurrent virtual exhibition making it a truly digital and global event".

Two HAL-Dornier 228s were subject of lease to Alliance Air which subsidiary of Air India will operate these 19-seater STOL aircraft for regional air links in parts of India, including the North East. Although touted as the first Indian-built airliners to be operated in the country, in fact HAL's Transport Aircraft Division at Kanpur has delivered licence-built Avro 748s to the erstwhile Indian Airlines and later, Dornier 228s to the erstwhile *Vayudoot*, which aircraft were later taken over by Indian Airlines (Short Haul Division), being operated on specific routes including to the Lakshadweep Islands.

The Defence Minister made some specific announcements in that the government plans to spend \$130 billion on Indian military modernisation over the next seven years, and that steps had been taken to strengthen the nation's security



A range of IAF helicopters on display included the Chinook, Dhruv ALH, Apache and Mi-17V5



HAL-built Hawk Mk.132s of the Surya Kiran formation aerobatic team taxi out as HAL Dhruv ALHs of the Sarang team get airborne for their respective displays

apparatus with domestic manufacturing and complex defence platforms becoming focus of the *Aatmanirbhar Policy*. The government had enhanced Foreign Direct Investment in the Defence Sector up to 74 per cent through the automatic route and 100 per cent through the government route, would also create a conducive system for exports, and offset discharge. The newly introduced *Buy Global-Manufacture in India* category of capital procurement in Defence Acquisition Policy 2020 specifically allows outright purchase of equipment from foreign vendors and indigenous manufacture through an Indian subsidiary, a joint venture or an Indian agency.



Surya Kiran Hawks

Mr Rajnath Singh said that the India pavilion at Aero India 2021 showcased India's design and manufacturing supply chain associated with various rotary wing systems. He said that with a strong and diversified *Micro, Small, Medium Enterprise* sector composed of more than active 5000 units, "India has the potential to become a reliable supplier of defence equipment to many of its friendly nations".

The Minister stated that "to achieve the twin goals of self-reliance and exports, we have set a target to achieve Rs 1,75,000 crore turnover, including export of Rs 35,000 crore in aerospace and defence equipment and services by 2024". He recognised India's interests beyond its shores and said that it was India's duty to remain capable and willing to assist them in times of natural calamities and security challenges, and expressed happiness at organisation of the first Indian Ocean Region's Defence Ministers' Conclave with the theme *Enhanced peace, Security and cooperation in the Indian Ocean Region*. This was implementation of the concept of the Indian Ocean, built around Security and Growth for All (SAGAR), as visualised by Prime Minister Narendra Modi. 🦋



(Photo: Angad Singh)

The USAF's B-1B Lancer swing-wing strategic bomber was the *pièce de résistance* at Aero India 2021, perhaps the first time a USAF bomber has touched Indian soil after World War II. The B-1B flew over AFS Yelahanka but was not alone, being flanked by two IAF Tejas LCAs, an unusual formation if there was one!



HAL's light combat helicopters



IAF Boeing C-17 flanked by two Su-30MKIs

Indigenisation thrust in maintaining IAF Fleet

Operating as it does a variety of aircraft types of foreign-origin ranging from the legacy MiG-21 Bison to the new generation Rafales, “there is immense scope for indigenisation in the IAF for a wide variety of spares and equipment ranging from aircraft general purpose spares, such as nuts, bolts, cables, gaskets, springs, etc to complex high technology spares, such as avionics equipment, aeroengine accessories, etc”. Indigenisation of spares for maintenance of aircraft and systems is undertaken through Base Repair Depots (BROs) of the IAF located in various parts of the country and No. 1 Central Indigenisation and Manufacturing Depot (CIMD), Nasik.

According to the IAF spokesmen, this is “part of IAF’s focus on self-reliance and the *Aatmanirbhar Bharat* mission, the IAF giving impetus to fast tracking of indigenisation as well as enlarging the scope of involvement of Indian aerospace and defence industry especially, MSMEs. The IAF has already identified indigenisation requirements of approximately 4000 lines of spares. Critical requirements for indigenisation include aviation-grade filters (fuel, hydraulic & pneumatic), aero-engine bearings, hydraulic and pneumatic hoses, multifunction displays, aviation grade circuit breakers, lamp filaments, spark plugs, amongst others. Enormous opportunities are available for the aerospace and defence industry partners in India including MSMEs to join hands with IAF in this vigorous indigenisation drive”.

The IAF seeks to engage with Industry for setting up repair and overhaul (ROH) facilities within India for high value retables/repairables. “The IAF aims to accrue huge savings to the financial exchequer, besides developing and encouraging in-house MRO facilities, thereby leading to reduced timeframes for repair and enhanced operational availability of assets”.



IAF aircraft on display included the MiG-29UPG, Jaguar DARIN-III, Tejas LCA and the Rafale.

IOR Defence Ministers’ Conclave at Aero India 2021

The Government of India hosted the Indian Ocean Region (IOR) Defence Ministers’ Conclave on 4 February, 2021 on the margins of Aero India 2021. The broad theme of the conclave was ‘*Enhanced Peace, Security and Cooperation in the Indian Ocean*’.

There was physical participation of representatives from 18 countries including Defence Ministers of the Maldives, Comoros, Iran and Madagascar, with six Ambassadors/ High Commissioners representing their countries (Australia, Kenya, Seychelles, Mauritius, Kuwait and Myanmar), while present were the Defence Secretary of Sudan and Service Chiefs from 10 countries.

The conclave was “an initiative to promote dialogue in an institutional, economic and cooperative environment that can foster the development of peace, stability and prosperity in the Indian Ocean region”. Aspects related to Defence Industry co-operation amongst participating countries, was addressed sharing of resources available in Indian defence shipyards for design & shipbuilding, use of Indian ports with friendly countries, Information-sharing towards increased maritime domain awareness, maritime surveillance and co-operation, Humanitarian Assistance & Disaster Relief (HADR), Marine Pollution Response activities, Development of technologies and capabilities for harnessing marine resources, according to the MoD spokesperson.



(Photo: Angad Singh)

Also, some Statistics

Over 600 exhibitors were physically present and another 108 were in 'virtual mode'. Around 3,000 Business-2-Business meetings were conducted and representatives from 63 foreign countries were in attendance. Some 201 MoUs, product launches and technology transfers were formalised at the *Bandhan* ceremony held on last day of Aero India 2021 on 5 February 2021. These included the formal handing over of Advanced Light Helicopter Mk.III to the Indian Navy and Indian Coast Guard (ICG), commencement of performance-based logistics of the ICG fleet, initial operational clearance of Army version of Light Utility Helicopter and others.

In his address, Defence Minister Rajnath had said that "*Bandhan* exemplifies the spirit of public-private partnership in defence and aerospace sectors having forged strategic ties that are poised to transform defence and aerospace manufacturing". He said that 128 MoUs, 19 ToTs, 4 Handing Overs, 18 Product Launches and 32 major announcements were recorded at Aero India 2021.

Mr Rajnath Singh reiterated India's intention to bring down defence imports by at least \$2 billion by 2022 to encourage local defence manufacturing. Highlighting the importance of a requisite eco-system for growth of the defence industry, he said that Rs 6,800 crore investments



Lineup at the static display

were pledged by both public and private industries in the defence corridors of Uttar Pradesh and Tamil Nadu. However, the Indian Defence Minister reiterated that 'self-reliance' did not mean isolation from the world or to act as a closed economy but actually to promote globalisation by making India a more competitive player on the global stage and inviting the global companies.

Mr Rajnath Singh reiterated the target for increasing the country's defence base from \$11 billion to \$25 billion by 2025, including exports of \$5 billion. Defence exports have increased from Rs 2000 to Rs 9000 crores over 2015-2020, mostly spearheaded by the private sector. With reference to the Indian aerospace industry he said that the aero components sector is set to grow from Rs. 30,000 crores today to Rs. 60,000 crores by 2024. He flagged the cost-competitiveness of India's manpower resources, availability of abundant, specialist capabilities

and geographical advantages as the reasons for its emergence as a global and regional Maintenance and Repair Operations (MRO) hub.

In his valedictory remarks, made on-line, the President of India Mr. Ram Nath Kovind stated that "Aero India 2021 is a living proof of India's ever-growing strength in the defence and aerospace sectors at the global level". Referring to the *Conclave of Defence Ministers of Indian Ocean Region (IOR)* on the theme of 'Enhanced Peace, Security, and Co-operation in the Indian Ocean', which was organised on the margins of Aero India 2021, the President said that India has always been an ardent advocate of universal peace and development. "It is important that IOR nations focus on fostering political, economic, cultural and defence co-operation", he added. The first ever IOR Defence Ministers' Conclave was attended by ministers and delegates from 26 countries.

HAL at Aero India 2021



(Photo: Angad Singh)

A unique flying display of HAL's indigenous platforms (both fixed and rotary wing) aptly titled *Aatmanirbhar Formation Flight* were part of the flying display at start of the 13th edition of Aero India on 3 February 2021 at Air Force Station, Yelahanka. "HAL are showcasing their prowess in defence and aerospace centered on the theme 'Conceive. Indigenise. Collaborate' at this, the world's first hybrid exhibition."

The *Aatmanirbhar Formation Flight* consisted of HAL products such as the LCA trainer (LIFT), HTT-40, IJT, Advanced Hawk Mk.132 and Civil Dornier-228 flying in a special formation showcasing the spectrum of trainers and signifying self-sufficiency in this segment. The Sukhoi Su-30MKI, Advanced Light Helicopter (ALH), Light Combat Helicopter (LCH), Light Utility Helicopter (LUH) also took part in the flying display, while the static display included the Do 228 light transport aircraft Hindustan Turbo Trainer (HTT)-40, LUH and the Dhruv ALH Mk III.

HAL's major attraction at Hall-E was the *Combat Air Teaming System* (CATS) simulator. The simulator had Tejas-Max cockpit as the mother-ship platform with the embedded air teaming intelligence concepts to demonstrate the fully integrated as well as autonomous wingman platforms and swarming of drones to engage in the mission. Immersive mission visualisation were projected over a wider screen apart

HAL & MIDHANI in MoU for Production of Composites Raw Materials



HAL and MIDHANI signed a Memorandum of Understanding (MoU) for development and production of composite raw materials. The MoU was signed by Mr R. Madhavan, CMD (HAL) and Dr S K Jha, CMD (MIDHANI) the first time that such an MoU has been signed for composite raw materials. Mr R Madhavan said that "composites are one area where HAL will collaborate." Composites raw materials, mainly in the form of Prepregs used in platforms like LCA, ALH, LCH and LUH are currently imported.

from the command and display at Tejas-Max cockpit.

The outdoor display adjacent to HAL stall featured rotary-wing products

including the LCH, ALH Mk.IV Rudra and ALH Civil variant.

HAL's indoor pavilion was spread over an area of around 1126 sqm in Hall-E



and showcases indigenously designed and developed fixed and rotary wing platforms, technologies covering power plants and future generation combat capable airborne solutions. With the central theme of the *India Pavilion* being rotary-wing capabilities in India, HAL's rotary platform Light Utility Helicopter (LUH) is the centre piece of the display with scaled models of the IMRH, ALH, LUH, LCH and the Indian helicopter manufacturing ecosystem/supply chain partners arrayed around it.

HAL were at the forefront to display their indigenously-built platforms to visiting defence delegations and holding business meetings with OEMs and customers



HAL, GE Aviation in contract for forgings

On 4 February 2021, HAL signed a contract with GE Aviation for development and supply of ring forgings for GE Aviation military and commercial engine programmes. The five-year contract involves supplying both steel and nickel alloy forgings for shrouds, cases, rings and seals. In the photo are seen Mr Chandrashekhar Yavarna, Senior Director, Global Sourcing Strategy, GE Aviation handing over the contract document to Mr M S Venkatesh, Executive Director, Foundry Forge Division in the presence of Mr M S Velpari, Director (Ops), HAL and other officials



besides signing agreements and contracts with its business partners for various projects. Product launches, handing over ceremonies and major announcements were all part of HAL activities during the Show. 🦋

HAL's unmanned rotary RUAV200



HAL's Helicopter prowess on display



Amongst the various HAL-designed, developed and produced helicopters on display at Aero India 2021 were the light combat helicopter (LCH) seen with an array of weaponry and the Coast Guard version of the Dhruv advanced light helicopter (ALH).

The Tejas – and its Loyal Warriors



Hinted at during Aero India 2019 and then publically revealed at Yelahanka two years later was a full scale model of the *Warrior* weaponised drone being developed by Hindustan Aeronautics Limited (HAL). This is part of the indigenous programme CATS (Combat Air Teaming System) which is “a composite amalgamation of manned and unmanned platforms which work together to penetrate

heavily defended enemy airspace.” This is India’s equivalent of the ‘Loyal Wingman’ project which stealth unmanned aerial vehicle is in development by Boeing Australia to perform autonomous missions using artificial intelligence.

According to reports, there will be multiple Warriors controlled by the Tejas pilot, the drones equipped with air-to-air and air-to-surface weaponry.





Also under development by HAL alongside the Bangalore-based *Newspace Research & Technologies* is the Hunter cruise missile with a range of 200 kilometers and swarm drones known as ALFA-S with the objective of attacking multiple targets identified through artificial intelligence. The drones will be housed in a aerodynamically designed carrier mounted on a Jaguar strike fighter. 🦋



Rs. 48,000 crore contract for 83 LCA Mk.1As handed over to HAL



(Photo: Angad Singh)

At inaugural of Aero India 2021, in the presence of Raksha Mantri Mr. Rajnath Singh, a milestone contract for 83 Light Combat Aircraft was handed over to Hindustan Aeronautics Limited (HAL). Earlier on 13th January 2021, the Cabinet Committee on Security under the Chairmanship of Prime Minister Mr. Narendra Modi had approved procurement of 73 LCA Tejas Mk.1A fighter aircraft and 10 LCA Tejas Mk.1 Trainer aircraft at a cost of Rs. 45,696 Cr along with Design & Development and Infrastructure sanctions worth Rs. 1,202 Cr. The contract is valued at close to Rs. 48,000 crore.

“The deliveries of all 83 aircraft shall be completed 8 years from now. HAL will be delivering the first 3 aircraft in the 3rd year and 16 aircraft per year for the subsequent 5 years.”

Defence Minister inaugurates HAL's second LCA plant

The Defence Minister Mr. Rajnath Singh inaugurated the second plant of HAL's LCA Division a day before the show began. He lauded the efforts made by HAL to increase the production rate of LCAs which is going to be “the backbone of IAF fighter fleet in years to come. “HAL's new LCA facility is example of how ‘Aatmanirbhar Bharat’ is shaping and HAL deserves the largest indigenous order of 83 LCA Mk-1A. LCA is pride of India and sends the right message to others that India can make fighters of class in-house. The fighter is superior in many ways when compared to others fighters in its category besides being cost effective. I compliment HAL for working through the COVID times and bringing out this facility.” 🇮🇳



First semi-cryo propellant tank handed over

On successful production of the first ‘ISROSENE Propellant Tank’ of semi cryo developmental project by HAL's Aerospace Division, the ‘Acceptance Certificate’ was handed over by Mr MK Mishra, GM, ASD to Liquid Propulsion Systems Centre (LPSC), ISRO.



The Coast Guard variant on display at Yelahanka

HAL ALHs to the Indian Navy and Indian Coast Guard

HAL handed over three Advanced Light Helicopter (ALH Mk. III) to the Indian Navy and two ALHs to the Indian Coast Guard as part of 16 ALHs on order. The helicopters were handed over by Mr. R. Madhavan, CMD, HAL to Admiral Karambir Singh, Chief of Naval Staff and Mr. K. Natarajan, DG, Coast Guard in the presence of Defence Minister, Mr Rajnath Singh.



The ALH has now accumulated close to 300,000 cumulative flight hours and has proven its mettle in versatile operations. The ALH Mk. III is fitted with state-of-the-art glass cockpit and more powerful Shakti engine. The contract involves integration of 19 major systems with the existing ALH MK. III that includes IFF Mk. XII & ATC Xpdr with ADS-B Out, V/UHF Communication System, Traffic Alert and Collision Avoidance (TCAS-I), SAR Homer system, Automatic Deployable Emergency Locator Transmitter (ADELT), Loud

Hailer, Radio altimeter, Rescue Basket, Medical Intensive Care Unit (MICU), IADS System, AFCS, Digital Video Recording System (SSDVR), Automatic Identification System (AIS), High Intensity Search Light (HISL), Pressure Refueling System, Control grips, EO POD Rev III, Surveillance Radar System plus a 12.7 mm gun. 🚁





HAL's LUH (Army Variant) receives IOC

HAL's Light Utility Helicopter (LUH) received its Initial Operational Clearance (IOC) for the Indian Army from CEMILAC at Aero India 2021. Chairman HAL said that the thrust "is being given by HAL for indigenous R&D programmes towards self-reliance and enhancing operational effectiveness of Armed Forces". Mr Arup Chatterjee, Director (Engg. and R&D), stated that performance of the basic helicopter in all terrains and under all weather conditions "was satisfactory." HAL is currently integrating and flight-testing mission role equipment on the LUH. "HAL is fully geared to fulfill the requirements of customers in time-bound manner."

All certification activities like Ground testing, Ground Test Vehicle endurance

runs, system testing, Flight testing including hot weather trials, cold weather trials, sea level trials and hot weather high altitude trials have been completed. Based on the flight trials carried out, all PJSQR requirements for basic helicopter certification have been complied satisfactorily. 🦁



Development of seaplane variant of Do-228

HAL's Transport Aircraft Division (TAD Kanpur) made an announcement for developing amphibian/seaplane variant of Do-228 aircraft on 5 February during the 'Bandhan' event at Aero India 2021. The development is expected to augment the service of aircraft both in defence and civil roles.



HAL receives Provisional Certificate of Indigenous Engine and Flight Display Unit (EFDU) from CEMILAC

HAL has received the Provisional Certificate of Engine and Flight Display Unit, (EFDU) indigenously developed for Jaguar DARIN III fighter aircraft. This was at the *Bandhan* programme during Aero India 2021. Mr Arup Chatterjee, Director (Engg and R&D) received the Clearance Certificate from Mr APVS Prasad, Outstanding Scientist and Chief Executive (Airworthiness), CEMILAC. Mr R Madhavan, CMD, HAL said “this development would not only lead to self-reliance but also enable HAL to develop further similar smart instrument display system and Multi-Function Display for various aircraft platforms.”

The EFDU developed by the Mission and Combat Systems R&D Centre (MCSRDC), HAL is a flight critical system displaying engine fuel and flight parameters required in operations. In case of failure of primary flight display unit, EFDU provides necessary engine, fuel, hydraulics and navigation data required for ‘get-you-home’ functionality on a single 4“X5” AMI LCD display. This EFDU will replace an imported Engine and Flight Instrument System (EFIS) Unit giving boost to the ‘Aatmanirbhar Bharat’ initiative. 🦋



Mr Arup Chatterjee, Director (Engg and R&D) receiving the Clearance Certificate from Mr APVS Prasad, Outstanding Scientist and Chief Executive (Airworthiness), CEMILAC

HAL Purchase Agreement with Elbit Systems for DOHS



HAL entered into an agreement with Elbit Systems Electro Optics Elop Ltd., Israel for supply of Digital Overhead Head Up Display Systems (DOHS) during Aero India-2021. The Digital Overhead HUDs will be initially manufactured in an existing facility of HAL's Division at Korwa. A dedicated facility will be progressively follow

in proportion to manufacturing volume. HAL and Elbit Systems have envisaged this mutual co-operation to upgrade its technological base and acquire high end technology on Digital Overhead HUD System which is primarily used in transport aircraft worldwide. The Digital Overhead HUD with modern optics provides sharp brightness, larger field of view and larger head motion box.

Earlier, HAL's Korwa Division entered into licensed Transfer of Technology agreement with ELOP Electro-Optics Industries Ltd, Israel for setting up the D-level maintenance and manufacturing facilities of CRT based HUD (front). More than 500 HUDs have been supplied for various IAF platforms including the Su-30MKI, Jaguar and MiG-27M upgrade. 🦋

HAL receives RFP for 70 HTT-40 Basic Trainer Aircraft



In the fitness of things, and ironically at the very place where some years earlier a previous Defence Minister and then Chief of the Air Staff had virtually dismissed the efforts by HAL to design and develop a turboprop basic trainer for the Indian Air Force, Hindustan Aeronautics Limited received the formal Request for Proposal (RFP) from the Indian Air Force for their basic trainer requirement at Aero India 2021 on

4 February 2021. The RFP is for 70 HTT-40 Basic Trainer Aircraft with provision for 38 more. The documents were handed over by Deputy Chief of the Air Staff Air Marshal Sandeep Singh and DG (Acquisition), Ministry of Defence Mr. V L Kantha Rao to Mr. R Madhavan, CMD, HAL.

The certification will be given against the Programme Compliance and Quality Review (PCQR), the production to take place at two manufacturing facilities of

HAL in Bengaluru and Nashik. The RFP has come within six years after its first flight which is a very short time-line in aircraft industry. The HTT-40 will have more than 60 percent indigenous content and the development is supported by agencies such as Centre for Military Airworthiness and Certification (CEMILAC), Regional Director Aeronautical Quality Assurance (RDAQA), Aircraft and Systems Testing Establishment (ASTE) among others. ✈



Air Marshal HS Arora, Vice Chief of the Air Staff was at Aero India 2021 and flew in the HTT-40

Lockheed Martin and HAL sign MoU

Lockheed Martin signed a Memorandum of Understanding (MoU) with Hindustan Aeronautics Limited to explore industrial opportunities. Lockheed Martin is strengthening and growing its relationships with Indian industry to generate jobs and economic benefits in support of “Make in India, Self-Reliant India, and Start-Up India” initiatives, as well as in support of India’s air power mission.

“We are excited to explore potential opportunities with HAL, one of the largest aerospace companies in Asia,” stated JR McDonald, Vice President of Business Development – Integrated Fighter Group, Lockheed Martin Aeronautics. “We are committed to continuing to integrate Indian industry into our aerospace and defence ecosystem and demonstrating Lockheed Martin’s commitment to India now and in the decades to come.”



Rolls-Royce and HAL expand partnership



Rolls-Royce and Hindustan Aeronautics Limited have agreed to expand their partnership in India for collaboration in two significant areas – expanding the supply chain for both Civil and Defence Aerospace and establishing an authorised maintenance centre for Adour Mk871 engines to support Rolls-Royce’s global customers. Through these new collaborations, the two companies will ‘build on their rich partnership of over 60 years, wherein Rolls-Royce engines have been ‘Made in India’ and supported by HAL under license from Rolls-Royce. This includes a ‘Letter of Intent’ (LoI) to work towards making Adour Mk871 engine parts in India for several

international customers. In addition, HAL has recently been awarded new business with Rolls-Royce to supply forgings including shrouds, cases and seals for Rolls-Royce’s Trent family of engines and for the Pearl 15 engines. These parts would be manufactured at HAL’s Foundry and Forge Division at its state-of-the-art facility in Bengaluru.

Mr. R Madhavan, CMD of HAL stated, “We are looking at new areas of cooperation and exports to countries which Rolls-Royce and HAL together contribute to in aerospace application.”

Kishore Jayaraman, President, Rolls-Royce India and South Asia stated, “We

value our long-standing partnership with HAL and are proud to have been serving the Indian Armed Forces together for several decades now. Our journey with HAL is the original ‘Make in India’ story that started in 1956 when our Orpheus engines were first manufactured in India. We are delighted to take this partnership to the next level through collaborations for sourcing as well as to set up servicing and maintenance support for our Adour engines. We share strong synergies with HAL and as we look at future programmes, we believe there is immense potential to further build on our shared capabilities.”

Safran and HAL sign MoU on military engine collaboration



Hindustan Aeronautics Limited and Safran Aircraft Engines signed an MoU (Memorandum of Understanding) announcing their intent to work together on bringing niche engine technology to India. Under the terms of the MOU, HAL and Safran Aircraft Engines intend to explore opportunities to assemble the Safran M88 engine and manufacture components for the engine with HAL for additional batch of Rafale aircraft for India and for any aircraft manufactured in India by HAL fitted with M88.

The transfer of a significant amount of technology in assembling/manufacturing programmes is also contemplated. The MOU also encompasses collaboration between HAL and Safran Aircraft Engines for indigenisation programmes relating to design and development of high thrust engines of 110 kN power and above with transfer of key technology in the framework of this development.

“We are looking forward to expanding our collaboration with HAL, by exploring opportunities in strategic areas”, stated Jean-Paul Alary, CEO of Safran Aircraft Engines. “Broadly, we’re committed to supporting the *Make in India* policy through major investments, synergy, and high-skilled job creation.”

“Safran is our key partner in respect of engines in HAL’s helicopters like Chetak, Cheetal, Light Utility Helicopter, Light Combat Helicopter and Advanced Light Helicopter. HAL and Safran have successfully co-developed ‘Shakti’ Engine for Advanced Light Helicopters and Light Combat Helicopter. We have manufactured more

than 450 Shakti engines in India at HAL Engine Division in Bangalore, which is testimony of success of our collaboration. Both HAL and Safran are keen to take this partnership to next level by exploring new avenues. HAL and Safran are interested in exploring opportunities for strategic business cooperation that leverage the complementary

talents and capabilities of the parties and support development of a robust ecosystem for aero-engines in India, consistent with the goals of the Government of India’s *Make in India* initiative”, stated Mr R. Madhavan, Chairman & Managing Director, HAL.

Both companies also teamed up in 2005 to create an equally-owned joint venture in Bengaluru which produces pipes for aero-engines. The MOU is significant as it will enable India to access very complex and niche technology mastered by very few countries and to build capability in the design and development of high thrust engines. Considering the country’s future requirement of fighter aircraft, this augurs well for self-reliance in the engine domain and also opens up possible opportunities for export. ✈️



IAF Rafale at Yelahanka 2021



HAL LCH at Aero India 2021

HAL reveals new image of the Multi Role Helicopter (IMRH)



At Aero India 2021, HAL revealed the new design of its IMRH which will have multi-role and multi mission capability and designed for utility and armed variants for Indian Air Force and Indian Army. Key features include high altitude performance, composite main rotor (S bladed) & tail Rotor (4 bladed), twin engine with FADEC, crashworthy tri cycle Landing gear, smart glass cockpit with large area displays, state of the art 4 Axis digital automatic flight control system and prognostic HUMS.

In an interview with *Vayu* on the eve of Aero India 2021, HAL CMD stated, “As per Minutes of the Review Meeting (dated 2 December 2020) on the IMRH chaired by Secretary DP, the IAF and Army are to issue a finalised JSQR by April 2021. Based on this, HAL will have to submit the DPR by June 2021. A preliminary version of the Operational Requirements have been issued by Air HW on 15 December 2020. HAL will provide feedback on the ORs to IAF shortly” 🦁

HAL's LCA DMG



The LCA Mk.1A Digital Map Generator from HAL's Mission and Combat Systems Research and Design Centre (MCSRDC), indigenously designed for LCA Mk.1A programme was revealed at Aero India. It has the latest Multicore processor based design with NXP QorIQW T2081 and Extensive Graphics Processing with MD E8860 and will aid the pilot in aircraft navigation, flight planning & tactical operations by rendering 2D & 3D maps and drawing overlays over the map.



DGCA approval for Civil Dornier 228 Landing Gears MRO

The DGCA has accorded maintenance organization approval (CAR-145) to Aircraft Division-BC under the scope of repair and overhaul of civil Dornier 228 landing gears. Aircraft Division, Bengaluru will be the only approved source other than the OEM, in Germany for carrying out manufacturing, repair, and overhaul of Dornier 228 landing gears for military, civil and export purposes.



DRDO displays an array of technologies



India's Defence Research and Development Organisation (DRDO) exhibited an array of its latest defence technologies with more than 300 products, technologies and innovations presented at in indoor, outdoor, static and flying displays. The models and exhibits were in various technology categories, with the thrust being on digital display of data to highlight product details.

Major attractions of DRDO's participation was flight display of its AEW&C system, LCA variants, plus the LCA Navy on static display. Highlights of the indoor exhibits included the combat free fall system, models of the Advanced Medium Combat Aircraft (AMCA), ABHYAS - High-speed Expendable Aerial Target, Twin Engine Deck Based Fighter (TEDBF), FCS System for the LCA and Aerostat Systems.

There were also displays of the Nirbhay missile, P-16 Heavy Drop System, AWACS India (in model form), Kaveri dry engine prototype, Gas turbine blade and Pilotless Target Aircraft Engine (PTAE) and others. In the area of materials, titanium sponge being developed for the aircraft carrier INS *Vikrant*, was displayed along with other aeronautics products.

Among engineering products, the exhibits included Aircraft Mounted Accessory Gear Box (AMAGB), AWAGB bearing, MRSAM launcher and two-stroke single/double/four-cylinder engines for UAVs. Armament-related products showcased are 250kg pre-fragmented bomb, 450kg HSLD bomb, INS GPS guidance kit for 450kg HSLD bomb, missile warhead models of Astra, Helina, canopy severance system (CSS) for the LCA and IR flares for the PTA.

Among missiles, full scale models of various air-launched and surface-launched missiles including the Astra, LRSAM, QRSAM, anti-radiation missile NGARM and Smart Anti Airfield Weapon SAAW were on display. Besides the missiles, technology sub-systems including the RF seeker, IIR seeker, Pinaka guidance kit, model of rail track rocket sled (RTRS) facility and exploder for naval warheads were on display.

As for electronics and communications, various mission and radar computers, laser warning sensors, AEW&CS data links, various SDR models, light weight portable laser target designator, radars and antennae were displayed. Integrated life support system, emergency survival rations, NBC Suit Mk.5, personal decontamination kit and other life sciences products were shown as well.

Within the *India Pavilion*, whose theme was *Rotary Wing Platforms*, some seventeen products applicable to helicopters were exhibited, Low Frequency Dunking Sonar (LFDS) for the ALH, torpedoes. Airborne Software Defined Radio, Radar for Naval Utility, Light-weight Electro Optical Payload (LEOP), Dual Colour Missile Approach Warning System (DCMAWS) and Digital RWR. The other systems applicable for rotary wing platforms included IFF Mk. XII, Combat Search & Rescue (CSAR), Heli-Net, SANT Missile and NASM-SR Dummy Model. 🦋



Close up of the radar antenna to be mounted on an A-320 platform

Fighter shapes in the making

Various fighter programmes under development by DRDO were publically displayed for the first time in model form during Aero India 2021. These included the single-engine LCA (Air Force) Mk.II also referred to as the medium weight fighter (MWF), with, alongside, model of the Navy's *twin-engine deck based fighter* (TEDBF).

The Indian Air Force has indicated its requirement for 5th generation fighters to be indigenously developed which is exemplified by scale model of the advanced medium combat aircraft (AMCA).



India's 'Stealth Works'



Publically revealed for the first time were an array of projects and programmes being undertaken by the Defence Research & Development Organisation (DRDO) alongside the Aeronautical Development Agency (ADA), the latter directly involved in the LCA Mk.II (medium weight fighter) and advanced medium combat aircraft (AMCA). In model form, these were the cynosure for all and being referred to as work in progress in India's 'stealth works', a take off from the US 'Skunk Works' which has been working on advanced development programmes since the mid-20th century, some of its products being the F-117, F-22 Raptor and F-35 Lightning II stealth fighters.

However, the model seen were those of the SWIFT, an autonomous *stealthy unmanned combat air vehicle* (UCAV), being developed by DRDO for the Indian Air Force. Details of the project are classified but according to public sources, this UCAV will be a stealthy flying-wing concept aircraft with internal weapons bay and a turbofan engine.

Major DRDO achievements during 2020



108 Systems & Subsystems towards achieving 'Aatmanirbhar Bharat'

Responding to the call given by India's Prime Minister for *Atmanirbhar Bharat*, the DRDO has taken several initiatives to strengthen the indigenous defence ecosystem. A DRDO delegation has appraised the Defence Minister Rajnath Singh on 108 systems and subsystems identified for design and development by Indian Industry.

LCA Navy operates from INS Vikramaditya

After completing extensive trials on the Shore Based Test Facility (SBTF), Naval version of Light Combat Aircraft (LCA) carried out a successful arrested landing onboard INS *Vikramaditya* on 11 January 2020 (see *Vayu Issue II/2020*).

'Atulya' Air Defence Fire Control Radar (ADFCR)

Air Defence Fire Control Radar (ADFCR) in conjunction with anti-aircraft guns form part of the Ground Based Air Defence System whose main purpose is effective point defence against air threats at short and very short ranges during day and night under all weather conditions, also in presence of enemy jamming. The radar has been developed as an indigenous solution

after DAC approval for large quantities for Indian Army. During February 2020, Phase-I of User Assisted Technical Trials (UATT) i.e. high-altitude low temperature tests were completed.

Software Defined Radio (Airborne)

The SDR secure indigenous system has legacy communication, digital voice/data communication, secure digital voice/data communication for Naval applications with 3 channel, 4-channel for tactical communication and single channel operation in V/UHF and UHF band. During March 2020, two 4-channel CEMILAC SOFT certified SDR-AR system installation and integration were successfully carried out on two Indian Naval Dornier 228s with SDR-AR ground station at HAL.

Dhruvastra 3rd generation helicopter launch anti-tank guided missile

The DRDO successfully conducted three flight tests of its indigenously-developed anti-tank guided missile (ATGM) *Dhruvastra* at the Integrated Test Range at Chandipur in Odisha, in July 2020. This is considered as "one of the most advanced anti-tank weapons extant."

Hypersonic Technology Demonstrator Vehicle flight-tested

The DRDO-developed hypersonic air-breathing scramjet technology was flight tested with the Hypersonic Technology Demonstration Vehicle (HSTDV) at Wheeler Island, off the coast of Odisha in September 2020. The Vehicle was launched using a proven solid rocket motor, which took it to an altitude of 30 kms, where the aerodynamic heat shields were separated at hypersonic Mach number. The hypersonic combustion was sustained and the cruise vehicle continued on its desired flight path at a velocity of six times the speed of sound for more than 20 seconds.

Multi Influence Ground Mine (MIGM)

The Multi Influence Ground Mine (MIGM) has been designed and developed by NSTL, to give the Indian Navy an edge against modern stealth ships. The MIGM is deployable from ships, submarines, and has successfully completed Technology Demonstrations during various Technical Trials.

'Uttam' Active Electronically Scanned Array Radar

The *Uttam* Active Electronically Scanned Array Radar, being developed by DRDO, is a multimode, solid-state active phased array



a fire control radar with scalable architecture which can be adapted for various types of fighter class of aircraft. “This is capable of tracking multiple targets with high accuracy suitable for firing missiles with interleaved air-to-air, air-to-ground and air-to-sea modes for all terrain operations”.

Flight test of ABHYAS

Successful flight test of the ABHYAS High-speed Expendable Aerial Target (HEAT) was conducted on 22 September 2020 by DRDO at the Interim Test Range, Balasore in Odisha. During the trials, two demonstrator vehicles were successfully test flown, the vehicle planned to be used as an expendable target for evaluation of various missile systems.

Flight tests of BrahMos missile

The BrahMos surface-to-surface supersonic cruise missile which incorporates indigenous booster and airframe sections along with other ‘Made in India’ sub-systems was successfully flight tested on 30 September 2020 from the ITR, Balasore in Odisha, “a major step in enhancing its indigenous content”. On 18 October 2020, another BrahMos missile was successfully test fired from Indian Navy’s indigenously-built stealth destroyer INS *Chennai*, precisely impacting on a target in the Arabian Sea, after performing high-level and extremely complex manoeuvres. On 1 December 2020, another BrahMos missile in anti-ship mode was successfully test fired against a decommissioned ship, “the missile performing highly complex manoeuvres and destroying the target”.

Flight testing laser guided ATGM

The indigenously-developed Laser Guided Anti-Tank Guided Missile (ATGM) was successfully test fired on 1 October 2020 against a target at longer ranges. The test was carried out by an Arjun MBT at the KK ranges (ACC&S) Ahmednagar in continuation of earlier successful trials. Laser guided ATGMs lock and track targets with the help of laser designation to ensure precision hit accuracy. This has been developed with multiple-platform launch capability and is currently undergoing technical evaluation trials from the main gun of the Arjun main battle tank.

Flight Test of SMART

Supersonic Missile Assisted Release of Torpedo (SMART) was successfully flight tested on 5 October 2020 from Wheeler Island off the coast of Odisha. “All the

mission objectives including missile flight upto the range and altitude, separation of the nose cone, release of torpedo and deployment of Velocity Reduction Mechanism were met perfectly”. Tracking stations (radars, electro optical systems) along the coast and telemetry stations including down range ships monitored all the events. SMART is a missile assisted release of lightweight Anti-Submarine Torpedo System for Anti-Submarine Warfare operations, far beyond current torpedo ranges.

Anti-Radiation Missile (RUDRAM)

The new generation Anti-Radiation Missile (RUDRAM) was successfully flight tested on 9 October 2020 homing in on a radiation target located on Wheeler Island off the coast of Odisha, the missile being launched from a Su-30MKI fighter aircraft. RUDRAM is the first indigenous anti-radiation missile of the country for the Indian Air Force missile integrated on the Su-30MKI fighter aircraft as the launch platform, with capability of varying ranges based on launch conditions. “The missile is a potent weapon for the IAF in Suppression of Enemy Air Defences (SEAD) effectively from large stand-off ranges”.

Final user trials of NAG missiles

Final user trial of the NAG 3rd generation anti-tank guided missile (ATGM) was carried out on 22 October 2020 at the Pokhran ranges. The missile was integrated with an actual warhead and the tank target was kept at designated range. Launched from the NAG Missile Carrier NAMICA, the missile hit the target accurately and penetrated the armour.





Enhanced version of PINAKA rocket system tested

The 'Enhanced' PINAKA rocket, developed by DRDO was successfully flight tested from the Integrated Test Range, Chandipur off the coast of Odisha on 4 November 2020. "Development of Enhanced Pinaka system was taken up to achieve longer range performance compared to earlier design with reduced length".

Major milestone for QRSAM missile system

The Quick Reaction Surface to Air Missile (QRSAM) System recorded a major milestone with its direct hit on a Banshee pilotless target aircraft at medium range and medium altitude. This took place from ITR Chandipur on 13 November 2020 off the Odisha Coast and was followed by another test on 17 November 2020. The missile uses all indigenous subsystems.

Successful trials of 5.56x30 mm joint venture protective carbine

The DRDO-designed 5.56x30 mm protective carbine (JVPC) has successfully undergone final phase of user trials on 7 December 2020 meeting all GSQR parameters, paving the way for its induction into service. A series of user trials had been carried out in extreme temperature conditions in summer and high altitudes in winter, the JVPC meeting the performance criteria of reliability and accuracy in addition to quality trials conducted by DGQA. 🦋



DRDO hands over ToT for 14 technologies to 20 industries

DRDO handed over Licensing Agreements for ToT (LAToT) for 14 DRDO developed technologies to 20 industries. The technologies transferred were from the area of electronics, laser technology, armaments, life sciences, materials science, combat vehicles, naval systems, aeronautics, sensors, and others. The product technologies transferred were Low Level Transportable Radar (LLTR), Inertial Navigation System for Ship Application (INS-SA), Long Range Optical Target Locator (OTL 1500), Hand Held Through Wall Imaging Radar (HH-TWIR) and Commander TI (Thermal Imager) sight for T-72 tanks. NMRL-Fuel Cell based Air Independent Propulsion Technology for Naval Submarines named NMFCAIP is a unique capability developed by DRDO and now transferred to the industry. Multi Agent Robotic System (MARS) will be produced by the Indian industry based on DRDO's design.

In his address, Raksha Mantri said *Bandhan* exemplified the spirit of public-private partnership'. He added that the fountain head of any capability "emerges from its foundation and the foundation of our vision rests on three pillars namely, research and development, public and private defence production and defence export". He mentioned that with an aim of encouraging the manufacture of defence related items in India, "our endeavour will remain to bring down the defence imports by at least two billion dollars by 2022".

Many armament systems, namely 155 mm x 52 Cal Advance Towed Artillery Gun System (ATAGS), Mechanical Mine Layer - Self Propelled (MML- SP) and Prachand Anti-Tank Munition had been handed over to the industry for production. Other technologies that were transferred for production by Indian industry were Individual Under Water Breathing Apparatus (IUWBA), Basic WhAP 8x8 & Add-on Armour for WhAP and 4 MW Diesel Engine Infrared Signature Suppression System. An MoU was exchanged between DRDO and HAL to finalise ToT of *Uttam* radar for new LCA configurations and new generation Radar Warning Receiver (RWR-NG).

BDL range on display at Aero India 2021



Top Down:
BDL produced Varunastra ship-launched heavy weight electrically-propelled anti-submarine torpedo; light weight anti-submarine torpedo (TAL); extended range anti-submarine rocket (ER-ASR)



MILAN 2T



MP ATGM



AMOGHA

Clockwise: Milan 2T light anti-tank infantry missile; MP ATGM; Nag anti-tank missile; Amogha-III third generation anti-tank guided missile, designed and developed by BDL; INVAR laser beam rider anti-tank guided missile, fired from T-90 tanks



KONKURS M



SAAW-DRDO

SAAW



STARSTREAK



Clockwise from top left: 9M113 Konkurs wire guided anti-tank missile (license from Russia); DRDO developed Smart Anti-Airfield Weapon (SAAW); short range man-portable air defence system Starstreak; Astra beyond visual range air-to-air missile; DRDO-developed MPATGM, or Man Portable Anti-Tank Guided Missile, third-generation fire-and-forget anti-tank guided missile derived from Nag ATGM

Rafael and BDL MoU on Anti-Torpedo Defence System for Indian Navy

On 4 February 2021, Rafael Advanced Defense Systems and Bharat Dynamics Limited (BDL) signed a MoU for joint induction of an Anti-Torpedo Defence System (SHADE) for the Indian Navy. The MoU was signed by Mr Eli Hefets, Rafael's Corporate Regional Director for India and Mr NP Diwakar, Director (Technical), BDL, in the presence of Defence Minister Rajnath Singh.

SHADE will be the first system in the world to employ a combination of soft kill and hard kill decoys, thereby providing robust and effective defence against modern torpedoes.



BEL showcases 30 products/systems developed as part of 'Aatmanirbhar Bharat'

Bharat Electronics Limited (BEL) showcased state-of-the-art products and systems spanning every domain of its business at Aero India 2021. The products and systems were clustered as 'Airborne & Space Application', 'Satellite and Space Application', 'Products and Systems for Self-Reliance (*Aatmanirbhar Bharat*)', 'High Performance Computing & Artificial Intelligence Systems', 'Land and Naval Products and Systems', 'Communication and Laser based Products', 'Non-Defence/Diversification and Outdoor Display Products'.

In addition, BEL showcased its R&D capabilities by launching/demonstrating some of its new products and technologies. Some of the new products and technologies were in the

area of Airborne & Space/Satellite Application including Self Protection Suite with DIRCM (with foreign ToT), Hand Held Field Signal Generator, Airborne & Ground Spread Spectrum Modem, Backpack Anti Drone System, BE NAVIC 705, Compact Time Reference Server (Airborne), VPX architecture based SDR for Air Borne platforms and Airborne Sonar.

In total, about 30 products and systems developed as part of the *Aatmanirbhar Bharat* initiative were on display, including Airborne Missile Electronics, Receivers for EW Systems and many others such as 2KW Fuel Cell, FO Gyro based Sensor Packaged Unit, Athremal Laser Transmitter, IR Jammer, Call Manager & Media Gateway, C-Band Tropo Power Amplifier and IR Seekers Missiles.

BEL showcased a range of Land and Naval Products and Systems comprising QRSAM Radars (BFMR and BSR), BFSR-XR AESA, DDR (FMCW), Coastal Surveillance System, GBMES, Single Combat Vehicle (QRSAM), Weapon Control System, and more. The company also displayed Communication and Laser based products including MODEM for Troposcatter Communication System, Encryptors, Frequency Modulated Continuous-Wave (FMCW) Radar for Fog Vision and Drone Guard systems for Railways, 4G Secure Phone and 5G Tablet PC, High Power Fiber Laser, Li Fi High Speed Communication System and Software Defined Radio in Communication and Electro Optics segments.



BEL signs MoU with L&T



At centre Mrs Anandi Ramalingam, Director (Marketing), BEL, and Mr Arun Ramchandani, Executive Vice President (Defence & Aerospace), L&T.

At Aero India 2021 Bharat Electronics Limited and Larsen & Toubro Limited (L&T) announced their MoU to cooperate in addressing the needs of evolving domestic and export markets for defence products and systems. The MoU seeks to leverage capabilities of both the firms through strategic alignment, enhancing indigenisation content and collaboration using high-end and advanced technologies to meet domestic needs and enhance export prospects.

BEL signs MoU with Beretta Italy

In line with the Government of India's vision for an *Aatmanirbhar Bharat*, BEL and Italian firearms manufacturing major Beretta Italy announced an MoU for indigenous manufacture of Close Quarter Carbine Weapons (CQB Carbines) and other small arms, required by Defence and other customers.

Grene Robotics and BEL to jointly develop air defence technology

Hyderabad-based Grene Robotics signed an MoU with Bharat Electronics Limited to jointly develop an autonomous MANPAD Data Link (ADML) system, a first-of-its-kind air defence solution that brings isolated MANPAD operators into a networked environment.

MoD and BEL sign contract for SDRs worth Rs 1,000 crore

Ministry of Defence and Bharat Electronics Limited signed a contract for procurement of Software Defined Radio Tactical (SDR-Tac) worth over Rs 1,000 crore.

The SDR-Tac, jointly designed and developed by Defence Electronics Applications Laboratory (DEAL) of Defence Research & Development Organisation (DRDO) through a consortium of domestic agencies and industry comprising Weapons and Electronics Systems Engineering Establishment (WESEE), BEL, Centre for Artificial Intelligence & Robotics (CAIR) and the Indian Navy will bring strategic depth to the Armed Forces," delivery to take place within three years. The BEL is already supplying SDR-Naval Combat (NC) and SDR-Air is under user evaluation trial. DRDO and BEL are planning to provide latest SDR with security grading to the Armed Forces.

BEL offset contract with Rosoboronexport

At the 6th India-Russia Military Industrial Conference, held at Bengaluru, Bharat Electronics Limited entered into an Offset Contract under 'invest in kind' with Joint Stock Company Rosoboronexport, Russia, for setting up industrial facilities for manufacture of a wide range of aviation hoses at BEL Optronics Devices Limited, Pune, a subsidiary of BEL.

With implementation of the Offset project, BEL will obtain cost-effective, state-of-the-art technology based on modern production and testing machinery and proven technological processes manufacturing high-quality aviation hoses certified for international standards for all types of aircraft operating in India. There is constant demand for aviation hoses, which are consumables in nature.



BEL modules to Thales for Rafale RBE2 radar

As part of Thales' offsets commitments under the Rafale India contract, Bharat Electronics Ltd has manufactured T/R (transmit/receive) modules for RBE2 radars for the Dassault Aviation Rafale and delivered them to Thales.

Thales is an active stakeholder in the *Make in India* policy, and in the offsets conditions included in the Rafale India programme. In November 2020, the first RBE2 AESA (active electronic scanning array) radar with front-end manufactured by BEL in India was delivered by Thales to Dassault Aviation. BEL implemented a set of rigorous processes at its Bangalore facility in order to achieve this key milestone.



Defence Minister at BrahMos Pavilion

Defence Minister Rajnath Singh visited the BrahMos Aerospace pavilion on inaugural day of Aero India 2021. He was briefed by DS & DG, BrahMos (DRDO) and CEO & MD of BrahMos Aerospace Dr Sudhir Kumar Mishra on the progress and achievements made in various business activities under the ambitious *Aatmanirbhar Bharat* programme.



Dr G. Satheesh Reddy, Chairman DRDO at BrahMos pavilion

Dr G. Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO seen here visiting the BrahMos pavilion, was briefed on the BrahMos weapon system and its recent achievements and progress.



IAF Chief at BrahMos pavilion



Air Chief Marshal Rakesh Kumar Singh Bhadauria, CAS Indian Air Force visited the BrahMos pavilion on 3rd day of Aero India 2021. Dr. Sudhir Kumar Mishra briefed him about the BrahMos Land Mobile Complex, Naval Fleet Platform, and the recent launches of Brahmos Air Launched Cruise Missile system.

COAS visits BrahMos pavilion



Chief of the Army Staff, Gen MM Naravane, visited the BrahMos Aerospace pavilion on inaugural day of Aero India 2021. He was briefed by Dr Sudhir K Mishra, CEO & MD about the BrahMos Weapon System and major milestones the India-Russia defence JV has achieved over the years. The Indian Army has since 2007 operationalised the mobile land attack Brahmos cruise missile variants.

BEML at Aero India 2021

Showcasing capabilities in Defence and Aerospace Sectors



BEML showcased some of its prime products during Aero India 2021. The theme was *Atmanirbharta*; and the display included, products such as the Transporter Landing System (TLS) and variants of Unmanned Aerial Vehicles (UAV), at its indoor Stall. BEML is also displaying various equipment and critical components in the aerospace sector.

The TLS displayed at BEML's outdoor stall is a ground-based precision landing system to improve access to airports where terrain or land constraints make instrument landing system (ILS) installation unfeasible or cost-prohibitive. TLS functions over any terrain using directional antennas and can be installed even on short runways

ending with water / obstructions. This will be manufactured in India by BEML in collaboration with Advanced Navigation and Positioning Corporation of USA.

BEML's Primoco UAV '150' (photo above) is designed for both civilian and military use, can take off and land autonomously, having an endurance of 15 hours. This UAV can be used for surveillance, monitoring, border patrolling and law enforcement.

Primaco UAVs will be built in India in collaboration with Primaco of the Czech Republic.

BEML also displayed its 25kg-class Tactical UAV being developed indigenously in collaboration with the Indian Institute of Technology, Kanpur. The UAV will carry payloads of 3.0 kg, including day & night cameras, fly continuously for 8 hours with 50 kms radio range. 🚀



MV Rajasekhara CMD, BEML

COAS at the BEML stand



Chief of the Army Staff Gen. MM Naravane visited the BEML stand and was briefed by Mr. MV Rajasekhara, CMD (Addl Charge) and Mr. A K Srivastava, Director Defence on BEML's ongoing projects related to aerospace and defence systems.

BEML signs MoU with CSIR-NAL



BEML signed a Memorandum of Understanding (MoU) with the Council of Scientific and Industrial Research (CSIR)-National Aeronautics Laboratory (NAL) to develop advance composite and autoclaves, mini unmanned aerial vehicles, design and analysis of aircraft structure and systems. BEML also teamed with NAL for joint development of 2 seater trainer aircraft through Technology of transfer (ToT).

At Yelahanka. Mr. A K Srivastav, Director Defence & Aerospace exchanged the copies with Mr. R Venkatesh, Director Business Development, NAL. "This will help BEML to increase its footprint in the aerospace sector."

BEML signs 11 MoUs

BEML signed MoUs with 11 entities to explore and enhance the business in Defence & Aerospace in the presence of the Defence Minister Mr. Rajnath Singh at the Bandhan Ceremony at Aero India. Some of them include: those with Advance Navigation Positioning Company (ANPC) for joint manufacturing of transponder landing system (TLS) for Indian armed forces, Airport Authority of India (AAI) and Oil exploration companies.

With Primoco UAV SE, Czech Republic for manufacturing of 150 kg class Surveillance UAV for Indian as well as global requirements.

With IIT Kanpur for joint development and manufacturing of 25 kg class tactical UAVs.

With SKAT Systems, Russia for joint manufacture of High Altitude UAVs.

With Rosoboronexport for projects such as infantry combat vehicle 'Boomerang', light armoured vehicle 'Strela', Auxiliary power units for T-72 / T-90 tanks.

With Adani Defence Systems & Technologies Ltd to provide mobility systems for armored personal carriers, infantry combat vehicles and main battle tanks.



A K Srivastav, Director Defence, BEML exchanging the copies of MoU after signing with Ashish Rajvanshi, Managing Director, Adani Defence Systems & Technologies Ltd in the presence of MV Rajasekhar, CMD, BEML

Far from the Seas, Shipbuilders at Aero India too

GRSE signs ten strategic collaborations



Garden Reach Shipbuilders & Engineers Ltd. signed strategic MoUs as part of the 'Bandhan' initiative at Aero India 2021, "that will help the shipyard boost its shipbuilding and ship repair capabilities and identify and explore synergies and partnerships for the niche 'portable steel bridges' market in India and neighbouring countries."

These include:

- ▶ ToT for Diesel Engine Infrared Signature Suppression System with NSTL, Vishakhapatnam.
- ▶ MoU with Sterling PlanB of Canada for Energy Storage Solutions for Electric/ Hybrid Propulsion in Ships.
- ▶ GE Power for Development of Electric/ Hybrid Propulsion for Naval Platforms.
- ▶ ASSL Bangladesh for Cooperation in Shipbuilding.

- ▶ NHIDCL for Supply of Bailey Bridges.
- ▶ ECT Marine Netherlands for Design of Contemporary Dredgers.
- ▶ CAS Electrical & Automation Pvt Ltd. for Product Development and Service Support for Helo Handling Systems.
- ▶ IIT Kanpur for Aerodynamic Studies in Ship Design.
- ▶ Abhyudha Bharat Defence Cluster for Indigenisation of Components.
- ▶ Island Ship Repairers for Purpose of Ship Repairs.

"GRSE is actively pursuing its goal to become an integral part of defence preparedness of the country aimed at self-reliance and has achieved more than 90% indigenisation on its recent projects of anti-submarine corvettes and landing craft."

GSL signs five MoU's

Goa Shipyard Ltd signed 5 MoUs/Agreements with various industry partners to expand its capacity for shipbuilding, ship repair and exports. An MoU was signed with Hindustan Shipyard Ltd, Visakhapatnam to undertake repair and construction of Indian Navy/Indian Coast Guard ships on the Eastern seaboard taking advantage of their bigger Drydock and draught available. This will enable GSL to take repairs of much bigger ships thereby enhancing the yard capacity.

Similarly, MoUs were signed with SeaTech, Singapore for undertaking engineering design work at R&D centres of GSL and also with industry representatives of Bangladesh for export of Patrol Craft and Offshore Patrol Vessels. GSL also showcased its products at a seminar hosted by Bharat Shakti at the Show.



Genser Aerospace and its light business jet Rajas



GENJET GLJ3X1 – A
RAJAS – KULEEN
रजस्-कुलीन






Elevate flying experience with RAJAS – KULEEN

Maximum Operating Mach	0.79
Range	2,250NM/ 4,167 km
2 x Turbofan Engine	2,095 hp / 9.32 kW
Maximum Take-Off Weight	12,000 kg / 5,454 kg
Cabin Length	19 ft / 5.79 m
Cabin Volume	394.8 ft³ / 11.18 m³

GENJET GLJ3X1 – B
RAJAS – RAKSHAN
रजस्-रक्षण






Special Mission Roles:

1. Light Weight Special Cargo
2. VIP Movement
3. Aerial Photography (Reconnaissance mission)
4. Maritime/Overland Surveillance & Search
5. Lead-in trainer for large jet transport aircraft
6. Versions with Air Ambulance
7. Optionally Piloted Aircraft (OPA) Capability etc.





At Aero India 2021, Genser Aerospace, “which has been spearheading the design and development of a Light Business Jet Platform Rajas”, revealed progress of the programme.

Genser, under the aegis of ‘Mission Aerospace Foundation of India’, have been working since 2015 on development of an intra-continental ‘2 pilot + 7 seat Light Business Jet’, complying to FAR 23, with 5000kg all up weight, with twin turbofan engines of 9KN each, having max cruise speed of 0.79 Mach and a range of 2250 nautical miles.

The aircraft is named Genjet GLJ3X1 Rajas and it is aimed to be the “most beautiful and unique signature shapes among the comparable aircraft”, targeting a market of 1200 aircraft by 2035 (50% domestic market: 600 aircraft; 2.7% overseas market: 600 aircraft).

Although primarily a business jet, non-combat roles for this aircraft, is evincing interest, particularly since *Light Transport Aircraft* have been identified as one of the items (49th) on the list of 101 defence items embargoed for import.

HAL, Naini Aerospace & Genser Aerospace together with its subsidiary Angas Aeronautics India Pvt Ltd signed an MoU to cooperate in design and development of the Rajas which is also envisioned in

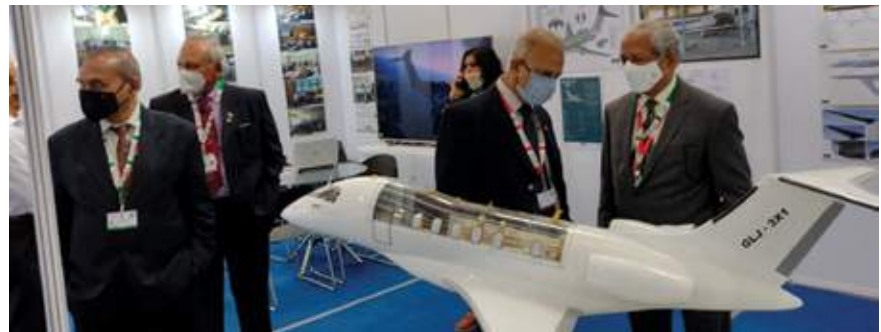


Full scale mockup of the Rajas built in 2019



different roles and versions; Rajas – Kuleen for extended range and Rajas – Rakshan for Special Mission Roles.

Genser which was started in 1997, is a multi-faceted aerospace engineering organization, delivering services across the aerospace lifecycle covering product design, manufacturing systems, in-service aviation support and Research & Analytics, and is also the initiator, owner & developer of the Rajas project, begun in 2015. ✈️



Rafael extends SPICE 250 range with new turbojet engine

At Aero India 2021 Rafael Advanced Defense Systems Ltd. unveiled a new variant of its SPICE 250 air-to-surface munition, with the addition of an integrated turbojet engine. The new variant is named SPICE 250ER (Extended Range) and is based on the smallest of the SPICE Family, which includes the SPICE 250, SPICE 1000 and the SPICE 2000 guidance kits. SPICE is a stand-off, autonomous, air-to-surface weapon systems that strikes targets with pinpoint accuracy and at high attack volumes, independently of GPS navigation, based on its autonomous electro-optic Scene-Matching Artificial Intelligence (AI) Algorithms.



SPICE 250ER will incorporate a miniature turbo-jet engine with an internal JP-8/10 fuel system, providing the weapon a range of at least 150 km, while retaining the same mission-planning system, aircraft interfaces and aircrew operation. It retains the identical external form-factor as the gliding variant using all existing SQR and aircraft interfaces, enabling similar load-out. The extended-range variant also features the same capabilities as the gliding variant, including the recently-unveiled ATR (Automatic Target Recognition) capability, Automatic Target Acquisition (ATA) and Moving-Target-Detection homing modes.

Alpha Design Technologies at Aero India 2021



A picture is worth a thousand words: here are 8000 words on the range and capabilities of Alpha Design Technologies!

Bharat Forge at Aero India 2021



As Babasaheb Kalyani, Chairman of Bharat Forge Ltd tweeted, ‘we are proud to be showcasing a wide range of our indigenously developed defence systems.... looking forward to engage with various industry leaders, policy makers and defence & aerospace experts on the journey towards *Atmanirbhar Bharat*.

Over the years, Bharat Forge has invested in state-of-the-art facilities for production of world-class products including airframes, structural and engine parts. The Company manufactures high end shafts, LPC Discs and HP Discs aero engine components, blisk blades, OGV blades and fan blades in keeping with the latest technology and design trends while maintaining high quality standards.



Mr. Rajinder Bhatia, President and CEO, Bharat Forge Defence and Aerospace

Bharat Forge and Paramount cooperation on Kalyani M4



Paramount Group and Bharat Forge Limited announced a cooperation that will see them join the technologies, capabilities and expertise of both groups in order to manufacture Armoured Vehicles in India. The Kalyani M4 is a multi-role platform, designed to meet

specific requirements of the armed forces for quick mobility in rough terrain and in areas affected by mine and IED threats. It offers ‘best in-class’ levels of ballistic and blast protection-up to 50kg TNT side blast or IED/roadside bombs owed to its ‘innovative’ design, built on a flat-

floor monocoque hull. “It is intended that the Kalyani M4 will see service with the Indian Armed Forces in the very near future.” The Kalyani M4 successfully completed a series of extreme vehicle trials in some of the toughest environments in India. 🦋

Airbus MoU with GMR Group



At Aero India 2021, Airbus signed a MoU with the GMR Group, “to explore collaboration opportunities across aviation services, technologies and innovation”. Airbus and GMR Group will team up to explore potential synergies in several strategic areas of aviation services, including maintenance, components, training, digital and airport services.

“Airbus and the GMR Group are committed to high standards of operational efficiency, innovation and sustainability. Through this partnership we will align in our mission to provide world class aviation services in the region,” said Rémi Maillard, President and Managing Director, Airbus India & South Asia. “We will work together towards developing solutions that will shape the future of aviation services and boost the development of aviation infrastructure in the region.”

Lockheed Martin and Tata Advanced Systems team up on NUH



William Blair, Vice President and Chief Executive, Lockheed Martin and Sukaran Singh, Managing Director and Chief Executive Officer, Tata Advanced Systems Limited seen at the signing ceremony

Airbus partners Flytech



At Aero India 2021, Airbus signed a MoU with Flytech Aviation Academy, a leading Indian aviation training academy, “to explore collaboration opportunities in Remotely Piloted Aircraft System (RPAS) training”. The Indian government estimates that there are 40,000 drones in the country and expects the number to reach one million in five years, which will require some 500,000 drone pilots.

Lockheed Martin and Midhani in Lol



William Blair, Vice President and Chief Executive, Lockheed Martin India with Sanjay Kumar Jha, Chairman & Managing Director, MIDHANI at the signing ceremony

Tata Boeing Aerospace (TBAL) to manufacture 737 vertical fin structures

Boeing has announced the addition of a new production line at its joint venture, the Tata Boeing Aerospace Limited (TBAL) in Hyderabad to manufacture complex vertical fin structures for the 737 family of aircraft. The expansion marks a significant milestone for the joint venture. "Tata Boeing Aerospace Limited is an example of Boeing's commitment towards co-development of integrated systems in aerospace and defence in India, for the world, and is a reflection of the country's *Atmanirbhar Bharat* initiative," stated Salil Gupte, President Boeing India. "Skilled talent, robust infrastructure, ease of doing business, and a highly responsive

government administration make Telangana an ideal destination," he added.

The vertical fin is a complex structural part and the new production line will utilise cutting-edge robotics and automation in manufacturing. The expansion will create additional employment opportunities and

enable skill development as well. Spread over 14,000 square meters, the state-of-the-art facility has been producing aero-structures for Boeing's AH-64 Apache helicopter, including the fuselages, secondary structures and vertical spar boxes for customers worldwide. 

Paras Aerospace and SpearUAV sign MoU



SpearUAV from Israel signed an Memorandum of Understanding with India's Paras Aerospace, a subsidiary of Paras Defence and Space Technologies Limited, to introduce the unique encapsulated Ninox 40 system to the Indian market for use by military forces, paramilitary, internal security, and law enforcement agencies.

Rostec at Aero India

Rostec State Corporation displayed over 200 of its latest civil and military Rproducts at Aero India 2021 and these included engines for military/civil aircraft and carrier rockets, advanced weapon systems, helicopters and many others. The Russian exposition in India was organised by Rosoboronexport and included delegations from UAC, Russian Helicopters, UEC and Shvabe holdings. Exhibition stands included products from various enterprises of the State Corporation, totaling over 200 examples of various military equipment. These included a model of the unique Su-57E 5th gen fighter (see photo), apart from models of the Su-35, MiG-35D, Il-76MD-90A military transport and Il-78MK-90A tanker aircraft.





The MRFA Competition

Gripen E's missile edge for the Indian Air Force

The Gripen E offer for the Indian Air Force builds upon the Gripen E family of aircraft. Gripen E is the most modern fighter in the competition and together with its weaponry, including the Meteor Beyond Visual Range missile, Gripen E will give the IAF an edge against its adversaries. The latest high performance sensors such as AESA radar,IRST system, advanced datalinks and AI-enabled decision support gives the pilot superior situational awareness and ability to see first-act first.

With its combat performance and power projection capability, Gripen E will provide the IAF with deterrence power in the region. Even more important, Gripen E can be armed with Indian-developed missiles or missiles of any provenance, unlike any other aircraft.

“Any weapon of Indian choice can be integrated with the Gripen fighter,” said Mats Palmberg, Head of Gripen India Campaign. “Gripen can also be equipped with Israeli, European, American weapons, giving it an edge in the ongoing MRFA

(Multirole Fighter Aircraft) competition. We are of course also prepared to integrate Indian weapons” he added.

Gripen E can carry nine missiles and 16 bombs as well as a large suite of other weapons and payloads. In addition, its inherent design enables easy integration of new weapon systems and stores for all types of missions, from air-to-air missiles to reconnaissance and heavy air-to ground armament. A specific feature of the aircraft is that it is programmed to deploy systems with different weights, centre of gravity and shapes with different aerodynamic features. Furthermore, its split avionics allows weapon integration and tactical system software updates or changes which can be made without the need to re-certify the flight critical software. These unique features, together with standardised interfaces and open architecture orientation, results in faster and easier integration of new weapons on the fighter.

In its offering to India, Saab maintains an all-inclusive fighter package that will meet the IAF's requirements at a

fraction of competitor costs. “Besides the Meteor, IRIS-T, A-Darter, and AIM-120 AMRAAM (Advanced Medium Range Air-to-Air Missile), other missiles like the Astra, Python 4/5, Derby, AIM-9X Sidewinder, ASRAAM and others can also be easily integrated to Gripen,” stated Palmberg. A wide range of guided/unguided bombs, reconnaissance pods, cruise missiles and anti-ship armaments are, of course also offered.

The Meteor BVR edge

Beyond Visual Range (BVR) combat with ‘See First–Shoot First’ capability is one of the most important features of modern fighter aircraft. The Meteor has changed the dynamics of BVR combat and taken it to a new level, providing unmatched air-to-air capability.

With an operational range of over 100 km, a BVRAAM Meteor missile can travel at speeds of over Mach 4, over four times the speed of sound. The missile can accelerate mid-way, leaving very little chance of the target to escape.



The Meteor is capable of engaging targets ranging from agile jets and UAVs (Unmanned Aerial Vehicles) to cruise missiles, simultaneously and autonomously in any weather condition.

“Meteor is an indispensable part of the Gripen for India offer. But we are also open to discuss other weapons and armaments that the Indian Air Force is interested in integrating to Gripen,” Palmberg added.

What Meteor capability means for India!

Accurate strike capability against both fast moving targets and small unmanned vehicles, is what that MBDA-developed Meteor long range missile provides! The missile will be considered a game-changer for the Indian Air Force for a long time to come. Known as the best missile of its type, Meteor has become an indispensable part of the ongoing Indian Multi-Role Fighter Programme (MRFA) and continues to generate interest around the world.

The Meteor BVRAAM (Beyond Visual Range Air to Air Missile) currently has the largest ‘No-escape Zone’ (NEZ) of any air-to-air missile which means that the missile leaves very little chance for any target to escape once tracked.

The Meteor has supersonic ramjet as opposed to rocket engines as in heavy weight missiles such as the Phoenix, R.33 and AMRAAM. The unique ramjet system allows the engine to be throttled back in order to save fuel, while the missile glides at speeds of up to Mach 4.

Unlike rocket-powered-engine missiles, the Meteor saves up enough energy to make

its critical attack while at its highest energy state giving it an edge while engaging highly agile targets. Furthermore, the two-way data link capability of the Meteor integration on Gripen, a feature not all fighters with Meteor offer, allows the fighter to target and re-target the missile even after it has been launched, making it almost impossible for the pilot to miss the target.

Meteor with the Gripen fighter

The advantages of Meteor can really be obtained if properly integrated and operated by a platform that can fully exploit its potential. The unique combination of Meteor and its integration with Gripen’s sensor and net centric warfare capabilities is at the core of what revolutionises air combat.

Gripen was the very first test bed aircraft for the Meteor and as such, considered “the perfect aircraft” for missiles of its calibre to be tested on. In 2018, Saab successfully completed a test flight for the Meteor on Gripen E (designated 39-8) for the first time, five years after the missile was first tested on a Gripen C platform. 80 percent of Meteor firing tests have taken place on the Gripen ever since.

The Gripen is designed to multiply the fleet’s combat capability through the networked operations capability where all connected assets are tightly co-ordinated and synchronised. All resources are shared and optimised to maximise the operational effect. Fusion of both on-board sensors such as the AESA radar, passiveIRST and AESA EW and off-board sensors from other air, land and sea assets acquired

through advanced data links, gives the pilot a coherent tactical picture and accurate target acquisition data, even against very low signature threats.

The aircraft integration fully exploits the Meteor’s operational kinematic range capability, as the Gripen’s radar system performance, in terms of range and field of view and data fusion capabilities for superior situational awareness and target acquisition take full advantage of the performance envelope of the missile. These features together with the two-way data-link makes revolutionary new tactics possible, thereby maximising the probability of total mission success.

As the former Swedish Air Force chief Maj Gen Mats Helgesson has said, “Meteor with the Gripen is a game-changer”! 

Mats Palmberg,
Head of Gripen India Campaign



Rafale International at Yelahanka

Rafale International were very prominent at Aero India 2021. At its booth located Hall B, Rafale International displayed a scale 1:5 Rafale mock up with the Indian colours in tribute to induction of the aircraft in the Indian Air Force. A Rafale M (Rafale naval variant) model of scale 1:10 was also displayed to present capabilities of this Rafale variant taking part in the tender for 57 aircraft to equip Indian Navy aircraft carriers. “This massive Rafale presentation illustrates the

spearhead aircraft” of the Indian Air Force, upgraded by Dassault/HAL.

Complementing this was space dedicated to the “Make in India” achievements of Dassault Aviation, with implementation of offsets obligations in line with contractual commitments, not to mention several ambitious projects with the DRDO and other partners. This section presented, after the first Falcon 2000 cockpit front section revealed at Aero India 2019, major parts of Rafale, engine doors and

as an international reference in the global aerospace market”. Larger infrastructures are currently being developed and will allow the ramp-up of DRAL capabilities leading to Falcon 2000s manufactured and assembled in India.

More importantly this paves the way for a full *Make in India* of the Rafale should India decide to proceed with additional acquisitions to fulfill needs of the Indian Air Force and the Indian Navy.

“The technological know-how and competences of Dassault Aviation and its partners, Thales and Safran Aircraft Engines are entirely dedicated to partner India in meeting its strategic defence and economic needs. Participating at Aero India and more widely, establishing ourselves in India with a view to developing wide-ranging cooperation under the *Make in India* policy, means renewing our vows with India after more than six decades of common history and a bright future ahead,” stated Eric Trappier, Chairman and Chief Executive Officer of Dassault Aviation. 🦋



determination of Rafale International to take part in Indian defence preparedness and its commitment to meet all future additional fighter aircraft needs”, stated company officials.

Also, a 1:10 scale Mirage 2000 I/ TI mockup showed off the “legendary

rudder manufactured by Dassault Reliance Aerospace Ltd (DRAL) facility in Nagpur.

These highlighted Dassault Aviation’s “full commitment to build up an Indian aerospace manufacturing eco-system, both in civil and military area, matching highest standards in this field and positioning India

Dassault in order for 12 Rafales for FASF



A few days before Aero India 2021 Dassault Aviation signed a contract for the sale of 12 Rafales with Florence Parly, French Minister of the Armed Forces. These aircraft will replace the 12 Rafales of the French Air and Space Force (FASF) transferred to the Hellenic Air Force.



Boeing offers Super Hornets for IN, F-15EX to IAF

VAYU Interview with **Ankur Kanaglekar,** Head India Fighter Sales, Boeing Defense, Space and Security



VAYU: *Boeing recently announced the results of ski jump trials of the F/A-18 Block III Super Hornet. Are there any updates on your talks with Indian Navy for their fighter requirements?*

Boeing: Boeing and the US Navy have recently proved that the F/A-18 Super Hornet can successfully operate from a ski jump ramp, demonstrating the aircraft's suitability for Indian Navy's aircraft carriers.

We are engaging with the Indian Navy on their requirements and have responded to the Request for Information for the Multi-role Carrier Borne Fighter (MRCBF) programme. We are confident that the multi-role F/A-18 Super Hornet Block III

will offer unrivalled value to the Indian Navy, that can be appreciated in the current economic environment, as it not only has a low acquisition cost, but also costs less per flight hour to operate than any other tactical aircraft in the US forces inventory, including single engine fighters.

VAYU: *What makes the F/A-18 Super Hornet fit for this requirement?*

Boeing: The F/A-18 Super Hornet Block III will offer the Indian Navy several unique and differentiated capabilities, with flexibility and best utilisation of precious air assets through carrier-compatible two seater variant (F-variant) and single seater (E-variant) for the Indian Navy. The

two-seater variant (F/A-18F) shares the same mission scope as a single seat (F/A-18E) while allowing for carrier-capable training and the ability to fly advanced missions from the carrier to benefit from a second crew on-board. Most importantly, carrier-based naval aviation technologies related to manned-unmanned interface can also be effectively operationalised with a two-seater carrier compatible version.

An advanced, multi-role, frontline fighter of the US Navy, the Super Hornet Block III was designed alongside the US Navy to meet its mission requirements through the next decade and beyond. The Indian Navy will stand to gain from the multi-billion dollar investment that has gone into the platform resulting in a most lethal and highly networked naval fighter. The aircraft can interface with the P-8I and other US-origin assets that the Indian Navy and the Indian Air Force have, or are in the process of acquiring. This will further augment lethality of these platforms and enhance India's force projection capabilities.

Of no less importance is the fact that the Super Hornet logically lends itself to enhanced maritime cooperation between the US Navy and Indian Navy in several areas of naval aviation. The commonality and interoperability benefits that Indian Navy will get as a result of F/A-18 Super Hornet on Indian Navy carriers would be unmatched.





VAYU: What about Boeing's offer of the F-15 EX to the IAF on its requirement for 114 aircraft? How many F-15EX has the US Air Force ordered so far?

Boeing: The F-15EX is the latest and most advanced version of the combat-proven, multi-role, all-weather day/night F-15 aircraft family. The US Air Force recently placed an order for eight F-15EX with Boeing. The contract between Boeing and USAF includes an option for up to 200 jets, with the USAF projecting to buy at least 144 F-15EX aircraft.

More than \$5 billion investment from the USAF and international customers has gone into the F-15EX which has resulted in several technology infusions such as advanced sensors including the highly reliable powerful radar, the world's fastest mission computer, advanced electronic warfare and other sensors and advanced cockpit system. The F-15EX can carry large payload and offers impressive performance in the form of range, speed and altitude. You may know that F-15 is the only aircraft that has 104 kills to its name in air to air combat!

We are happy to report that the United States government has recently approved our request to offer F-15EX to the Indian Air Force. We look forward to the requirements from the Indian Air Force being defined in the form of an RFP. ✈️

As part of Boeing's *For India, by India* aircraft sustainment strategy, we are exploring the possibilities of the Block III Super Hornets being serviced in partnership with the Indian Navy, US Navy and industrial partners from India and the US throughout lifecycle of the aircraft. This will further develop advanced expertise in aircraft MRO in India, resulting in higher availability of the aircraft.

All these together with the fact that the Super Hornet Block III has the ability to offer superior economics to the Indian Navy as it not only has low acquisition cost but also costs less to operate per hour of operation compared to any other tactical fighter in the US Forces inventory which differentiates Boeing's F/A-18 Block III Super Hornet offer for the Indian Navy.

Boeing and Air Works in Strategic Collaboration

Boeing has announced strategic agreements with Air Works for the maintenance, repair and overhaul (MRO) of two key Boeing defence platforms in India: the P-8I operated by the Indian Navy (IN) and the VIP transport fleet operated by the Indian Air Force (IAF).

Boeing India's strategic collaboration with Air Works is an important first step under its recently launched initiative, the *Boeing India Repair Development and Sustainment* (BIRDS) hub, which is an in-country network and alliance of suppliers led by Boeing in India that envisions a competitive MRO ecosystem for engineering, maintenance, skilling, repair and sustainment services of defence and commercial aircraft. The hub aims to grow capabilities in India in the areas of heavy maintenance, component repairs, training and skilling of IAF and IN maintainers.

An important aspect of the hub is training programmes to increase skilled manpower by developing sub-tier suppliers and medium, small and micro enterprises (MSMEs) to build high quality MRO capabilities in India.



Rolls-Royce and the Indian Air Force

An association built on the shared vision



IAF C-130J (photo: Angad Singh)

Since its foundation in 1932, the Indian Air Force's is a remarkable history of achievements, currently the fourth largest in the world in terms of assets and personnel. 'Guardians of the Indian Skies' have a rich history of accomplishments over the last eight decades – and Rolls-Royce with an equally rich legacy – is proud to be associated with the IAF since its inception. Our relationship with the Indian Air Force goes back to the time when our Bristol Jupiter engines powered their first Westland Wapitis. Since then, we have further strengthened this relationship and today, more than 750 Rolls-Royce engines of 10 engine types are powering different aircraft of the Indian military. Rolls-Royce engines equip a wide range of aircraft in inventory of the Indian Air Force from combat and strike aircraft (the Jaguar, powered by the Adour Mk811) to trainers (Hawk Advanced Jet Trainer, powered by Adour Mk871) to strategic airlift aircraft (C-130J Hercules, powered by AE2100) and even VVIP and surveillance aircraft (ERJ145, powered by AE3007).

Looking at the future, we remain committed to developing the Indian aerospace industry and supporting Indian self-reliance. An excellent example of

this is the Adour Mk804/Mk811 (which powers the Jaguar) which was made and continues to be supported by HAL in India, with our support. Along with being active contributors to India's ever-growing defence capabilities, we have been fostering holistic partnerships with key corporate players like Bharat Forge, Godrej & Boyce, Force Motors, Tata Group, as well as various MSMEs and startups, to give a fillip to the nation's supply chain ecosystem. We are also focused on boosting STEM education

and leveraging India's engineering talent-pool through our partnership with QuEST and TCS.

Last but not least, we applaud the valour and indomitable spirit of the Indian Armed Forces. Through innovation and a shared vision to co-create and co-manufacture in India, we have and will continue to push boundaries for building a future-ready and truly 'Atmanirbhar Bharat'.

Louise Donaghey,
Sr. Vice President, Rolls-Royce



IAF Hawk AJT

MBDA Commitments on ‘Make in India’



MBDA, the maker of the Rafale’s game-changing weaponry, showcased its *Make in India* commitments during Aero India 2021. MBDA exhibited a full range of missiles and missile systems designed to provide next generation air combat capabilities, including air dominance, strike and maritime engagement for the Indian Air Force.

Notably MBDA’s stand featured a display wall of missile system components *Made in India* by the company’s large Indian industrial ecosystem. Also exhibiting in the same Hall B was L&T MBDA Missile Systems Ltd, MBDA’s joint venture with Larsen & Toubro, which displayed the systems it has offered to the Indian Armed Forces as well as its work on MICA missile launchers for the Indian Air Force’s new Rafale fighter aircraft.

Air dominance

The Meteor is MBDA’s ramjet-powered and network-enabled beyond visual range air-to-air missile, which is widely recognised as a game changer for air combat.

At Aero India 2021, MBDA also had its SCALP which is being delivered for the Indian Air Force’s Rafale aircraft.

ASRAAM is being delivered to the IAF as its new generation close combat missile programme. ASRAAM will arm the IAF’s upgraded Jaguar fleet and potentially other IAF platforms.

Also, the MICA is being delivered for the IAF’s Mirage 2000 upgrade and for the Rafale.

Mistral ATAM has been delivered to India to equip the weaponised version of the Advanced Light Helicopter, the ALH Rudra. The same system has successfully undergone integration on the LCH platform also manufactured by HAL.

Battlefield engagement

MMP is the only fifth generation anti-tank missile available in the world, designed for dismounted infantry as well as for integration on combat vehicles. The technologies pioneered in MMP will be further developed by ATGM5 in India for specific operational requirements of the Indian Armed Forces.

Maritime superiority

Exocet is well known in India where the submarine variant, SM39, has been delivered to the Indian Navy to arm its *Scorpene* submarines (Project 75). The AM39 version can be launched from maritime patrol aircraft, strike fighters such as the Rafale as well as medium to heavyweight helicopters.

Sea Ceptor is the next-generation, ship-based, all-weather, air defence weapon system. Sea Ceptor utilises the CAMM missile that will protect both the host ship and high value units in the local area.

Marte is a family of fixed and rotary wing and ship-launched anti-ship

missile weapon systems designed to meet operational requirements in complex littoral environments and blue water scenarios. At Aero India 2021, MBDA displayed Marte ER, the latest addition to the family. 🦅

CNS at the MBDA pavilion



Chief of the Naval Staff Admiral Karambir Singh visited the MBDA pavilion during Aero India 2021. As per the Company, the Indian Navy has “excellence at its side with high-performing missile systems from MBDA such as Exocet on board its new *Kalvari*-class submarines”.

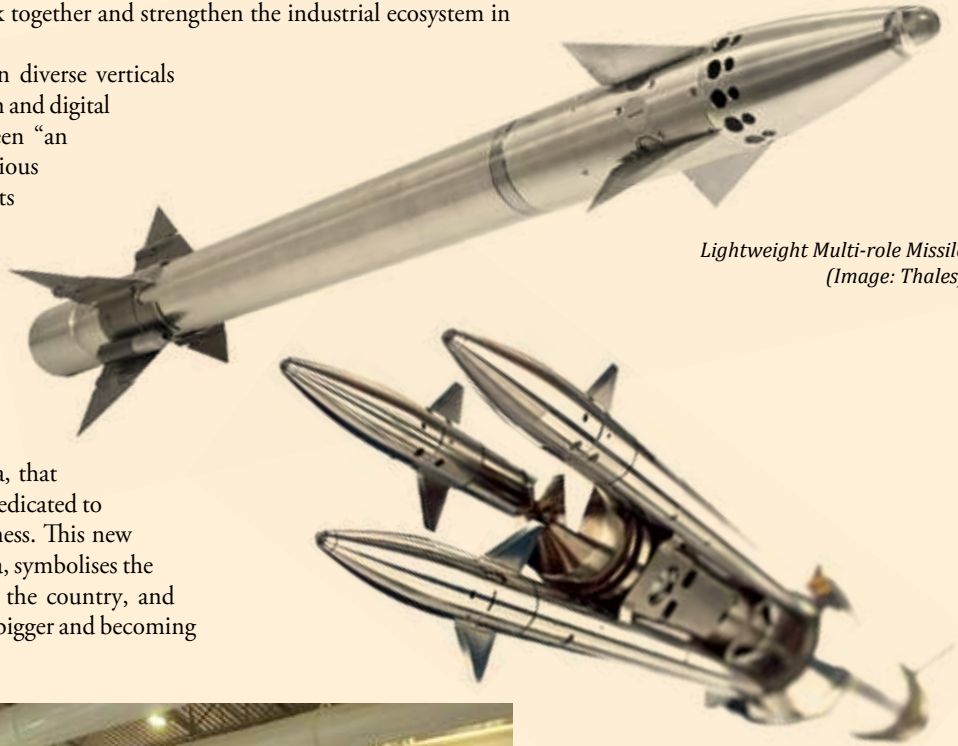
MBDA has built over 50,000 missiles in India during this time, and is working through its Indian joint venture – L&T MBDA Missile Systems Ltd – to deliver new *Make in India* programmes and provide enhancements for the Indian Navy’s fighting potency.

L&T MBDA Missile Systems Ltd has already submitted its first bid to the Indian Armed Forces for the Sea Ceptor, the next generation of naval air defence systems.

Thales: “steadfast partner in India’s growth story”

As India moves towards its goal of *Atmanirbharta* or self-reliance, it opens up immense opportunities for local and global organisations across the defence and aerospace sectors among others to work together and strengthen the industrial ecosystem in the country.

Backed by its strong presence in diverse verticals like defence, aerospace, transportation and digital identity and security, Thales has been “an unwavering partner in India’s ambitious plans and growth story by sharing its niche technologies and expertise.” As a company driven by its purpose of building a future one can trust, Thales has been striving to closely work with its customers and meet their requirements with the best possible solutions. Recently, Thales moved to a bigger and smarter India headquarters in Noida, that also has a bigger engineering centre dedicated to its digital identity and security business. This new office is a key stake for Thales in India, symbolises the Group’s long-term commitment to the country, and demonstrates how Thales is growing bigger and becoming more ‘local’.



*Lightweight Multi-role Missile
(Image: Thales)*

STARStreak (Image: Thales)



Defence Minister at Thales’ stand at Aero India 2021

In its journey of close to 70 years in this country, Thales has built a mature industrial footprint backed by its joint ventures with Bharat Electronics Ltd dedicated to radars, with Samtel dedicated to military avionics and Reliance Aerostructure Limited for electronic warfare and airborne radar as well as over 75 supply chain partners and other industrial partners. The company has also been closely working with Hindustan Aeronautics Limited for over five decades.

Thales is a proud member of the Rafale India team. It has also successfully undertaken the upgrade of the Mirage 2000 programme together with Dassault Aviation while working closely with HAL, among other key programmes of the Indian Air Force, Indian Navy and Indian Army. It continues to bring its latest technologies that serve modernisation needs of the Indian Armed Forces. 



Rafael's BNET family at Aero India

Rafael is a leading worldwide supplier of advanced defence systems with proven successful operational track record. Rafael is a major supplier of communication systems to the Israel Defence Forces (IDF) and the main communication supplier to the Israeli Air Force particularly in the areas of broadband radio, wireless immune and secure jam-resistant networks, UAV communication and missile data-links.

The BNET SDR Family is the most advanced product family of its kind, integrating advanced wideband network capabilities with interoperability between all radio types for tactical manoeuvring forces, battle groups and below, but also as an option for mid-tier communications. All BNET radios family shares the same architecture and same baseband waveform implementation in different form factors. All BNET SDR family members support common Waveforms (WF).

BNET is a unique radio and network architecture that enables future digitised warfare by delivering ultra-wideband, low

delay, data integrity and availability for reliable information interchange capabilities. BNET allows natural continuation of fighting since all forces are connected as they proceed to their new missions and objectives without the need to push forward relay equipment. All radios of land, sea, and air units participate in one scalable MANET network. A single BNET MANET is used to connect all of the platoon, company command and battalion command platforms within a battalion. Multiple subnets are established to support the different voice and data communities-of-interest (e.g., battalion command net, company command nets, platoon nets). Real-time data flow by BNET allows better and faster decision making by commanders and integration of all systems through BNET radio, shortens dramatically the Sensor-to-Shooter cycle and enables combat units to react immediately.

In anticipation of worldwide new requirements for fully digital true Software Defined Radio (SDR) system, Rafael has assembled a comprehensive team of

experts specialising in communication and advanced electronics. The objective of this team was to combine Rafael state-of-the-art capabilities in digital processing with its robust SDR architecture and its innovative suite of voice and data waveforms. This effort has resulted with a family of new generation SDRs: the Global-Link / BNET family for air and ground communications, this family based on wideband ultra fast sampling technology. 🦋

- Rafael has already delivered 1000s of Global link/Netcor V/UHF/L Band SDR systems.
- The Global Link system is in contract for 6 customers, including the IDF and worldwide customers. The SDR has already passed flight tests demonstrating live video transmission in L+ UHF band and is operational.
- The Global Link system won the Indian SDR tender of 1000 radios.

Rostec increases life of IJT's AL-55I engine



advantages: its modular design ensures low operating cost, and its modern digital control system ensures safe piloting and ease of maintenance. The engine has a maximum thrust of 1760 kgf.

Among various tests with the power plant are performance tests when struck by foreign objects, such as birds or hail, and several specialised tests for confirming calculated parameters. Because of its unique characteristics, the AL-55I engine has great potential, together with the HJT-36 aircraft, to become an integral part in the training of Indian Air Force pilots.

The HJT-36 basic jet trainer has been flying powered by the AL-55I jet engine, manufactured by United Engine Corporation of Rostec. The service life of the engine was recently increased to 1,200 flight hours.

AL-55I is a turbojet engine designed by UEC-Saturn and produced in cooperation between UEC-Saturn and UEC-UMPO. It is specially designed for the Indian HJT-36, and has a number of



RAC MiG in strategic partnership with AEPL

Aviatech Enterprises Pvt. Ltd. (AEPL), a Crown Group Company, specialising in defence aerospace MRO and aviation engineering services including engineering design, manufacture, product development and production for indigenisation and NABL accredited calibration facility, have entered into a 'Framework Agreement' with Joint Stock Company RAC MiG.

AEPL will be the in-country authorised partner for RAC MiG for providing post-warranty product support for MiG-29K/KUB aircraft, associated systems, ground support equipment (GSE) and special to type test equipment (STTE) in inventory of the Indian Navy.

Speaking on the partnership, Rear Admiral Srinivas Kanugo, VSM (Retd), Head of Aerospace Engineering and CEO Aviatech Enterprises Pvt. Ltd. (AEPL), stated, "We are proud to be the preferred Partner of Choice for JSC RAC MiG, Russia's premier aerospace and defence company. The 'Framework Agreement' is an enabling agreement which paves the way for enhanced in-country product support at the doorstep of the Indian Navy establishments operating or maintaining the MiG-29K/ KUB fleet of aircraft. It drastically reduces the turnaround timelines of the aggregates through the contracts on a long term basis as per MOD (Dept of Defence Production) guidelines. The association of an Indian partner, AEPL in the follow-on support contracts addresses critical maintenance, logistic and supply chain issues on 24x7 basis, thus enhancing availability of the aircraft and associated systems."

The above Agreement is in line with the 'Make in India' policy under 'Atmanirbhar Abhiyan' vision of the Government. The Agreement has been concluded under the spirit of 'Inter-Governmental Agreement (IGA)' signed between India and Russian Federation in September 2019. It is also in line with the area of focus of IAF to engage with the Industry to set up repair and overhaul (ROH) facilities within India for high value rotables/ repairables and encouraging in-house MRO facilities, thereby leading to reduced timeframes for repair and enhanced operational availability of assets. ✈️



Partnership between SASMOS and Matra Électronique



SASMOS, the specialist manufacturer of electrical wiring interconnection system, electromechanical assemblies & electronics sub-systems from India and Matra Électronique, a leading electronic equipment manufacturer from France for the Aerospace, Defence, Marine and Space market have signed a Strategic Cooperation Agreement. This partnership “will ensure emergence of Aerospace and Defence Electronic Systems equipped with the most advanced and efficient technologies”.

OIPL MoU with United Shipbuilding Corporation



OSK India Pvt. Ltd. (OIPL), a Crown Group Company, have signed an MoU with United Shipbuilding Corporation of Russia, to provide augmented indigenous product and services support to the Indian Navy. The exclusive cooperation agreement with United Shipbuilding Corporation of Russia is for maintenance and servicing of Indian naval ships and for manufacturing and supply of spares.

Aequs Aerospace-Saab JV major milestone in Airbus A321 programme



Aerostructures Assemblies (AAIPL), a joint venture between Aequs Aerospace and Saab AB, marked an important milestone with completion of the 100th shipset each of Over Wing Exit Doors (OWED), skeleton assemblies and Door 3 Plugs (D3P). The shipsets were completed “well on time” by AAIPL establishing the company’s competencies in complex assembly of the D3P and a strikingly high build rate for the OWED.

AAIPL has established itself as a strong supply chain player and has been making door plugs for Airbus’ A321neo Cabin Flex configuration since 2017 and producing wing panels and D-nose assemblies for the A380 programme since 2014. Besides end products, its capabilities also include development of assembly tools, jigs, and fixtures for domestic business. The AAIPL facility is located within the Aequs SEZ, the country’s first *Notified Precision Engineering Special Economic Zone* (SEZ), at Belagavi in Karnataka.

HCL in Digital Workplace Services agreement with Airbus

HCL Technologies (HCL) has signed a five-year Digital Workplace Services Agreement with Airbus. HCL, to “establish a modernised digital workplace to enhance the user experience and service quality for the majority of Airbus employees globally”. HCL’s Fluid Workplace Model will enable Airbus to deploy the latest digital technologies and will rapidly simplify Airbus’ existing IT processes and optimisation of delivery costs, using unique end-to-end management services to cover the information and operational technology landscape.

“We’re delighted to be working with Airbus as a key strategic partner in its digital workplace transformation journey. The combination of HCL’s scale transformational expertise and management capabilities of IT and OT landscape will enable Airbus to remain at the forefront of innovation and deliver leading-edge user experiences,” said Sandeep Saxena, Executive Vice President (UK&I, France & Benelux), HCL Technologies.

Godrej & Boyce in LAToT for MML-SP by DRDO

Godrej & Boyce, flagship company of the Godrej Group announced that its business, Godrej Precision Engineering received the Licensing Agreement for Transfer of Technology (LAToT) for the Mechanical Mine Layer, Self Propelled (MML-SP) from the Ministry of Defence's DRDO Laboratories at the 'Bandhan' ceremony at Aero India 2021. Raksha Mantri Rajnath Singh, Chief of Defence Staff General Bipin Rawat, three Services Chiefs, Secretary Department of Defence R&D and Chairman DRDO Dr G Satheesh Reddy and Secretary (Defence Production) Raj Kumar along with other senior officials from Ministry of Defence and Karnataka Government were present.

The MML-SP has been designed for laying anti-tank Bar Mines in varying soil conditions, camouflaging and recording their position accurately. "Godrej Precision Engineering's state of the art production facilities, stringent quality control and testing systems, coupled with decades of experience in building several 'first-in-India' products for defence applications will enable quicker roll out and induction of this product" stated company officials. 🇮🇳



Book on 'The Tejas Saga' released

The DRDO monograph, *Radiance in Indian Skies The Tejas Saga* was released by Defence Minister Rajnath Singh during Aero India 2021. The book is co-authored by Air Marshal Philip Rajkumar (Retd) and Mr BR Srikanth and is about "the inspiring journey of the Tejas from concept to entry in to squadron service" [Review in next Vayu Issue].



AXISCADES and VRM to supply simulators for jet trainer aircraft



AXISCADES and VRM have signed an Industrial Cooperation Agreement for design, build and supply of simulators for jet trainer aircraft and “this partnership of AXISCADES and VRM is fully prepared to produce and deliver world class simulators for the training of Indian Air Force pilots”. Virtual Reality Media, (VRM) Slovakia, is a company, engaged in design, development and production of state-of-the-art simulators and training systems.

VRM and AXISCADES are working on Dornier 228 Level-D Full Flight & Mission Simulator (FFMS) for Hindustan Aeronautics Limited, for which the contract has already been awarded to VRM. AXISCADES, is the industrial partner to VRM in India to perform a significant workshare for the project.

AXISCADES and SOVAM MoU on airport ground support equipment

AXISCADES and SOVAM have signed an Memorandum of Understanding (MoU) to evaluate and address the business opportunities for airport ground support equipment for the civil and defence airports. France based SOVAM has more than five decades of expertise in airport ground support equipment for civil and military airports and provides a full range of solutions based on their own design, production and assembly lines such as aircraft tractors, baggage tractors, passenger stairs, water and servicing vehicles, maintenance mobile platforms, special loaders and hi-lift trucks.

Zeus Numerix demonstrate nano drones



Zeus Numerix demonstrated Nano drones to CDS Gen Rawat, COAS Gen Naravane and ADG ADB Maj Gen Jauhar when they visited us at the DRDO TDF stall during Aero India 2021. The indigenously developed drone is capable of surveillance in constricted spaces and is extremely maneuverable. These nano drones are extremely lightweight, portable and rugged. Operated using mobile phones, these drones live stream HD videos for surveillance.

.... and is a winner at IDEX

Zeus Numerix was one of the winners of the 4th Edition of IDEX Defence India Start-Up Challenge (DISC 4) for “Reduction of Radar Cross Section of Naval Warships”. The Award was announced and a



Certificate of Recognition was awarded by the Defence Minister Rajnath Singh in presence of Dr Ajay Kumar Defence Secretary and other dignitaries.

First indigenously developed 9mm Machine Pistol



India's first indigenous 9mm Machine Pistol has been jointly developed by IDRDO and the Indian Army. This Machine Pistol fires in-service 9mm ammunition and sports an upper receiver made from aircraft grade aluminium and lower receiver from carbon fibre. 3D printing processes have been used in designing and prototyping of various parts including trigger components made by metal 3D printing.

The Vayu Team at Yelahanka



The Vayu Team at its stand in Hall A

In keeping with its matchless track record, established since the very first international Air Show in India, the *Vayu Aerospace Review* has published Special Show Issues and Show Dailies for widespread distribution at the event. The *Vayu* team at Aero India 2021, pictured above, continued that tradition! ✈️



RE Rogers: “Pillars of the Show!”

RE Rogers is synonymous with every Aero India and DefExpo show in India, apart from their very professional management and support of several other expositions throughout India, and abroad.



The back bone: Rajinder Singh Sethi of RE Rogers flanked by Surendhar and Manoj at the Show

Greece contracts for 18 Dassault Rafales



Eric Trappier, Chairman/CEO of Dassault Aviation, and Theodoros Lagios, Director General of Armament and Investments of the Greek Ministry of Defence, signed in Athens, two contracts respectively for the acquisition of 18 Rafale aircraft and associated logistic support.

The order for 18 Rafales includes 12 Rafales recently in service with the French Air Force and 6 new Rafales produced at Dassault Aviation plants. To meet the urgent need of the Greek authorities, the deliveries of aircraft will be begin in the summer of 2021 and will be spread over two years. The logistic support contract will support the Hellenic Air Force Rafale's air operations over four and a half years, "maintaining the availability of equipment and systems at the highest level. The Rafale in Greece highlights the quality of the strategic relationship between Greece and France and the continuation of more than forty-five years of solid partnership with Dassault Aviation and its industrial partners Thales and Safran."

"As with the Mirage F1 in 1974, the Mirage 2000 in 1985 and finally the Mirage 2000-5 in 2000, the Rafale is an opportunity to launch new cooperation's with the Greek aerospace industry."

MBDA to arm Hellenic Air Force's Rafales

The Greek Rafale weaponry will benefit from commonality with those with the Mirage 2000s and Mirage 2000-5s currently in service in the Hellenic Air Force. Like these, the Rafales will be armed with SCALP cruise missiles, AM39 Exocet anti-ship missiles and MICA multi-mission air-to-air missiles. Additionally, MBDA will also supply Meteor beyond visual range air-to-air missiles.



PAC/CAC JF-17Bs equip No.18 Squadron PAF



As recorded in *Vayu* Issue I/2021, another batch of JF-17B twin seat operational trainers were formally handed over to the PAF in late December 2020, and of the 26 such aircraft built, 14 will be operated by No.18 Squadron which is the designated Operational Conversion Unit (OCU). The other 12 aircraft have reportedly been distributed to JF-17 squadrons which are equipped with a mix of Block I and IIs.

Pakistan's 5th generation fighter



In a recent interview, Air Marshal Syed Noman Ali, present Chairman of the Pakistan Aeronautical Complex has referred to Pakistan's 5th gen fighter programme (*Azm*, which means 'Great', 'High in Dignity' in Arabic). Even as the PAC is responsible for its design & development, concept studies and preliminary design are ongoing. It is claimed that detailed design will follow before building of prototypes and the entire programme would be in three phases, each lasting around two years. It is anticipated that first flight is aimed for 2028 even as PAC are in discussion with "international partners" to join the programme. (The image above purporting to be the *Azm* is from the internet).

APU for Turkey's TF-X



Engine maker TRMotor has signed a deal with Turkish Aerospace Industries, prime contractor of the Turkish TF-X programme, to develop an auxiliary power unit and an air turbine start system for the country's first indigenous fighter. First flight of the TF-X was to be in 2023, but that has since been revised, with the aircraft now expected to fly in 2025-2026. There are speculations that the Turkish and Pakistani Governments are discussing possible collaboration on this 5th generation fighter aircraft.

USAF studies on F-16 replacement

The USAF Chief of Staff General CQ Brown has reportedly cleared a study in tandem with DoD's *Cost Assessment and Programme Evaluation* (CAPE) on the service's future mix of tactical aircraft. The objective is to finalise the study in time for the USAF's FY 2023 budget requests and the study will include a "clean sheet design" for a new "four-and-a-half-gen or fifth-gen-minus" fighter to replace the present F-16s in service. Rather than simply buy new F-16s, General Brown stated, "I want to be able to build something new and different, that's not the F-16 – one that has some of those capabilities, but gets there faster and uses some of our digital approach."

As for its total squadrons, the USAF may modify the long-touted service goal of 386 squadrons, "as modeling and simulation will provide the real capability within the budget available."

RAAF Hornets replaced by Lightning IIs

No.77 Squadron of the Royal Australian Air Force has operated the F/A-18A/B Hornet since 1987, based at RAAF Base



Williamstown, New South Wales. The squadron's Hornets will now be replaced by the Lockheed Martin F-35A Lightning II, transition to the Lightning II having started in January. The remaining RAAF Hornet squadron is No.75 at RAAF Base Tindal, Northern Territory.

Boeing F-15EX in first flight



The new Boeing F-15EX fighter made its first flight at St. Louis in the US on 2 February 2021, "paving the way for early delivery of the first two such jets to the US Air Force later this quarter". Flown by Boeing F-15 Chief Test Pilot Matt Giese, the multirole fighter's avionics, advanced systems and software were flight tested. This modern variant of the F-15 includes fly-by-wire flight controls, an all-new digital cockpit, modern AESA radar and the ADCP-II, the world's fastest mission computer, with the US Air Force having a stated requirement for 144 F-15EXs.

First Japanese Boeing KC-46



The first Boeing KC-46 tanker destined for the Japan Air Self-Defense Force (JASDF) has made its maiden flight, an important milestone as the aircraft now transitions into the certification phase of development. Japan is the KC-46 programme's first international customer and scheduled to receive its first such aircraft this year, the contract being for four KC-46 tankers.

PAF Il-78 upgrades



Ukraine's state-owned Ukrspetsexport company has a contract with Pakistan to repair and modernise the PAF's Il-78 aerial refueling tankers, work to be carried out by Nikolaev Aircraft Repair Plant under Ukroboronprom. While the initial contract is for one aircraft, the total contract involves two more Il-78s. The Pakistan Air Force procured four Il-78s mid-air refueling tankers from the Ukraine some fifteen years back.

Vietnam orders 12 L-39NG trainers



Vietnam has contracted with OMNIPOL and the Czech Ministry of Defence for 12 Aero L-39NG jet trainers manufactured by Aero Vodochody, the aircraft to be delivered in 2023-2024. In addition to the L-39NGs, Vietnam has also contracted for training of pilots, instructors, ground crew and mechanics.

Tactics and combat testing renamed as 'Black Flag'

The United States Air Force's 53rd Wing's large force combat training tactics has been renamed as 'Black Flag'. The large-scale exercises, which employ weapons and tactics that the US Air Force will conduct in "a realistic, massed-force, fully-integrated, high-threat-density exercise environment", 'Black Flag' will be a counterpart to the existing 'Red Flag' and 'Green Flag' exercises. The 53rd Wing is responsible for operational test and tactics development for the air force's fighter, bomber and remotely-piloted aircraft fleets.

10-years of Rafales in the UAE



The French Air and Space Force marked ten years of operating Dassault Rafales from Al Dhafra base in the UAE. During this time the Rafales have undertaken missions over Afghanistan, Libya, Iraq and Syria. Operations began in 2008, initially with Dassault Mirage 2000-5Fs and from 2010 with Rafales of 3/30 Fighter Squadron 'Lorraine'. In related news, French Air and Space Force Dassault Rafales recently flew more than 8,000km from France to Djibouti, Africa and back to simulate a ground attack mission and demonstrate their long-range strike under *Operation Minotaur*. Operating from their Saint Dizier air base, three Rafales were joined by two Rafales from Mont-de-Marsan.

Rafale Talios pods



The French Air and Space Force has revealed that the Talios laser designation pod has been operationally used for the first time with the Dassault Rafale. The sortie of just under five hours took place on 25 November during *Operation Chammal*, an escort mission from the French forward operating base at Prince-Hassan Air Base, Jordan. The Talios (Targeting Long range Identification Optronic System) is manufactured by Thales and will replace the earlier Damocles pod with French Rafale squadrons.

RAF, Qatari joint exercises



In a joint Royal Air Force/Qatar Emiri Air Force Exercise *Epic Skies IV* from Doha, RAF Typhoons carried out 60 missions jointly alongside (and against) Qatari Dassault Rafales and Mirage 2000-5s. The six Typhoons also carried out air-to-air and air-to-surface missions. Qatar has ordered 24 Typhoons plus training for its pilots and technicians, the first Typhoon expected to be delivered by 2022.

Airbus SC-105 for Brazil

The Brazilian Air Force has received its third and final Airbus SC-105 Amazonas search and rescue (SAR) aircraft during a handover ceremony at the company's facility in Seville, Spain. These will operate from Campo Grande AB in Mato Grosso do Sul state, operated by the 2nd Squadron of the 10th Aviation Group (2^o/10^o GaV) Pelicano (Pelican). Locally designated the SC-108 Amazonas, the dedicated SAR platform is a variant of Airbus' C-295MPA Persuader twin-turboprop maritime patrol aircraft.

ATR 72 MPA in Turkish service



The first P-72 (ATR 72) maritime patrol aircraft completed under the MELTEM III programme has entered service with the Turkish Navy. The programme covers the provision of six ATR 72-600 airframes converted to MPA configuration. The original contract for this project was for ten MPA versions of the ATR 72-500, but was reduced to six airframes based on the new variant, plus two ATR 72-600s configured purely as standard utility transports.

Do 328 re-dux



The recently formed European commercial aircraft OEM Deutsche Aircraft is reportedly developing an upgraded version of the Dornier 328 turboprop airliner, the D328eco. Established by 328 Support Services GmbH (328SSG), itself a subsidiary of Sierra Nevada Corporation, Deutsche Aircraft plans to introduce the type for commuter and multi-role markets by 2025, the aircraft to be produced at a new final assembly line in Leipzig in eastern Germany. Deutsche Aircraft claimed the D328eco "will pave the way to zero emission flight within the next 15 years, much faster than any other OEM, outpacing 2050 international guidelines".

'Anonymous' C-295s delivered to USAF

In late December 2020, some three Airbus C-295 tactical transport aircraft were reportedly ferried from Seville via Newfoundland and Labrador in Canada to the USA. Observers believe that these will join the 17 Do 328s being operated by the United States Air Force's Special Operations Command and designated the C-146A Wolfhound, for highly classified purposes.

New Embraer turboprop airliner

Embraer is reportedly planning a new turboprop airliner of 70-100 seats, with the company confirming that the Brazilian manufacturer has been examining various concepts and that they are "talking to partners that may be interested in investing to make it viable". The company's CEO Arjan Meijer, also emphasised that the focus is on bringing an efficient and sustainable product to market and that Embraer plans to the conventional turboprop engines rather than hybrid-electric or fully electric powerplants. "There a big opportunity to bring to the market an aircraft that is more efficient, faster, more comfortable (and which is also) more environmentally friendly".

Scorpions for Kazakhstan



US Defence Security Corporation Agency (DSCA) has approved a FMS to Kazakhstan of King Air B300ER Scorpion aircraft with intelligence, surveillance, reconnaissance (ISR) mission systems and related equipment. The deal comprises two King Air B300ER Scorpion aircraft, three Raytheon AST TITAN communications intelligence (COMIT) sensor suites and three Leonardo Osprey 30 active electronically scanned array (AESA) radars.

Gulfstream G550s for Italy

US State Department approval has been granted for a FMS to the Italian Air Force for Gulfstream G550 aircraft with airborne intelligence, surveillance, reconnaissance, and electronic warfare (AISREW) mission systems and related equipment. The principal contractor will be L3Harris, based at Greenville in Texas.

First Belgian A400M

The first Airbus A400M for Belgium has been delivered from the final assembly line at Seville-San Pablo Airport, Spain, to Brussels-Melsboek. This aircraft is first of seven on order, which will be operated by the Belgian Air Force's 15 Transport Wing/20 Squadron, Tactical Transport Flight.

Airbus Helicopters resilient in 2020

In 2020, Airbus Helicopters got 289 gross orders in a challenging market heavily impacted by the economic consequences of the COVID-19 pandemic, reinforcing the company's position on the civil and parapublic market. Additionally, the company delivered 300 rotorcraft worldwide despite the pandemic travel restrictions, resulting in a stable 48% share of the civil and parapublic market and thus allowing Airbus Helicopters to maintain its "market-leading position".

Order highlights for 2020 consisted of 84 helicopters for the 'best-selling' H145, including 17 UH-72B for the US Army, the first Fenestron and Helionix-equipped versions to be ordered. The H135 achieved sales of 33 units and also received EASA certification of an alternate gross weight as well as a new single



pilot IFR cockpit layout at the end of 2020. Milestone Aviation and Heli-Union both became new customers for the multi-mission H160, ordered to address a wide range of missions including offshore transportation.

The NH90 had a successful 2020 with the Bundeswehr placing an order for 31 naval helicopters. The French Armement General Directorate also confirmed the development of a new Standard 2 version to equip the French Special Forces and the first NH90 for Qatar performed its maiden flight at the end of the year.

NH90s for Qatar



The first two NH Industries NH90 helicopters for the Qatar Emiri Air Force made their initial flight at end of 2020. Qatar has ordered 28 NH90s, comprising 16 TTHs for land operations and 12 for naval missions with an option for a further 12 helicopters in a mix of variants, the contract including support, maintenance training of aircrew and maintenance technicians plus associated infrastructure including simulators and training aids. The final example is planned for delivery in 2025.

MQ-9 Reapers in auto take off/landing



The US Air Force MQ-9 Programme Office has completed testing for automatic take-off and landing capacity (ATLC) which allows the USAF's MQ-9 Reaper fleet to perform with automated inputs from sensors onboard the platform, creating a more flexible and dynamic weapon system to meet current and future operational requirements.

IAI Heron Mk.II UAVs "to Central Asia"



Israel Aerospace Industries (IAI) has signed two contracts, one to sell and one to lease two Heron Mk.II UAV systems to a "central Asian country". The systems include reconnaissance payloads, Heron Mk.II drones and land arrays.

IAI loitering munition systems

Israel Aerospace Industries has signed three significant contracts valued at over \$100 million for supply of loitering munitions systems "to several countries". The contracts include sale of the multi-purpose ROTEM system, sale of naval version of the HAROP system "to an Asian Navy" and sale of the ground version of the HAROP system to "another customer in Asia".



NATO selects Thales for its First Defence Cloud solution



NATO has selected Thales to provide the first certified defence cloud solution that can be deployed in the theatre of operations in less than 24 hours. With this contract, the Group enters a new market sector, "demonstrating its capacity to integrate the best civil and commercial technologies available and to adapt them to the needs of the armed forces".

Sikorsky-Boeing Defiant X

Sikorsky and Boeing have released images of their advanced helicopter for the US Army's Future Long Range Assault Aircraft competition, known as FLRAA. The aircraft, named Defiant X, will be the "fastest, most maneuverable and most survivable assault helicopter in history".



NGC Battlefield Airborne Communications Node Operation



The US Air Force recently awarded Northrop Grumman a \$3.6 billion indefinite-delivery/indefinite-quantity (ID/IQ) contract for continued Battlefield Airborne Communications Node (BACN) operations, sustainment and support.

BAE Systems turret for CV90s



BAE Systems has signed an extensive mid-life upgrade contract worth more than \$500 million with the Dutch Defence Materiel Organisation (DMO) for the Royal Netherlands Army's inventory of 122 CV90s, with an option for an additional 19 vehicles.

Boeing's Loyal Wingman

Boeing Australia and the Royal Australian Air Force have successfully carried out first test flight of the Loyal Wingman



uncrewed aircraft. Flight of this first military aircraft to be designed and manufactured in Australia in more than 50 years, flew under the supervision of a Boeing test pilot monitoring the aircraft from a ground control station at the Woomera Range Complex. Additional Loyal Wingman aircraft are currently under development, with plans for teaming flights scheduled for later this year.

France orders Thales O-NYX



With more than 80 years of experience in high-end optics and more than 110,000 night vision goggles in service worldwide, Thales has built on feedback from successive generations of operational users to enhance the perception of soldiers on night-time missions. The French armed forces have recently placed a new order for 3,000 O-NYX night vision goggles.

Thales AirMaster C ultra-compact airborne surveillance radar



Threat detection, identification and surveillance missions depend on a force's ability to operate in any type of environment and all weather conditions. Drawing on its experience with the successful Master series of radars, Thales has developed a new, ultra-compact surveillance radar with enhanced target detection capabilities for fixed-wing aircraft, helicopters and UAVs. "With its low integration and operating costs and high availability and performance, the AirMaster C sets a new standard for airborne radars."

The AirMaster C is a new surveillance radar with an ultra-compact, programmable 2D active antenna based on SiGe (silicon-

germanium) technology. SiGe is much more energy efficient than other technologies used for AESA radars and allows the radar to self-cool. Weighing less than 20 kilograms and housed in a single unit design, the radar has a 30% lower SWaP (size, weight and power) than other radars in this class.

Sikorsky VH-92A helicopters for the US President



Continuing their 63-year legacy of “providing safe and reliable transportation for President of the United States”, Sikorsky is to manufacture some 23 VH-92A Presidential Helicopters for the US Marine Corps. These are on schedule, with first delivery of these next generation presidential helicopter later this year.

B-21 progresses



Some two years since completing the Critical Design Review (CDR), Northrop Grumman has brought its digital design of the B-21 Raider closer to reality, with two test aircraft now in production. The Raider story began in February 2016 when Northrop Grumman initiated design and build work for the B-21

and the programme has progressed rapidly over the years. Within three years, the B-21's design was proven stable and mature through a successful CDR completed in November 2018 at Northrop Grumman's Manned Aircraft Design Centre of Excellence in Melbourne, Florida.

LM Long Range Anti-Ship Missiles



Lockheed Martin has been awarded a \$414 million contract from the US Navy and Air Force for Long Range Anti-Ship Missile (LRASM) production, the largest LRASM production contract in history of the programme. The combined Lot 4/5 contract continues production of the air-launched variant of LRASM, now operational with the US Navy F/A-18E/F and US Air Force B-1B.

UAE's anti-ship cruise missile



HALCON unveiled its HAS-250 cruise missile at the International Defence and Exhibition Conference (IDEX) 2021. The HAS-250 is a UAE-designed and developed surface-to-surface missile capable of travelling at speeds of up to 0.8 Mach, with a range of over 250km. During its terminal phase, this would fly towards its target at sea-skimming altitude.

DARPA LongShot UAV



DARPA's LongShot programme, which is developing an air-launched unmanned air vehicle with the ability to employ multiple air-to-air weapons, has awarded contracts to General Atomics, Lockheed Martin and Northrop Grumman for preliminary Phase I design work.

1st F-35A for Denmark takes flight



L-001, Denmark's first F-35 Lightning II production aircraft has made its inaugural flight. Denmark is the fifth European NATO nation to fly and operate an F-35 and joins four other European nations who already operate the F-35: the United Kingdom, Netherlands, Norway and Italy.

China threatens Taiwan – again



The People's Republic of China have issued "stern warnings" to Taiwan (Republic of China) as they believe that the latter are moving towards officially declaring formal independence "which means war"! However, Taiwan President Tsai Ing-wen has repeatedly said it is already an independent country. As for the PLAAF's recent activities, Chinese Defence Ministry spokesman Wu Qian said. "The military activities carried out by the Chinese People's Liberation Army in the Taiwan Strait are necessary actions to address the current security situation in the Taiwan Strait and to safeguard national sovereignty and security".

In response, Taiwan's Mainland Affairs Council said China "should think carefully and not underestimate the island's determination to defend its sovereignty and uphold freedom and democracy". Taiwan's Defence Ministry earlier reported six PLAAF aircraft, including four J-10 fighters, had penetrated its air defence zone, close to the Taiwan-controlled Pratas Islands in the South China Sea. (Also see '25 Years Back' section in this Issue), Was Taiwan on the Brink of War?

Elbit and AH-64 Apache IHADSS Sustainment

Elbit Systems of America will provide the US Army with continued support and maintenance of the Integrated Helmet and Display Sighting System (IHADSS) that is used by AH-64 Apache Pilots. The IHADSS is a Helmet Mounted Display (HMD) for rotary-wing aircraft, with the ability to align turreted weapons, missile seekers and gimbaled night vision to the pilot's line of sight.



Germany for 5 P-8A's

The US State Department has made a determination approving a possible Foreign Military Sale to the Government of Germany of five P-8A aircraft and associated support, and related equipment, for an estimated cost of \$1.77 billion.



Dutch Helicopters snowbound!



In the first week of February 2021, very 'wintery' weather situations were recorded (in the Netherlands), with temperatures going down to -10 or even -15° Centigrade at night with some 10-20 cm of snow. The last time this kind of winter weather was seen in the Netherlands was about a decade ago.



Because of the Corona/Covid travel-limitations plus arctic conditions, the Dutch Royal Air Force Helicopter Command (*Koninklijke Luchtmacht Defensie Helikopter Commando*) made use of this weather to perform some arctic training in the Netherlands instead of going on an arctic deployment to Norway.

During the warm summer months, the helicopter crews train for 'brown-out' landings in the sand, where the blown-up sand will hamper vision. Now there was the option to exercise the 'white-out' landing and take-off conditions where the vision was hampered by snow flying around.

In the military low-lying area 'GLV5' near Eindhoven Air Base, several Eurocopter AS532 Cougar and Boeing CH-47 Chinook helicopters had been exercising in the snow. The Cougar helicopters landed during end of the day, by last sunlight, while the Chinooks had landed during a sunny afternoon. 🦋

Photos and text: Joris van Boven and Alex van Noije



25 years of AS532 Cougars in the Netherlands



This year, in 2021, the Aérospatiale/Eurocopter/Airbus Helicopters AS532 Cougar will have been in operation with No. 300 Squadron of the Royal Netherlands Air Force for over 25 years. This unit is part of the Defence Helicopter Command (DHC) and is based at Gilze-Rijen Air Base. On 29 October 1993, the contract had been signed for the purchase of seventeen AS532U2 Cougars and the first medium-duty transport helicopters were delivered in April 1996. The unit is nicknamed 'Wildcat' which is why they fly with this callsign.

On its 25th anniversary, the Squadron performed an anniversary flight flying six Cougar helicopters in one large formation. The six Cougars made a scenic flight across the Netherlands and then flew over Roosendaal, after which the course was set for the coastline. The route continued via Hoek van Holland, Scheveningen, Hoofddorp and Utrecht. Finally, the helicopters flew to Ede where a special photo shoot was organised for the formation.

The *Wildcat Formation* only landed in Ede for a small group of photographers who had been informed upfront by the

Royal Netherlands Air Force, landing on the heath in two rows of three helicopters with the spectacle lasting only 15 minutes, performing multiple "hover" formations for the photographers. Thereafter, the Cougars flew on to Eindhoven AB for a Low Approach and then landed again at Gilze-Rijen AB just after 1600 hours.

For No. 300 Squadron, flying this Wildcat Formation involved long and extensive preparations. The formation was led by commander of No. 300 Squadron who was at the controls of the Wildcat 01, as the formation leader.

Of the seventeen AS532 Cougar helicopters purchased by the RNLAf, twelve are currently in operational service. 🦅

Article and photos: Joris van Boven and Alex van Noije



Tatoi Tecnam's in



Greek pilot-training and modernisation

In January 2021, the Greek Ministry of Defence awarded Israel-based Elbit Systems a contract to install and operate a new pilot training programme at Kalamata Air Base. This deal, which includes replacement of the old T-2 Buckeyes by M-346 aircraft and upgrading of the current T-6 Texan II's, will finalise the overall modernisation of the Hellenic pilot training programme. This process had earlier started after delivery of new Tecnam P2002s at Tatoi-Dekelia air base, close to Athens, where screening of new cadets and primary flying training takes place.

Entry of the newly manufactured Tecnams with the Hellenic Air Training Command as a lead-in trainer began with an order for 12 aircraft in 2018. This decision did not come as a surprise considering the Hellenic Air Force was looking to replace its Cessna T-41 Mescaleros. The T-41D force was declining with an increasing number of airframes which had technically run out of flight hours, after an impressive 50-year service in Greece. With the choice for Tecnam P2002JFs, the Hellenic Air Force became the second military user after Argentina, which has operated 8 aircraft since 2016.

P2002s integrating

By the end of 2018 the first Tecnam delivery from Capua, Italy took place, destination being Tatoi Air Force Base and No. 360 Squadron. Delivery flights were done by Tecnam crew and included one refueling stop at Italian Air Force Base Lecce, before crossing the south Adriatic sea towards Greece. With an ongoing delivery rate of

some 2 aircraft per month, all Tecnams had been delivered by mid-2019. Upon arrival at Tatoi, the Tecnams were inspected for final acceptance by a HAF technician and pilot, and after approval, the aircraft officially accepted and consequently received HAF roundels and military registrations.

In parallel was an ongoing training course for the instructor pilots to qualify





them for the P2002JF. Major Manolis Papadakis, instructor pilot of No. 360 Squadron, said that two senior pilots of the squadron initially received their training at the Tecnam factory and then

imparted further training of their 18 colleagues at Tatoi-Dekelia. The first phase consisted of a two-week theoretical course, added with some flights in the simulator to practice several flight elements. The



second phase was the flying part with about 6 sorties from the left seat including navigation and instrumental flights, ending in an intermediate evaluation. Additionally another 6 sorties were conducted from the instructor's right seat following the same programme but then focusing on how to instruct. A final 13th sortie was conducted as an exam to evaluate the requested flying- and instructors abilities. The 13 sorties totalled about 15 flying hours.

Cadet programme

The normal programme course of new cadets starts in October and is completed by mid-July. The flying part of the course for cadets is of 30 sorties, amounting up to 36 flight hours. Major Papadakis explained that "we begin to train the cadets for solo flights. This will take approximately 12 sorties after which the cadet is capable to fly the aircraft themselves and will do 2-3 solo flights. After the solo flights and the green light from the instructor, we continued with a variety of instrumental flights, navigation, more advanced flight manoeuvres and agility training. Further we see to continuation of progress in the cadet's performance in basic flight manoeuvres", the programme showing if the cadets are capable of moving to the next step flying the T-6A.

Equipment and changes

The P2002JFs are equipped with dual (connected) control stick, a single instrumented cockpit and a single throttle. The cockpit also more provides the pilots with an improved view. The installed Garmin cockpit system, integrated with radio and Instrumental Landing System (ILS), can map the terrain with graphics, showing airways, approaches and air force bases. For the cadets nothing will change now as "we maintain our focus on screening the cadets on their capability to take off, fly and land the aircraft. Future Garmin use has to be determined later" Major Papadakis added.

The present HATC aircraft, like the P2002, but also upgraded T-6 Texans and near future M-346s will without doubt be more suited for front line Hellenic fighters including the upgraded F-16V and Mirage 2000-5 platforms but also on the newly ordered Rafales and the possible future F-35. 🦅

Article and photos: Peter ten Berg

FOREVER YOUNG!

Portuguese Air Force Chipmunks: a 60+ year career



The Portuguese AF Chipmunk-era took off in 1951 with delivery of the first of (eventually) seventy-six aircraft to the *Escola Militar de Aeronautica* (Military Aeronautical School), based at Sintra. These DHC-1 Chipmunks then replaced obsolete de Havilland DH82 Tiger Moths in Portuguese service since 1934. In 1986, marking 40th anniversary of the de Havilland Chipmunk, thirty-seven DHC-1 aircraft still remained in operational use with the once more reformed *Esquadra de Instrução 101*. Aircraft attrition, on an average two DHC-1s annually, was mainly attributed to the age and modification-standard of their Gipsy-engines.

In October 1987, the *Força Aérea Portuguesa* decided to purchase eighteen Aérospatiale TB-30 Epsilon turboprop trainers to replace the obsolete – and out-dated - DHC-1 Chipmunk trainers. Having received its first Epsilon trainer in February 1989, *Esquadra 101* regained its operational training-status in December

1989. All DHC-1 Chipmunks were then withdrawn from operational service as FAP's elementary pilot-training aircraft after delivery of the final TB-30 Epsilon in 1989 and conversion of Esq101's pilot instructors on these new French-made trainers at Sintra/BA1.

Seven old and redundant de Havilland DHC-1 Chipmunks were then transferred almost immediately to the *Academia da Força Aérea* (AFA), also located at Sintra/BA1, to be used as target towing aircraft. In 1987 were purchased Aérostructure ASK-21 gliders, assigned to AFA's *Esquadra de Voo 802 'Águias'* (aka *Eagles*) responsible for initial screening and aerial training of students attending the *Academia*.

A profound reform of FAP's flying training syllabus, implemented in 1997, anticipated the renewed introduction of seven modified DHC-1 Chipmunk-trainers, evaluated as optimal cost-benefit alternatives for FAP's initial pilot screening programme, the so-called *Estágio de Selecção para o Voo* (ESV).

Estágio de Selecção De Voo

Esquadra de Voo 802's main mission of selecting candidate pilot-cadets for the AFA and FAP kicks off annually late July with the arrival of (on average) thirty male/female candidates, all wanting to attend the AFA and become an operational FAP-pilot. Having already passed psychotechnical, physical and medical testing outside the AFA, the instructor pilots of '802' will assess during a 12-day period the 'flying stamina' of each of these young candidates.

At first, the AFA-pilots cadets, under close supervision of their instructors, are given a three/four days academical instruction course, exclusively focused on the DHC-1 Chipmunk. An inflight guide, aircraft checklist and technical operating manual would be handed to these youngsters for self-study and a preliminary exam, which they have to pass with a >75% score before entering the actual inflight screening. Being the only military user of the Lycoming-powered DHC-1 Chipmunk,

the checklist and operating manuals were made by *Esquadra 802*.

On fifth day of their presence at Sintra/BA1, all remaining candidates will start their inflight screening by flying up to seven general-handling flights during which basic aircraft manoeuvring, straight-level flying, turns, climbs and descents are demonstrated to and 'copied' by them, closely monitored by the '802'-instructor in the backseat. More complex stalls and traffic patterns are also taught. To assess the 'air-ability' of the candidates some elementary aerobatic manoeuvres are flown by the instructor in the latter stage of the selection-process.

On an average, 50% of all candidates will eventually join the AFA.

AFA-Flying

All AFA students, including those destined to become operational pilots, will study at the *Academia* for 4.5 years, being instructed a wide variety of academical lectures and study-material. During their academical curriculum at the AFA, pilot-students will be able to fly the DHC-1 Chipmunk during their study-period at Sintra/BA1.

The first year of AFA-flying is dedicated to basic flying (*C1 Contacto Basico*), instructing the students over a 12 mission-long training course for take-off, landing, traffic patterns and basic aerobatics-techniques. At end of the first year, during their 20th Chipmunk-flight (including seven ESV-flights), all students will fly unique solo-mission on the DHC-1 Chipmunk during their AFA-career.

During their second year at the AFA, students are taught the 12-mission long advanced flying course (*C2 – Contacto Avançado*), involving aerobatic-flying in addition to C1-related flying into the flying programme. Simulated flame-out landings are also practiced by reducing the engine into 'idle-mode' over Sintra/BA1 at various relative starting points, altitudes, various airspeeds and teaching the student how to land safely on first section of the runway.

In latter AFA-years, *Esquadra 802* will instruct on navigation (*N1 Navegação VFR*) and formation (*F1 Formação*) phases, totalling some 15 missions. On their seven low level visual flying rules navigation missions, students will use FAP's standard tactical pilot charts, also used by the TB-30 Epsilon-equipped *Esquadra 101* (FAP's dedicated initial training squadron).

Before final graduation from the *Academia da Força Aérea*, all students –

Keep the Chipmunks flying!

The daily flying operations of *Esquadra 802* (which amount to 1000 flying hours annually) with its six remaining DHC-1 Chipmunks is supported by a small but well-trained and –equipped maintenance section, 'pampering' their aircraft to the utmost.

Since their 'structural' upgradation in 1997, including installation of a more powerful Lycoming-engine, the *Esquadra's* Chipmunk-maintenance programme is well established, executing various dedicated pre-planned inspections (50/100/300 hours) and a 600 hours SMLU (Structural Midlife Update) at Sintra/BA1.

Although its initial elementary flying training-role has been replaced by more modern and capable aircraft, the 'reborn' DHC-1 Chipmunk will remain a vital asset within the *Força Aérea Portuguesa*, especially in an era marked by rationalisation and efficiency, for several decades to come...



both flying and non-flying - with several DHC-1 Chipmunk aircraft, move to Ovar in Northern Portugal for a one week long 'boot-camp'. At Ovar some extra training missions are flown by the graduating 'fifth year' students in preparation of their transfer to *Esquadra 101* and its TB-30 Epsilon trainers to start their demanding 'the real thing' pilot training.

Since *Esquadra 101* only initiates one dedicated training course a year, AFA-students will remain for some months at *Esquadra 802* to retain their capabilities, flying the DHC-1 Chipmunks depending on weather conditions and the flying programme. 🦋

Photos and article:
Stefan DEGRAEF and Edwin BORREMANS

50 Years after Operation Cactus Lilly



PT-76s and Su-7s in The battle for Kushtia

December 2021 will mark a half century after the decisive action in (then) East Pakistan when both history and geography were made. The blitzkrieg advance into the riverine country that was to become the new nation of Bangladesh and total surrender of Pakistan's forces there, was surely the 'finest hour' for the Indian Armed Forces. This is the first of a series of articles on battles fought, in the words of those who led from the front. In this account, Major General Pramod K Batra (retd) writes about a 'Battle Honour, a Tactical Blunder and Historic Moment' when he was commanding 'A' Squadron 45 Cavalry deployed in West Bengal under 4th Mountain Division. In his words,

I was fortunate to command A Squadron of PT-76 tanks (*Chariots of the Lesser Gods*) during the Bangladesh War 1971. A brief introduction to this tank would be appropriate for *Vayu* readers. This tank was essentially designed by the Russians for operations in continental Europe to cross network of rivers/canals. PT stands for *Plavushi Tanka*, meaning a tank that can swim or float and 76 is the calibre of its gun. The tank's ground pressure is equivalent to that of an infantry soldier and it can carry 22 combat soldiers/RCL mounted on jeep on its deck with the water current not exceeding 3 knots or so to cross a water obstacle. Being amphibious the PT-76 is light weight, does not have sufficient armour protection and was therefore not suitable



Pair of Sukhoi Su-7s of the IAF

for armour battles – hence ‘Chariot of the Lesser Gods’!

An overview at strategic level of how formations were deployed before the war in erstwhile East Pakistan is given in the map to focus readers attention on our II Corps operating from the south west, covering a frontage of some 650 kilometers from Farraka barrage in the north to Bay of Bengal in the south. II Corps had 4 Mountain Division and 9 Infantry Division on its Orbat, with an Armoured Regiment, 45 Cavalry (PT-76s) and a squadron of T-55s (63 Cavalry). II Corps had allotted one squadron (‘A’) 45 Cavalry to 4 Mountain Division. The remaining armour was allotted to 9 Infantry Division. Hereafter, I focus on some of important battles of 4 Mountain Division though the three battles were distinct in nature, yet connected.

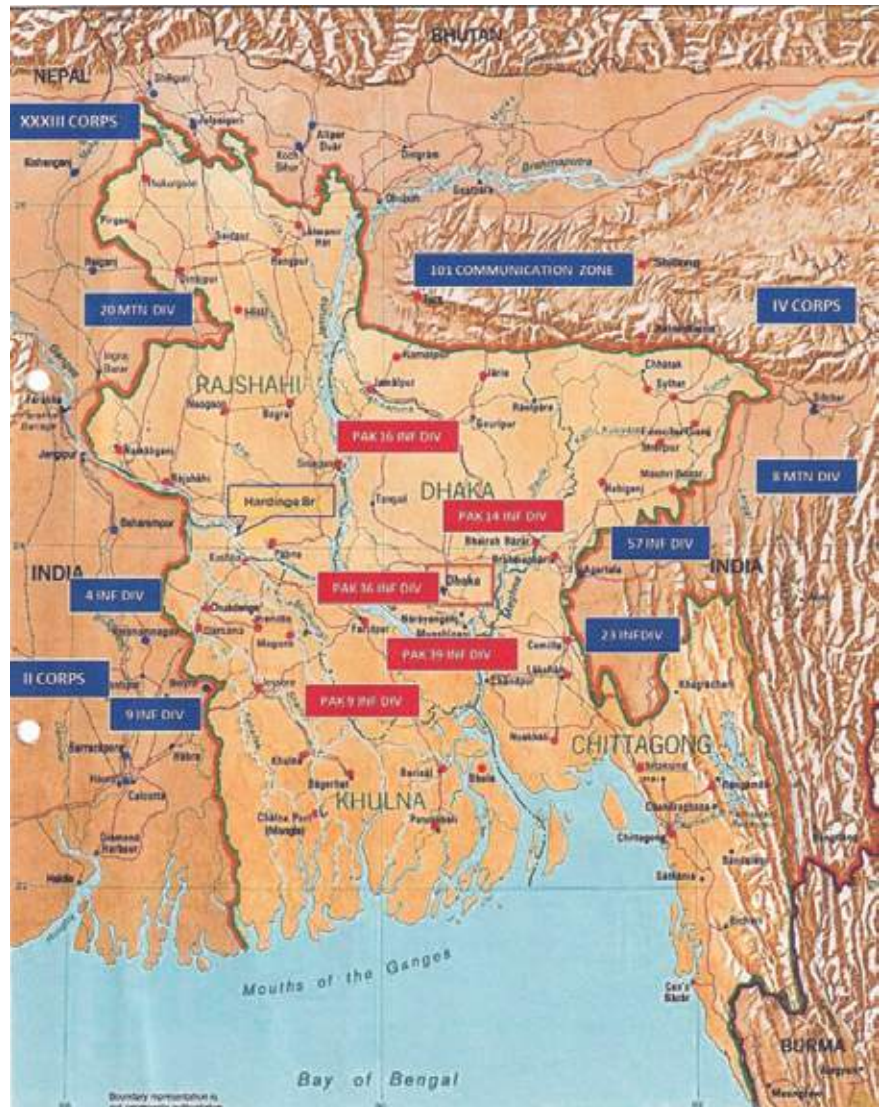


The famous ‘Red Eagles’, 4th Mountain Division



Unit badge of 45 Cavalry

Tasks allotted to 4 Mountain Division were firstly to advance on axis Majida-Jibbannagar-Kotchandpur-Jhanida, secure Ferry on River Madhumati, Faridpur and then secure Ferry at Goalunda Ghat. If the situation demanded, to mop up Kushtia and Hardinge Bridge and further north, towards Bogra in XXXIII Corps sector.



Map of erstwhile East Pakistan with Indian and Pakistan Army Divisions superimposed

Conduct of Operations

Jibbannagar was to be the curtain raiser for 4 Mountain Division operations, therefore success had to be ensured at all costs. Intelligence sources indicated that Jibbannagar was held by two regular

companies of the Pakistan Army supported by elements of recce and support. My Squadron, less a troop was allotted to 62 Mountain Brigade for this operation. Earlier, on 25 November along with a patrol of 5 Maratha Light Infantry led by Maj



PT-76 tank in jungle dispersal

Karambaya (later Maj Gen), we carried out a reconnaissance on the route our tanks had to take for the night move to the location from where my squadron was to support the attack, some 8 kilometers inside enemy territory.

On the night of 26/27 November, Jibbannagar was captured with our tanks providing close and effective fire support and threatening the enemy's route of withdrawal. Kotchandpur was captured by 9 Dogra, supported by 'A' Squadron less two troops providing close fire support on the night 30 November/1 December. The presence of our tanks had psychological effect on the enemy who offered little resistance. After the successful attack, CO 9 Dogra expected a counter attack, but after some discussion he finally relented and allowed us to move. The next objective for 4 Mountain Division was to be Darsana.

Battle of Darsana

Darsana lay on northern flank of the axis of advance of 4 Mountain Division. It was held in strength and the GOC Major General MS Barar in his wisdom decided to capture it, so that it did not create any threat to the Division's axis of advance. The plan was to clear enemy outposts at Akandabaria and contact his position at Darsana from the east with 22 Rajput and one company of 5 Guards to establish a road block on the enemy's route of withdrawal. The task for capture of Darsana from the east was given to 41 Mountain Brigade and they were allotted 'A' Squadron 45 Cavalry less one troop and 2/9 GR from 62 Mountain Brigade.

By swift and bold action, 22 Rajput captured Akandabaria on night of 2/3 December and established a firm base for attack on Darsana. I was told to send one troop of tanks on 3 December at 1700 hrs to assist 22 Rajputs to capture enemy's forward line of bunkers which were blocking their advance. The tanks neutralised these bunkers and company Rajput crept forward to occupy them. However, taking advantage of darkness the enemy re-occupied these bunkers. The Rajputs suffered some casualties but managed to capture five vital bunkers astride the railway line by 0300 hrs on 4 December. A company from 5 Guards then established the road block behind Darsana by 0400 hrs on 4 December.

The attack on Darsana

Attack on Darsana was to be in three phases: in the first, 5/1 Gorkha Rifles were to capture Darsana Railway Station with my squadron less a troop attacking from the South. In phase 2, one company from 5/1 Gorkha Rifles with one troop PT-76s was to capture Chandpur. Phase 3 would involve 2/9 Gorkha Rifles from 62 Mountain Brigade with my squadron less two troops to exploit the situation.

'A' Squadron less a troop moved into 22 Rajput location and was deployed by me for the ensuing task. All geared up and rearing to go! H-hour was 0730 hrs. We could see enemy bunkers. CO 5/1 GR Lt Col C Venugopal with his team and I were being briefed on last minute details when a



Indian infantry PT-76s during the advance in East Pakistan, December 1971 (image: MoD)



Indian infantry and tanks advance in East Pakistan

barrage of artillery fire landed upon us, and the wireless operators and some officers were wounded. As the CO ordered me to move for the attack, I saw Capt Naik, the battery commander had been severely wounded and I carried him piggy back and left him in a 22 Rajput bunker.

Our guns now opened up and engaged the enemy bunkers, lifting the fire at 0715 hrs. Our tanks then provided close fire support to the Gorkhas assaulting in broad day light. We had identified 14 bunkers and knocked off 12 by the practiced creeping fire. The enemy were observed abandoning their bunkers and running away. This quote is from the after action report of 4 Mountain Division: "The tanks neutralised the flanks and the remaining tanks shot up the infantry from north to south bunker by bunker. The two companies of 5/1 GR now cleared the forward row of bunkers".

The first phase of attack was over.

I joined the CO and took him on my tank to join the Gorkhas on the first objective. Here I quote from *History of The 9th Gorkha Rifles*. "In Phase two 5/1 GR supported by tanks of 'A' Squadron 45 Cavalry (Maj PK Batra) cleared the Pak defences around Darsana. The attack by 5/1 GR was led brilliantly by Lt Col Venugopal riding on the tank of Maj PK Batra". The devastating and accurate fire of the PT-76s and Gorkhas had unnerved Pakistan's 18 Punjab. As the companies got organised to take on a counter attack, we planned the second phase. Our engineers did a fantastic job to rapidly make a lane through the minefield for the tanks. The quick success of the plan prompted the battalion commander to seek permission to capture rest of the objective. A quick plan was made for capture of Chandpur, which was actually objective of the second phase. The two troops in the meantime had joined us on the first objective. One troop with a company of 5/1 GR attacked Chandpur; however, the enemy had not sited his defences for an attack from this direction and withdrew without much resistance. With one troop, we moved towards the third phase. In one of their *langars* on the way we found half cooked meals. This objective too was captured without much resistance.

At this time 2/9 GR joined the action. Link up with the road block company was established by the Gorkhas and a troop of PT-76s and the operation was over in about 6 hours. This action is actually a classic example of close cooperation between tanks and infantry, utilising firepower, shock actions and mobility, which resulted in low casualties and unnerving of the enemy. For this action both 5/1 GR and 'A' Squadron 45 Cavalry were awarded '*Battle Honour Darsana*'.

However, there was to be no respite for my squadron. After capture of Darsana, the Pakistanis thought that our next objective would be Chuadanga, a town that happened to be the native place of Dr Malik, Governor of East Pakistan. 57 Infantry Brigade of the Pak army, after loss of Darsana had moved to Chuadanga. GOC 4 Mountain Division had different plans and decided to establish a road block between Chuadanga and Jhenida, based on the presumption that once the enemy realised our objective was not Chuadanga he would reinforce Jhenida.

The task given to 41 Mountain Brigade was establish a road block at Uttarnaryanpur with 5 Guards less one company and 'A' Squadron less a troop and another road block on a subsidiary track linking Chuadanga and Jhenida at Paschim Durgapur with an infantry company and troop of tanks. 41 Mountain Brigade,

about 2030 hrs a convoy of vehicles was seen approaching site of the road block. This convoy could have been captured but some trigger-happy soldier opened fire which resulted in mayhem. Taking advantage of darkness, enemy abandoned their vehicles and managed to get away, losing some personnel and equipment. In



Indian infantry cross dry river bed (image MoD)



Assessing the plans for relentless advance (image MoD)

less a battalion was to advance along axis Kotchandpur – Jhenida and capture Jhenida at the earliest.

5 Guards and my squadron, less one troop commenced the advance at 0800 hrs on 5 December and moved cross country in enemy territory, crossed River Chitra in area Shibnagar and established both the road blocks by last light as planned. We had now moved 23 kilometers deep inside enemy territory. The road block proved to be timely and most effective, the enemy could not now reinforce Jhenida. At

this fiasco I lost my NCO, Dir. Sisupalan who was coordinating location of his tank in relation to the infantry deployed on ground.

By this time it was realised that we were out of range of our artillery fire. Several attempts by the enemy including one by an infantry battalion to dislodge the road block were foiled the next day. The tanks were mainstay for the success of these road blocks. The Pak 57 Infantry Brigade had to finally pull back towards the Kushtia/Hardinge Bridge to the north, but before that they

were to give us bloody nose at Kushitia. However, this also broke cohesiveness of Pakistan's 9 Infantry Division as their 107 Infantry Brigade were pulled back towards Khulna, down south.

41 Mountain Brigade less one Battalion advanced with 9 Dogra and contacted Jhenida with a troop of tanks, but came across heavy resistance. I was told to send one more troop of tanks to reinforce them, so I moved these from the road block at Pashim Durgapur by first light. The leading element came under heavy fire and could not make headway. I was ordered to move another troop to assist 9 Dogra. Since, two troops were already with the Dogras. I decided to take one troop there myself from the road block as most of my squadron were at Jhenida. I reached the Dogra location with a troop, was briefed by the CO and launched the attack at 1230 hrs. By 1400 hrs Jhenida was captured. The enemy had well prepared defences with anti-tank ditches but suffered 24 killed, many were wounded or captured as were 30 vehicles, tonnes of artillery, mortar, RCL and small arms ammunition and important documents, maps etc.

The next morning an elated GOC said, while complimenting me, "Batra, get me Magura before 9 Infantry Division from Jessore reaches and I will personally put MVC on your chest". My reply was "we will do our best, Sir". Thus started the race for Magura.

62 Mountain Brigade was given the task of capturing Magura. My Squadron less two troops and a company of SKOT APCs of 7 Punjab were allotted to 62

Mountain Brigade. After capture of Jhenida. I was ordered to leave one troop of tanks at Jhenida to foil any attempt by enemy to recapture it, while one troop had already been given to 7 Mountain Brigade, which was the Corps reserve.

The Combat group comprising my squadron less two troops, a troop of SKOTS and company 5 Maratha Light Infantry started at about 0800. The advance was led by 'A' Squadron headquarters with two troops followed by SKOTS and 5 MLI company. We were in high spirits and throwing caution to the winds, moved fast, in a kind of blitzkrieg. Lt Col Venugopal came on the net and advised me to be cautious as he had observed us moving fast. We did slow down a bit but the speed at which we moved took the enemy by surprise as at about 1500 hrs or so we contacted Magura which was under heavy shelling. Pakistan's 9 Infantry Division headquarters now abandoned Magura and fell behind River Muchikhali. Magura was in our hands by 1700 hrs, though heavy shelling kept us on guard for quite some time. The Brigade concentrated on night 8/9 December at Magura and we advanced and contacted west bank of river Madhumati by 1100 hrs on 9 December.

Kushtia: A Tactical Blunder

In the evening I got orders to move to Kushtia immediately as there had been a major reverse and we had lost many tanks. I could get no more information. The Squadron 2i/c was in B echelon and not feeling well, neither was my senior

troop leader. The move from Madhumati to Kushtia, a distance of 90 kms was very trying. All kinds of thoughts were coming to my mind as we sped onwards on a pitch dark night, but there was no fear of an enemy. We reached Brigade headquarters after 5 hrs and at a distance I saw one of my destroyed tanks, with some four of my men shrouded under a blanket on the deck. My mind went blank, anguish and pain hit me. I was summoned to meet the GOC and Brigade Commander. As this action were narrated to me, I lost my cool but all that the GOC said was "these things happen in war", there was no remorse, feeling of guilt or regret. The BM took me one side and asked me to cool down. Tragically six officers were killed and 22 Rajput had suffered over 110 casualties.

What had happened that fateful day was that 7 Mountain Brigade, the Corps reserve was released and reverted to 4 Mountain Division and given the task to capturing Kushtia with two troops of 45 Cavalry attached. The Brigade Commander was told that Kushtia "was not held", as ascertained by both the Corps and Divisional Commanders who had flown over the area. The advance would be led by PT-76s followed by 22 Rajput in troop-carrying vehicles (TCV). 2/Lt Sam Chandavarkar however felt that the terrain was not suitable for tanks, even for PT-76s with their low ground pressure. The area was marshy, wooded and Kushtia was a built up area, the main road just ten feet wide, passing across a high embankment. Advancing on this with tanks could be suicidal. Young Sam requested that the advance be led by Infantry. But sadly, there is no Tennyson in India to write about courage of 22 Rajput and 'A' Squadron 45 Cavalry who displayed extraordinary courage and devotion to duty for "theirs was not to reason why".

Sam led the advance with five PT-76s on either side of the road following basic tactics of fire and move. As the leading elements entered Kushtia, Pakistan's 57 Infantry Brigade, with tanks, RCLs, MMGs and all arms opened concentrated fire. This ambush surprised our advancing elements, the leading 4 tanks got direct hits from a distance of 200 yds by tank and RCL fire. The Pak Infantry deployed on the ground opened up on the unsuspecting leading company of 22 Rajput. There was no place to manoeuvre. One tank managed to get away but not before knocking out



The amphibious capability of the PT-76 tank is well captured in this image



Indian infantry examine destroyed Pakistani Chaffee tank

two Chaffee tanks. The Pakis followed by pulling back of troops and Commander 7 Brigade in the meantime had deployed a battalion on a water obstacle to extricate the withdrawing Rajputs. By 1700 hrs, the situation had stabilised. The Brigade asked for air strikes but these were delayed as proper coordination had not been carried out before commencement of this operation.

Many years later, a retired Pakistan Army Officer wrote about this action in the East Pakistan which he titled 'tank ambush at Kushtia', referring to this "as the last battle fought by Pakistan's 57 Brigade". However, he has completely omitted the ghastly atrocities committed by the Pak Army on captured, and wounded, Indian Army soldiers at this battle. I write about this as a riposte to his article. Ambush yes, battle NO. A battle is a sustained fight between professional armed forces.

Now, the set back at Kushtia forced GOC 4 Mountain Division to concentrate his entire Division less one battalion on holding Madhumati which resulted in loss of crucial 72 hours.

Many year later, in 1979 I was sent with a questionnaire by the College of Combat for Gen Jacob who had retired as Army Commander Eastern Army and was Chief of

Staff Eastern Command during 1971. At the end of our interaction, I could not resist but ask him about the debacle at Kushtia. He said, "II Corps were making good progress and had contacted Madumati, there was no need for them to go for Kushtia. They would have captured ferry at Madhumati and onto Gotandaghat ferry and probably be knocking at the doors of Dacca. They lost

72 crucial hours. It was a bad move". As the old saying goes, "never trouble the trouble, unless the trouble troubles you".

4th Mountain Division now concentrated for the capture of Kushtia and patrolling was carried out on 9 and 10 December. The Indian Air Force had launched continuous air attacks, bombing and rocketing the enemy. The plan was to capture Kushtia



Disabled Pakistani Chaffee tank on Harding Bridge, knocked out by PT-76 of 45 Cavalry

with 7 Mountain Brigade and 41 Mountain Brigade to lead the advance to Hardinge Bridge. However, indications were available that the enemy had withdrawn his major force from Kushtia. Luckily my suggestion to carry out an outflanking move by tanks to cut off the road linking Kushtia, and Hardinge bridge was accepted. Kushtia was captured by 7 Mountain Brigade by 1700 hrs on 11 December, to a thundering welcome by the local population.

The Gorkhas of 5/1 GR and PT-76s of 45 Cavalry had one task left: capture of the Hardinge Bridge. The enemy had built a strong defensive system on western side of the bridge. The embankment was some

10 meters above the ground level had three layers of bunkers covering all approaches, with minefields and anti-tank emplacement. A quick plan for the capture was made. With accurate and devastating fire by tanks, two companies of 5/1 GR cleared the outer defences. My gunner spotted a Chaffee on the bridge and knocked it out.

With such strong defences, Pakistan's 57 Infantry Brigade could have given a better account of itself. However they had fled, leaving behind howitzers, mortars, RCL guns, machine guns and other automatic weapons, jeeps, trucks and other assorted weapons.  (to be continued)



Major (later Maj Gen.) Pramod K Batra
commanded 'A' Squadron 45 Cavalry
during the 1971 War

(all images from author except where credited)

No. 221 Squadron's air support at Kushtia



On the Eastern front, the lone Sukhoi Su-7 Squadron was No.221, which supported the Army's blitzkrieg advance towards Dacca. No.221 Squadron had been allocated the tasks of counter air, offensive air support and photo recce, launching attacks against the Kurmitola and Tezgaon air bases on 4 December, destroying three Sabres on the ground. 9 TAC thereafter directed the squadron against riverine traffic, railways and artillery positions. The Su-7s were operated in pairs to be called up by advancing army units to

soften defence strong points, carrying out very accurate rocket attacks against bunkers. In the war for bridges and ferry crossings, the Su-7s were particularly active and a large number of barges, steamers and gun boats were hit.

Before No.221 Squadron was transferred to the Western Sector on 12 December, it was to play an important part in the capture of Kushtia. To quote the Squadron diary, "on 11 December, one span of Hardinge Bridge was destroyed, thereafter constant bombardment and bunkers, troop

positions and railway sidings near Kushtia was carried out. This resulted in the fall of Kushtia the same evening, mostly because of the creditable performance of No.221 Squadron. On 12 December, to give this operation a final touch, bombs and rockets were delivered on retreating enemy troops, ammunition depots, the main power house near Hardinge Bridge and on ferry-craft carrying troops".

From the book 'Valiant to the Last' by Pushpindar Singh

Ancient Aviator Anecdotes



Air Vice Marshal (R) Cecil Parker and his.....

Rear View Mirror



A veteran pair: Harvard and Tiger Moth of the IAF's vintage flight

The Early Years

Our air force shares a year of birth (1932) with this writer. The new year (2021) marks 70 years since I joined the IAF (1951) and 35 years since I left it in 1986. My first 18 years of early childhood, school and college were spread over five states from Gujarat in the west to Bengal in the east. My boyhood dream to become a pilot appeared to take off when I received joining instructions from No. 1 Air Force Academy in 1950. The next 35 years were equally nomadic as I moved 19 times on posting(s) across seven states from J&K in the north to TN in the south. I learnt that the air force trains its officers in very professional courses and employs them thereafter in the inter-dependent functions of Operations, Training, Staff and Command.

The Air Force Years

Courses: No 58 Pilots Course 1951-52 (Tiger Moth & Harvard): Fighter Conversion 1952 (Spitfire & Tempest): Flying Instructors Course 1955 (HT-2 & Harvard): Junior Commanders Course 1957: Air Staff Course 1960-61: Instrument Rating Instructors Course 1965 at IPIS USA (T-39): Combined Course 1969 at CAW: Work Study / Management Course 1969 at CDM: Indoctrination Course at IAM: Defence Studies Course 1980 at RCDS UK (Hawk & Harrier): SDMC 1984 at CDM.

Operations: Squadron pilot in No.7 Sqn (Vampires): Squadron pilot in No 3 Sqn (Toofani): Staff pilot in Air HQ Comn Sqn

(Vampire & Devon) Flight Commander in No.20 Sqn (Hunter).

Training: QFI at AFFC (HT-2, Prentice & T-6G): Directing Staff (Air) 1973-74 and then Chief Instructor (Air) 1981-83 at DSSC Wellington.

Staff: Air HQ (Dte of Trg) 1961-62 and HQ TC IAF (CFTO) 1975,

Command: Founding CO of MEU Ambala 1957: Founding CO of OTU at Jamnagar (Hunters): CO No. 20 Sqn 1969-72 Hindan / Pathankot (Hunter) : Stn Cdr FTW Hakimpet 1975-77 (Iskra, Kiran & Chetak): AOC Adampur 1978-79 (MiG-21s): Comdt AFA 1983-85 (Kirans) and AOC J & K 1985-86 (Helicopters & Jaguars).

Total Flying Hours 3945.

The Later Years

Retirement, for the first time, gave me control over my own time and choice of activities, commercial and otherwise. The first decade (1986-95) were spent in the corporate and academic world(s) with the added comfort of WFH (long before the OED sanctified this abbreviated phrase, post Covid-19!). We travelled extensively; I had the leisure for swimming and tennis, flew a microlight and was able to write regularly. One book ('Airlooms') was published in 2014 and, since then, this is my 83rd AAA which is a summarised look-back at the long road travelled in 88 satisfying years. The road ahead is of course a very short one but will be traversed with the same support from faith, family and friends.

From the Rostrum

Early last month, along with New Year greetings, came two invitations, one each from Commandant(s) of CAW (College of Air Warfare) and AFA (Air Force Academy). The first was to address an ongoing course on air operations in the 1971 Indo Pak war and the other to participate in a Training Workshop as part of the Golden Jubilee celebrations of AFA. Thirty five years have elapsed since I retired from the air force, hence I was certainly privileged to be remembered and invited. I expressed my thanks to both but explained that this hearing-impaired, 88 year-old great grandfather had given up public speaking a decade ago! They very gracefully accepted my regrets; however the subject did take my memory back to some of the public speaking I was required to do both during and after my years in the air force.



The confidence to speak effectively in public is an attribute that can be developed depending upon individual motivation. I was introduced to speaking from the rostrum during the 1960-61 Air Staff course at DSSC Wellington. In 1963 during *Ex Shiksha*, I was a flight commander in a Hunter squadron based at Palam and was detailed to give a Briefing-cum-Lecture on IAF SOPs (Standard Operating Procedures) for air operations from Palam to the senior staff of the visiting USAF F-100 squadron. After the talk, our American aircrew visitors were served their very first *samosas* along with tea. (I do not know if it was my lecture or our *samosas*, but their air operations went off very well!) Soon after the 1971 war the Government of Punjab hosted a civic reception for the air force gallantry awardees from our air force base at Pathankot where I was in command of a squadron. Each of us were requested to say a few words. I was extremely proud of my young officers who spoke extempore very confidently both in English and in *shudh* Hindi.

In 1972 I was invited by Principal of the Hyderabad Public School to address the boys on the Indo-Pak war. I did so and was delighted at the volley of questions I had to field. There was however one student who asked no question and sat quietly at the back: my teen-aged son seemed embarrassed to have his father at the teachers podium!

Post retirement in 1986 I was with a company in Mumbai and was required to make presentations where my air force experience in briefing rooms came in very handy. Having left the air force some years earlier, I was pleasantly surprised to receive an invitation to address the officers at Pathankot on the subject of 'Courage'. The Chairman of my company was an aviation enthusiast and encouraged me to accept the invitation. Later on in the academic world I was fairly comfortable on the teacher's dais.

Friends and relatives have periodically requested me to raise the toast at weddings/anniversaries of sons and daughters and I was happy to oblige. But after a couple of these nuptials terminated in divorce, I observed a distinct decline in such invitations! What I enjoyed most however were my visits to schools as the Chief Guest for functions where I had the opportunity to interact with the future generation of young boys and girls who were very forthright in their comments and questions. Any effective presentation in the public domain requires preparation and practice and in these two endeavours I must acknowledge the great help I receive from my wife, herself a teacher for many years. 14 February 2021 marked 65 years that she has patiently vetted (and improved) almost all my scripts whether destined to reach the reader in text or audience in person from the rostrum. 🦋



25 Years Back

From Vayu Aerospace Review Issue II/1996

Alliance Air is formed

On 16 March, Indian Airlines (IA) formally announced the establishment of an independent subsidiary for allied airline services ('Alliance Air') to provide regional air transportation in the country. According to IA Managing Director, PC Sen, the carrier will be phasing out its Boeing 737s which would be transferred to the new entity for operations from 15 April 1996.

10 more Mirage 2000s

The Government of India is considering purchase of 10 Mirage 2000-5 aircraft worth \$250 million from France. This fighter is the latest version of the Mirage 2000, inducted into the IAF in mid 1980s and has fly-by-wire flight control systems, a more aerodynamic body, marginally lesser weight, a new generation weapons load and electronic warfare capability. This report has caused surprise since it comes in the wake of advanced negotiations by the defence ministry with the Russians to acquire Sukhoi Su-30 fighters, reportedly "costing less and capable of carrying a heavier weapons load".

Dornier 328 Regional Airliner in India

Enroute to Germany after its display at the Asian Aerospace'96 Show at Singapore, a Dornier 328-110 aircraft was flight evaluated by potential operators and technical collaborators in India. The 33-seat Dornier 328 with a full load of passengers flew from Delhi's Palam airport to Jabbarhati airport of Shimla in 30 minutes. On board the aircraft were the Chairman and members of the Board of Archana Airlines, who have contracted for four Dornier 328 aircraft with first deliveries expected in mid-1996. VIF Airways of Hyderabad have also contracted for a similar number of Dornier 328s.

PAC critical of MiG-29/RD-33 contract

The Public Accounts Committee (PAC) have once more been critical of the Ministry of Defence (MoD) in not only the original execution of contracts for the MiG-29's introduction into the Indian Air Force but by being reticent on the subsequent Action Taken Report. It was recorded that the Government of India had concluded two contracts with the then Soviet Union for procurement of MiG-29s, the first in September 1986 for procurement of a "certain number" (actually 50) of MiG-29s along with 32 spare engines, spares, related equipment and weapons at a total cost of Rs 1388 crores (then approx. \$ 550 million). These aircraft were received during 1986-1990 as scheduled and went into operational service (with Nos. 28 and 47 Squadrons). The second contract was concluded in February 1989 for procurement of more aircraft (20) with related equipment, weapons and 26 spare engines at a total cost of Rs 821 crores (then approx. \$295 million), these being received during 1990 (for No.223 Squadron).

PSLV-D3 in perfect launch

On 21 March ISRO made the third developmental flight of the Polar Satellite Launch Vehicle (PSLV-D3) successfully launched from Sriharikota placing a 930kg Indian remote sensing satellite, IRS-P3, into a near-polar sunsynchronous orbit. ISRO chairman K Kasturirangan, described it to the scientists as a "significant milestone in our programme. Today, we have witnessed a perfect flight. It is a success you richly deserve".

Defence Budget rises to Rs 27,819 crore

The defence allocation of Rs 27,819 crore for the coming fiscal year marks an increase of Rs 940 crore over the revised expenditure

of Rs 26,879 crore for the year 1995-96. The rise in defence budget was substantial during 1995-96 itself keeping in view that Rs 1379 crore was added to the original budget estimate of Rs 25,500 crore. However the Air Force appears to have been hard hit having the revised estimate fallen to Rs 223 crore over the budget estimate. In case of the Navy, there has been an increase of Rs 300 crore between the budget estimate for 1995-96. The Army budget at Rs 12,972 crore is short by Rs 40 crore over the revised estimate which in turn is up by Rs 500 crore over the budget estimate of Rs 12,432 crore for the year 1995-96.

Surplus F-16s for Eastern Europe

Lockheed Martin is examining the use of surplus F-16A/Bs drawn from stocks in Belgium and the Netherlands to offer in fighter competitions in the Czech Republic, Hungary and Poland. While using secondhand European F-16s would entail more conversion work than drawing on US Air Force stocks, this solution is viewed in some quarters as being "more politically acceptable". Such an approach would be viewed as one European country providing other European countries with combat aircraft.

Was Taiwan on the brink of War?

Acting under the election year pressures from the Congress and the rival Republicans, the Clinton administration reportedly had decided to take action and ordered its aircraft carrier groups led by USS *Independence* and USS *Nimitz* to move towards Taiwan. The destroyer *Hewitt*, guided missile frigate *McClusky* and guided missile cruiser *Bunker Hill* had also been ordered to position themselves nearer to the 220km wide Taiwan straits. China regards Taiwan as a renegade province and the Communist Party is committed to using any means, including military, to effect a reunification. 🦋

IAF Mirage 2000s at PAF Shorkot Road!



The Pakistan Air Force recently celebrated *Golden Jubilee of Mirages* in their service, a grand occasion graced by the President himself along with PAF senior brass. The PAF has operated Mirage III/5s for half a century, many of them bought second hand from previous operators in Europe, the Middle East and Australia and refurbished in-country. Wags have jocularly said that while “the Indian Air Force has the Mirage 2000, the PAF has 2000 Mirages”!

Notwithstanding, someone took this seriously enough as amongst the large posters set up at PAF Shorkot Road displaying PAF Mirages, there was this one of IAF Mirage 2000s as well! We don't know the fate of that awkward master of ceremonies that day but could this have been a Freudian slip?

Still, the French company Dassault would have been quietly pleased!

Aatmanirbhar Bharat : Indian Railways style!

The Indian Railways Workshop at Samasthipur in Bihar have taken lead in building the new generation Rafale multi-



role fighter in India. The workers proudly presented these Rafale models, built from scrap material, to authorities who later happily displayed them at the Railway Station.

Demonstrating self reliance!

The cup that cheers!

On sidelines of the recent book release (*Epic Battle of Longewala*) by the IAF Chief at the Air Force Museum Palam, was inauguration of the ‘Longewala Lounge’.



is a welcome addition and will surely satiate the thirst of air enthusiasts after their walk around the vintage aircraft on display.

The café could well have been named as a ‘Turkey Shoot’!

Hero on both sides

Wg Cdr Abhinandan Varthaman of the Indian Air Force has many fans on both sides of the Indo-Pak border. While his portrait has been gaily painted on trucks in

Pakistan, as also now adorning Cessna 172s of the Karachi Flying Club (with young ladies seen taking selfies) Abhinandan's moustaches have become famous in southern India with many young men sporting his characteristic whiskers!



Air Travel Times

Even as the Ministry of Civil Aviation continues to issue guidelines for air travellers, various airlines are clamping down on passengers flouting the Covid 19 precautionary rules.

Fly, but only if you must!



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